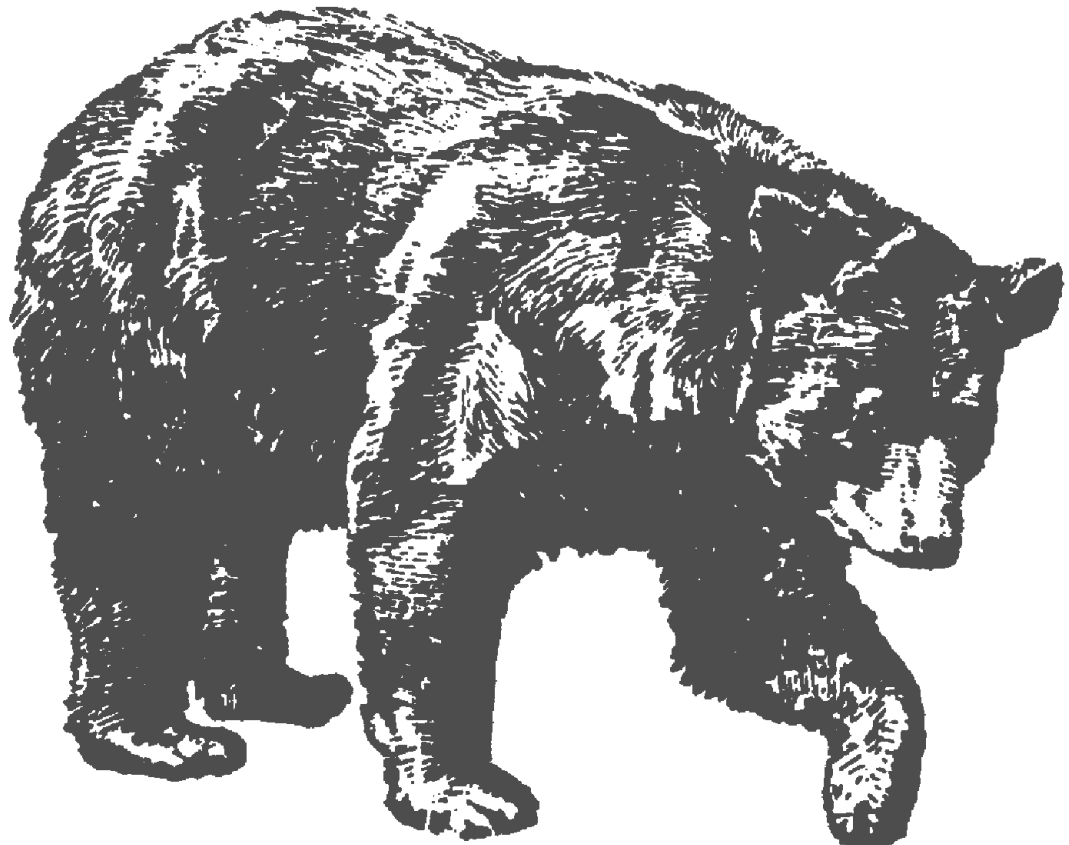


Black Bear

Ecology and Management of the Louisiana Black Bear





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Ecology, and Management of the Louisiana Black Bear


Black bears hold a prominent place in the history and folklore of people in the southeastern United States. During a bear hunting trip around Onward, Mississippi, in the early 1900s, President Theodore Roosevelt refused to shoot a bear that had been captured and tied to a tree. A journalist traveling with the hunting party penned the phrase “Teddy’s Bear.”

Black bears, once common in the Lower Mississippi River Valley (LMRV), have been reduced to an estimated population of fewer than 500. Since the turn of the twentieth century, bear habitat has been significantly reduced or eliminated throughout much of the LMRV region. Unrestricted and illegal harvests are among the reasons for their reductions.

Many people believe the downward trend in bear population numbers can be reversed, and they are working actively to restore the black bears. The Black Bear Conservation Committee, a broad-based coalition comprised of agencies, industry, academia, and land-owners, is increasing awareness regarding challenges and needs presented by the plight of black bears in east Texas, southeast Arkansas, Louisiana, and Mississippi.

Attitudes of people in the LMRV will help determine the black bear’s future. If restoration is to be successful, it is because public and private sectors are working toward a common goal of balancing humans and black bears.

History and Current Status

 The American black bear (*Ursus americanus*) was once found throughout North America from Alaska and Canada south to northern Mexico; currently 16 subspecies are recognized. Those animals found from east Texas through Louisiana and southern Mississippi are considered to be the Louisiana black bear (*Ursus americanus luteolus*). The bears in southeast Arkansas in the White River National Wildlife Refuge are genetically similar to the Louisiana black bear.

Historic references report bears in the LMRV reached peak abundance and were “widespread and common” in the bottomland hardwoods of the Mississippi and Atchafalaya drainages before settlement

by Europeans during the early 1800s. Bears were important to Native Americans, explorers, and settlers as a source of food, fur, and oil.

In Mississippi, a game survey in 1929 reported bears in northeast and north-central Mississippi and along the Pearl River. Statewide protection of bears was implemented in 1932, and at that time, fewer than 12 animals were believed to exist in Mississippi. Three pairs of bears were released in separate localities in 1934-35; this release was determined unsuccessful. In 1976, the last breeding population in the state was documented in Issaquena County. A statewide population inventory by the Mississippi Game and Fish Commission in 1978 reported bears as “uncommon” in 20 counties.

The Mississippi Museum of Natural Science collection includes 14 bears killed in Mississippi between 1972 and 1994. Mississippi Department of Wildlife, Fisheries and Parks estimates 25 to 50 bears are scattered in the Mississippi, Pearl, and Pascagoula drainages. Several bears are regularly sighted in the extreme southwestern part of the state, including Wilkinson County and along the Mississippi River from Rolling Fork to north of Greenville.

In Mississippi, legal hunting of black bears was closed in 1932. In 1974, the black bear was placed on the first list of rare and threatened vertebrates of Mississippi, and in 1984 was classified as endangered in Mississippi. The civil penalty for violating the State Endangered Species Law is \$1,000, or imprisonment for not more than 1 year, or both.

The Louisiana black bear (*luteolus*) was listed by the U.S. Fish and Wildlife Service in 1992 as federally threatened and, although bears in Arkansas north of the Louisiana/Arkansas border were excluded from this list, the historic range of *luteolus* includes southern Arkansas. The bear population in and around the White River National Wildlife Refuge is considered as “expanding and healthy.”

The decline of black bears in the LMRV region can be attributed to human disturbance, illegal kill, and habitat loss. The original 25 million acres of bottomland hardwoods in the LMRV region were reduced to 5 million by 1980. Because of the low reproductive

rate of black bears, the effect of illegal kill, especially of females, is a serious concern.

Ecology

Description

Black bears are black with a brown muzzle and occasionally will have a white blaze on the chest. Adult males weigh from 200 to 400 pounds, and adult females weigh from 120 to 200 pounds. Body lengths for both sexes vary from 3 to 6 feet from nose to tail.

Bears have good reasoning ability, long-term memory, dexterity and speed, tremendous strength, and are elusive. They are considered to be adaptable animals.

Reproduction

Female black bears typically begin having cubs at the age of 3 to 5 years. Two-year-old bears may produce young where habitat quality and food resources are excellent. Females in poor-quality habitats may not produce young until 7 years of age, and food shortages during the previous year may decrease litter size.

Mating usually occurs during summer, with egg implantation delayed for about 5 months following mating. Cubs are born in winter dens in January and February. Twins are most common, but litter sizes may range from one to five. Cubs are helpless at birth, are about 8 inches long, and weigh from 8 to 12 ounces. The sex ratio at birth is usually 1 male to 1 female.

Cubs grow rapidly, and by the time the mother and cubs leave the den in April or May, the cubs weigh 4 to 8 pounds. Cubs stay with the mother for the first year and share a den the first winter following their birth. They emerge with the mother again in the spring and stay together until summer, when the family unit dissolves. During mild winters, the family unit may stay active through the winter. After the family unit dissolves, the female goes into estrus, breeds, and the cycle is repeated.

Denning

Black bears are not true hibernators. They go through a winter dormancy period called carnivorean lethargy or torpor, which includes denning for periods of time during winter, at which time normal body metabolism changes dramatically. This torpor aids in survival during food shortages and severe winter weather conditions. The onset of denning in the Deep South is from late November to early January. Activity and movements decrease greatly during this period, and bears enter “predens” or “nests,” or may directly enter the den where they will spend the winter.

Bears do not eat, drink, urinate, or defecate during the denning sleep. Waste products are recycled as a result of unique metabolic and physiological processes. Most bears are easily aroused if disturbed while denning.

Denning activity is influenced by food availability, age, sex, reproductive condition, day length, and weather. Interruption of denning period or changes in den sites during the denning period may be caused by human disturbance, flooding, changing weather conditions, and poor concealment of ground dens.

Bears in the LMRV region are more active in winter months than are the bears found in more northern latitudes. Male bears, in particular, may be more active in winter; some males may bed for a few days or weeks in one area before moving to a new bedding site. Pregnant female bears usually prefer den sites that are secure and inaccessible, and when available, will select large, hollow trees that are dry, insulated, and secure.

Movements

Monitoring bear movements reveals that bears are the most active from dusk through dawn, although daytime activity is not unusual. In forested cover, bears often use “daybeds,” which are usually shallow, unlined depressions scratched in the ground or leaves. Mothers with cubs often rest at the base of trees; if disturbed, she can send the cubs up the tree, then climb the tree with them, or leave the area alone. Bears also rest in the crown or lower branches of a tree.

Male bears often move two to eight times the distances that females move. Home ranges, or the land areas used annually or periodically, vary by year and season. Home-range size is influenced by sex, population density, age, food availability, and reproductive status. Male home ranges typically increase during the summer mating season, and in the fall, bears move more often when foraging heavily to build winter fat reserves.

Bear activity and movement center on meeting habitat needs (year-round) and finding mates (breeding season). Estimates of home-range sizes indicate adult males may use more than 40,000 acres, and adult females may use up to 18,000 acres. Older male bears exert social pressure on younger bears, particularly during the breeding season, forcing them to disperse to other areas.

Research indicates bears frequently use uncleared drains, ditches, bayous, and river banks when moving across open land from one forested area to another. These travel corridors are particularly important to adult and juvenile males that reside in a landscape composed of fragmented forestland and large agricul-

tural fields. Travel corridors of brush and trees as narrow as 50 yards across have been used by bears to pass through agricultural areas, but the wider the better.

Mobility of bears, particularly young, dispersing males, puts them at considerable risk. Conflict situations often result when bears enter unfamiliar territory and encounter humans. Bears have a homing instinct and will attempt to find a way back to familiar territory; therefore, relocation of nuisance bears is rarely successful. Bears have traveled up to 400 miles from relocation sites, and frequent road and highway crossings, coupled with contact with humans, increase stress and likelihood that bears will not survive relocation.

Food Habits

Black bears are carnivores (meat eaters) but are not active predators of vertebrate animals. They are better characterized as opportunistic omnivores, because they eat almost anything available, including plant and animal matter. Considerable time is spent foraging for food. Feeding signs are usually found where bears are active and may include torn logs, clawed trees, and trampled food plants. Bears locate food by smell and feed at all levels of the forest, from climbing trees for acorns and berries to rooting up grubs in rotten logs on the forest floor.

After emerging from the den in the spring, bears may remain in a semifasting state for a short time. With the onset of feeding, succulent vegetation is first consumed, followed by residual hard mast such as acorns and pecans, agricultural crop leftovers, and insects. From late spring through summer, soft fruits such as berries, pokeweed, devil's walking stick, thistle, sassafras, palmetto, persimmons, and wild grapes are important food items. By fall, diets shift heavily to pecans and acorns, which are carbohydrate-rich food sources that build fat reserves necessary for denning. Bears exhibit the greatest weight gain during fall hard-mast consumption.

Agricultural crops are important foods year-round and are particularly important where habitat is fragmented and bear densities are high. Bears are attracted to crops such as corn, wheat, and sugarcane and often become attracted to human garbage and pet foods. Where bears are present, take measures that prevent access to these attractive foods.

Habitat



Requirements

The Louisiana black bear lives primarily in relatively large, contiguous areas of bottomland hardwood habitat. Habitats must provide escape cover, dispersal corridors, abundant and diverse natural foods, water, and denning sites. Black bears are adaptable habitat generalists, and well-managed, productive forests can provide good bear habitat. With the large home-range size needed, it is critical to have large expanses of suitable habitat.

Food items must be present in sufficient quantity and quality on a year-round basis. These foods generally include the following items:

- Grasses, thistles, and other annual weeds.
- Fruiting vines and shrubs.
- Hard mast such as acorns, agricultural crops, and forages.
- Insects, small invertebrates, and vertebrates found on the forest floor in rotting logs, slash, and snags.

High-quality escape cover is especially important for bears living in fragmented habitats and/or in close proximity to humans. Bears adapt and thrive if provided areas of retreat that ensure little chance of close contact with humans. Thick understory brush or cover found typically in diverse bottomland hardwoods with fairly open canopies and mature trees provide this natural cover. Timber harvest slash and the thick regrowth normally associated with harvest can enhance escape cover quality and provide additional feeding and denning habitats.

Providing a mix of small wildlife openings, interspersed with thick brush cover, mature mast-producing stands, with occasional denning trees and brush piles, meets most bear habitat needs. Travel corridors of timber connecting two separate forest areas may aid in bear movement and dispersal, and if located along drains (streamside management zones [SMZ's]), may help protect stream water quality and provide den trees.

Movement studies document that bears use heavy cover for daybeds and denning sites. Daybeds often are located in hardwood forests that have been logged within the previous 5 years. Brush pile and ground nests are most frequently used as dens by males, who prefer denning in areas with discarded logs and thick briar and vine growth.

Management



Habitat management practices that benefit black bears also benefit other animals. Landowners and managers who want to enhance their lands for bears can incorporate the following guidelines into individual management strategies.

• Natural bottomland hardwood forests

Large tracts of mature bottomland hardwood forests of mixed tree species normally provide good to excellent habitat for black bear, and often do not require intensive management to improve or maintain. Landowners can successfully integrate timber harvest with black bear habitat management and in many cases improve habitat conditions.

Stand diversity is greater if an uneven-aged management system is used, with single-tree selection, group selection, or small-patch harvest cuts as the harvest options available. Diverse age classes, stand types, and vegetative composition within the forest provide good habitat conditions for black bears.

Rotation length for crop trees should be a minimum of 50 years; 70 to 100 years may be preferred for hard-mast production. Stand thinnings, or intermediate cuts, should be performed on 5- to 15-year intervals. Design intermediate cuts to remove poor-quality trees, promote regeneration of desirable tree species, increase food production, or increase escape cover for bears. Avoid diameter-limit cuts because they often are detrimental to timber and bear management over the long term.

Concentrate on midstory timber stand improvement through herbicide injections to remove less desirable, noncommercial tree species and species that do not benefit bears. These include American hornbeam, box elder, and eastern hop hornbeam. Leave the bears' beneficial species such as mulberry, swamp dogwood, spicebush, and other fruiting species.

Natural regeneration of desirable hard-mast species such as oaks can be through silvicultural management operations. Group selection or small patch removals enhance regeneration of shade-intolerant oaks and increase early successional foods such as dewberry, blackberry, elderberry, and pokeberry.

• Hardwood plantations

In hardwood plantations, schedule harvesting operations to create maximum diversity. Do not schedule harvest cuts on adjacent compartments or stands during the same time period. Maintain corridors as wide as possible between plantation fields, and manage the corridors by selective harvests that favor hard mast species and cavity trees. In intensive, short-rotation

plantations, use stump-sprout regeneration, where feasible, to allow regeneration within 1 year of harvest. Leaving clumps of larger standing trees in the harvested stand will increase use of these areas by sows.

• Pine plantations and forests

Managers typically use even-aged management strategies to regenerate pine stands. Regeneration usually falls within two methods—those leaving two to three seed trees per acre for natural regeneration and harvest cuts, with some form of site preparation followed by planting pine. Make irregular-shaped harvest areas to promote edge habitat.

To create maximum diversity between stands, have at least 7 years' difference in age classes between two adjacent regeneration areas. This ensures a constant supply of soft mast within a relatively small area.

Thin even-aged pine stands as soon as economically feasible (12 to 15 years, depending on site quality). Thinning allows sunlight to reach the forest floor and promote the growth and production of soft mast and low brush. Fire helps maintain the pine ecosystem; burn on a 3- to 5-year rotation, depending on site quality. Planted pine stands may be burned as early as 7 to 10 years old and within 2 years following intermediate thinnings. Protect hardwood areas from fire.

In pine systems, leave hardwood-mast producers along the sides of streams. SMZ's should be wide and large enough to be separately manageable stands. When feasible, leave logging slash and tops for bedding areas; they are best left unburned. Snags and dead fall trees provide foraging sites for insects.

• Upland mixed pine-hardwood forest

Upland sites where stands of timber are a mixture of pine and hardwood can provide excellent bear habitat. Typically, the hardwood component is composed of hickory, oak, cherry, sweetgum, and beech. Forest management activities should favor the oaks and other hard-mast species. Harvest operations should provide open canopies where soft mast and thick brush will develop.

• Special considerations

Any forest management plan that includes bears as an objective has special considerations. Identify and protect present and potential cavity trees, especially bald cypress, overcup oak, and tupelo gum. With the Federal listing of the Louisiana black bear, you must protect cypress and tupelo gum when they are adjacent to water, with visible sign of defects, and a minimum of 36 inches diameter at breast height (dbh).

Regeneration of cypress and tupelo is generally from stump sprouts of trees up to 14 inches dbh, if sufficient sunlight is available. Total harvest is usually the best method of regeneration for these stands. Regeneration

from seed is more complex; cypress needs exposed wet soil for germination and continued moisture for about 2 to 3 years for seedling establishment. Removing trees in permanently flooded areas nearly always results in conversion of forested wetlands to open water. Thin species by age 20, with regular thinning at 10-year intervals thereafter to remove poorer quality stems.

Provide thickets for escape cover. These can be composed of any species, but in particular, switchcane thickets or brakes historically are associated with the Louisiana black bear. Switchcane can also provide a seasonal food source and should be favored in hardwood stands. It can be encouraged through removal of overstory trees and can be artificially regenerated by seed or rhizome transplanting.

Logging and access roads that provide a permanent approach to occupied bear habitat should be located a minimum of half a mile apart. Control vehicular access by using gates or permanent road closure after logging to minimize disturbance to bears.

Maintain some forest openings within large expanses of forest so early successional fruiting species or planted food crops such as corn in summer and wheat in winter can be provided.

• **Agriculture**

Manage agricultural land to improve bear habitat. Agricultural practices beneficial to bears can include proper crop selection, development of travel corridors, or even conversion of agricultural land to forest.

Corn, sugarcane, and winter wheat are better bear crops for food and cover than soybeans or cotton. Locating crops next to forested areas and leaving strips of crops unharvested are positive management techniques. **Always use pesticides and herbicides in accordance with label guidelines.**

Vegetative buffers left unsprayed next to forestland help prevent drift into the forest edge. For producers participating in acreage-reduction programs, set-aside acreage can be located or used in a manner that creates beneficial wildlife habitat. Plant at least 50 percent of the set-aside lands, not to exceed 5 percent of the crop acreage base, to an annual or perennial cover crop by November 1 of each year.

Locating set-aside acreage next to sloughs, SMZ's, and forestland can provide connecting corridors or wider expanses of cover for bears. Fallowed lands grow up into suitable bear cover habitat and allow bear use and movement between fragmented habitats. Make these areas as wide as possible.

• **Food plantings**

Food plantings developed in forested habitats for game species are not necessarily bad for bears. Commonly planted forage species include clovers, wheat, ryegrass, and bahiagrass. Wheat is particularly good when the heads are in the late "milk" stage.

• **Conservation Reserve Program**

A Conservation Reserve Program offers incentives for wildlife habitat practices. The following CRP practices are the most desirable for black bears.

- CP-3 Tree Planting (pine)
- CP-3A Tree Planting (hardwood)
- CP-4B Permanent Wildlife Habitat (corridors, noneasement)
- CP-4D Permanent Wildlife Habitat (noneasement)
- CP-12 Wildlife Food Plots
- CP-25 Rare and Declining Habitat Restoration

CP-4 practices require the landowner to plant at least 30 percent hardwood/shrub, which is Mississippi's policy. CP-4B and 4D require planting a mixture of herbaceous, shrub, and tree species best suited for various wildlife species in the area. A minimum of 30 percent of the acreage must be planted to trees or shrubs, or a combination of the two (no pine).

Hardwood species preferable for black bears include trees (oaks, pecan, hickories), shrubs (blueberries, huckleberries, and other fruiting species), and other mast-producing species. CP-25 requires a site-specific plan to accomplish the intended purpose.

Under CP-12, 5 percent of the acreage, up to 5 acres, can be planted to annual food plots. Corn is a good first choice for a summer crop, and wheat is a good choice for a winter crop. Diversify mast-producing trees and shrubs, where these are planted, and include hard-mast sources such as red oak, white oak, and sweet pecan and soft-mast sources such as black gum, mulberry, hackberry, persimmon, haws, plums, dogwood, and sassafras.

Even if landowners do not specifically include bear management objectives in reforestation and CRP efforts, bear habitat is usually enhanced from these practices.

• **Landscape level**

Because of the large home ranges of black bears, suitable habitat is seldom owned or provided by one landowner, with the exception of government agencies or industrial landowners. It is important, therefore, to involve multiple adjoining landowners working together at a landscape level in a cooperative effort.

Landscape level management objectives include the following situations:

- Preventing further habitat fragmentation.
- Connecting fragmented habitat with corridors.
- Effectively using fragmented resources by integrating management.
- Focusing efforts of user groups toward common goals.

Successful management depends strongly on the willingness, ability, and commitment of landowners to work closely together. Ultimately, for the bear, coordinated landscape management may offer the best opportunity for bear restoration and management in the Southeast. One excellent example of how this may be accomplished is exhibited by the Black Bear Conservation Committee. This multidisciplinary group has worked with Federal and State agencies to form Bear Management Units (BMU's). Each BMU is coordinated by a team made up of landowners, agency personnel, and local leaders, who provide input into BMU plans.

Human versus Bear Conflicts



Black bears are usually nonaggressive animals and pose a threat to people only when threatened or provoked. Bears and humans can coexist peacefully when high-quality habitat is available and humans are willing to reduce conflict situations. Conflicts are inevitable, however, even when bear numbers are low; as Louisiana black bear restoration efforts succeed, more conflicts are expected.

Reported conflicts include damage to apiaries and crops, but crop and property damage by bears is limited compared to other kinds of property and crop losses. Locally, however, damage to bee hives can be severe.

Black bears have damaged pressure-treated wooden structures such as deer stands, signs, and outbuildings. Occasionally, bears may eat corn from feeders used to attract wildlife, or they may scavenge animals caught in commercially set traps. Bears can become a nuisance around garbage dumps, cabins, and campsites, where garbage or foodstuffs are available.

Livestock predation is not presently a problem in the range of the Louisiana black bear. **Attacks on humans are unlikely, because bears are secretive and have a retreating nature.**

Landowners, farmers, and others show a high tolerance for bear-caused damage and are likely to accept minor damage as a normal part of business.

Beekeepers, however, do not have a high tolerance level and have encountered problems with bears.

Continued public education and damage assistance rela-

tive to the management of human/bear conflicts are important parts of the future success of the Louisiana black bear restoration.

Human Behavior

Unprovoked attacks on humans are uncommon throughout the species' range. Most attacks occur when humans surprise or otherwise threaten the animals. Avoid bears in all situations. Bears that become tolerant of human activity may become aggressive, especially if a handout is expected. **Feeding bears is not recommended in any situation!**

Never approach bear cubs; a sow with cubs is defensive and can be dangerously aggressive if she thinks her young are in danger. Be as noisy as possible in bear habitat. When camping, store food and other attractants far from sleeping areas.

Promptly report "friendly" bears. In confrontational situations, identify yourself by making noise and moving upwind of the bear; stay calm and retreat as soon as possible. Bears that confront humans often rear on their hind legs to get a better view or smell; this is a nonaggressive behavior. Do not climb trees.

Remember—bears are excellent climbers.

Hunter Cooperation

Hunting clubs should consider incorporating bear awareness and management techniques into their annual activities. Discourage feeding deer unless the hunters are willing to accept foraging bears at their feeders. Hunting dogs may chase bears; where bears are present, control dog running.

Spring running of dogs can adversely stress sows and cubs. In some areas, controlling untamed dogs may be necessary. Always identify hunting targets carefully before firing; black bears may easily be mistaken for wild hogs or Russian wild boars.

Apiaries

A 1994 survey of Mississippi commercial beekeepers indicated that over the previous several years most respondents had never seen a bear, but some had experienced bear-related damage to their apiaries. Damage to bees and hives is the most costly agricultural problem associated with the Louisiana black bear; bears eat larvae and honey. Beekeepers can initiate prevention strategies that preclude or minimize bear-caused damage.

Locate beehives as far as possible from bear habitat that provides cover and travel areas. Harvest honey as soon as possible after the seasonal nectar flows. Also, move the hives to new locations if bear activity is detected nearby.

Help protect apiaries with electric fencing, bear-resistant platforms, or get professional help. Bear-resistant fence designs are available from USDA/APHIS/Wildlife Services. Beekeepers may also consider consolidating hives to form the smallest apiary that can be practically managed.

Crops and Livestock

Crops and livestock may occasionally provide food for bears; as apiaries, do not locate them in or near occupied bear habitat. Protect gardens, small fields, and pastures with bear-resistant fencing, and harvest crops promptly when mature.

Use scare devices such as gas exploders, lights, sirens, and scarecrows to temporarily frighten bears away from crops and fields; these are short-term control measures. Harassment with chase dogs may be effective short term, but in most cases is illegal. With livestock operations, take carcasses of dead animals to an approved landfill site or deeply bury or burn the carcass to prevent scavenging by bears.

Structures

Where bears could damage wooden structures, use alternate materials such as steel, aluminum, or fiberglass. Remove from unoccupied buildings and store in bear-resistant containers any foodstuff that attracts bears. These foods may include items such as human food, pet food, grains, and foods that attract wildlife.

Access Management

Most private landowners control access to their properties by fences, gates, signs, patrol, or by word-of-mouth. Public agencies also control traffic on public properties. Consider bears in any periodic review or adjustment of access control techniques and management.

Roads and Other Hazards

Vehicles kill bears when they cross highways, particularly on roads that cross historic bear travel corridors. Natural resource agencies should assist roadway authorities in identifying these corridors so they can implement collision-prevention methods such as culvert crossings. Drift fences can be placed to direct bears to culvert entrances and facilitate movement beneath the roadbed.

Preventing human injury or death from collisions is a major priority and concern. Possible accidents may be anticipated and avoided by informed drivers. Informational billboards, bear crossing signs, brochures, and reduced speed limits around crossings areas may help avoid problems.

Garbage/Landfills

Bears like garbage, and those that obtain meals regularly from landfills, dumpsters, or residential garbage cans may soon become a nuisance. This undesirable behavior is almost impossible to change; “garbage dump bears” usually have to be destroyed.

In occupied habitat, enclose landfill perimeters with bear-resistant fences. To reduce odors, maintain only a small exposed area of garbage, and cover fresh-dumped areas with a deep layer of dirt as frequently as possible. Homeowners need to put garbage in closed containers located away from occupied areas. Hunting clubs should dispose of animal offal by hauling to approved landfills, burying, or completely burning it. Keep skinning sheds and food-handling areas immaculately clean.

Solutions

Restoration depends on the immediate and effective responses by wildlife professionals to reported conflicts. In the past, some individuals have destroyed bears as a means of “conflict resolutions.” Help reduce conflicts by managing the animals involved in the conflict, manipulating the resource being damaged, or placing a physical or psychological barrier between the conflicting resource and the bear.

One goal of the Black Bear Conservation Committee is to promote the natural establishment of a viable population of the Louisiana black bear in suitable habitat. Conflict resolution relies on nonlethal damage control techniques such as barriers and resource management strategies. Due to low densities, destruction of offending animals is considered as a last resort, unless human health or safety is jeopardized.

Hunting is commonly considered as a damage control tool with many species. Consider legal harvest as a part of the overall management plan in the future, as bear densities increase to a level that will sustain harvest and, thus, reduce conflicts. Live trapping and releasing bears into the same general area after aversive conditioning may alter offensive behavior and resolve some conflicts. However, releasing bears far from the capture site may cause them to roam long distances in search of familiar territory. This increases susceptibility to vehicular collisions or negative human encounters. Leave conflict bears in their established territories whenever possible.

Agency Responsibility



State and Federal agencies work cooperatively to develop protocols for addressing conflicts. The responsibilities relative to conflict management include the following:

- In Louisiana and Mississippi, reported problems are handled by the U.S. Department of Agriculture Wildlife Services, in consultation with the U.S. Fish and Wildlife Service and the Louisiana Department of Wildlife and Fisheries or the Mississippi Department of Wildlife, Fisheries and Parks.
- Texas Parks and Wildlife Department provides assistance to citizens who report problems with bears in Texas.
- In Arkansas, the Arkansas Game and Fish Commission handles bear problems.

As with any wildlife population, the objectives and attitudes of landowners, land managers, resource users, and the general public determine if bears are considered an asset or a liability. Continued research and responsible management of bear habitat and populations can result in perpetuation of this wild resource in the Lower Mississippi River Valley region. Public education can provide knowledge to allow people to form unbiased opinions and make informed decisions about the Louisiana black bear.

Assistance Programs



State, Federal, and private programs can assist private landowners in implementing timber, wildlife, and conservation programs. Options may include a variety of conservation practices landowners can choose from to meet their needs.

Farm Services Agency Programs

Conservation Reserve Program

The Conservation Reserve Program (CRP) was reauthorized under the 1996 Farm Bill, which is administered by the Farm Services Agency. The program's intent is to protect highly erodible and environmentally sensitive lands by maintaining protective vegetative cover such as trees and grasses. Wildlife considerations are enhanced under the new bill. Cost-share assistance is available to implement conservation practices. Landowners receive annual payments to maintain conservation practices; this is in addition to annual rental payments.

Natural Resources Conservation Service

Environmental Quality Incentives Program

Another part of the 1996 Farm Bill is the Environmental Quality Incentives Program (EQIP), which combines the functions of the Agricultural Conservation Program (ACP), Water Quality Incentives Program, and other USDA programs. EQIP provides technical assistance, cost-share funds, and incentive payments for structural and land-management practices to improve water quality on agricultural lands.

Wetlands Reserve Program

A Wetlands Reserve Program (WRP) was reauthorized under the 1996 Farm Bill. The WRP assists landowners in restoring eligible prior-converted cropland and protection of limited amounts of adjacent wetlands.

Wildlife Habitat Incentives Program

Another 1996 Farm Bill provision includes the Wildlife Habitat Incentives Program (WHIP), which diverts \$10 million per year from CRP to cost-share payments to private landowners for wildlife habitat management plans and improvements. Eligible practices include management for upland wildlife, wetland wildlife, threatened and endangered species, and fisheries.

U.S. Fish and Wildlife Service Partners for Wildlife

The Partners for Wildlife program provides technical and financial assistance to private landowners. The program helps landowners restore and enhance fish and wildlife habitat. It is primarily centered around restoration of historic vegetation and hydrology, which must comprise 70 percent of the project area.

State Incentive Program

Texas and Mississippi are the only two states in the region that provide state-funded incentive programs. These programs are administered by their respective state forestry agencies and are mainly geared to reforestation.


Cooperative Extension Service

The Cooperative Extension Service is a state- and federally funded agency that provides research-based educational and informational assistance to landowners, professionals, and the general public. County Extension agents and wildlife specialists provide information through publications, videos, workshops, seminars, and individual technical assistance on a request basis.

Private Conservation Organizations

Private conservation organizations work with landowners to develop conservation easements on their properties, which may provide Federal tax benefits, estate tax savings, or protection of natural areas for future generations.

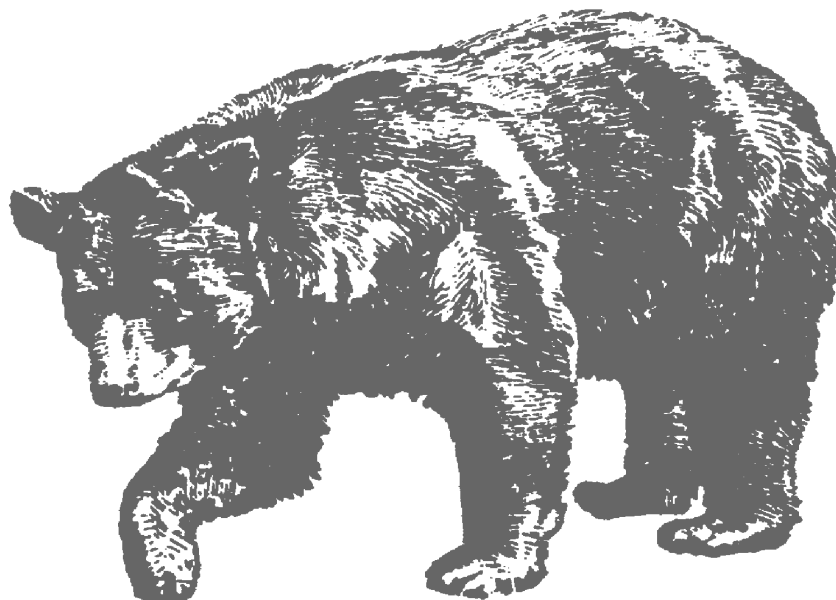
Summary

 Bears in the Lower Mississippi River Valley region have been reduced significantly since the time of early European explorers; indications are the downward trend is reversible. The decline in forested habitat is leveling off or reversing within the bear's historic range.

Attitudes of the general public and landowners are changing toward acceptance of black bears. People are beginning to understand that black bears can coexist and be managed along with other resources such as crops, timber, and recreation. The public is no longer tolerant of the illegal harvest of black bears, and fines and other punitive measures address this concern.

Perhaps the best hope for black bear restoration in the LMRV region rests with the Black Bear Conservation Committee. Representing more than 60 cooperating agencies, companies, universities, and organizations, the BBCC's priorities are to put the resource first, find common ground, build coalitions, avoid confrontation, use credible science, and to have a strong commitment to black bear restoration and management.

Ultimately, acceptance of black bears depends on the attitudes of the people in the LMRV region. Working together, everyone can contribute to the restoration and management of the Louisiana black bear.





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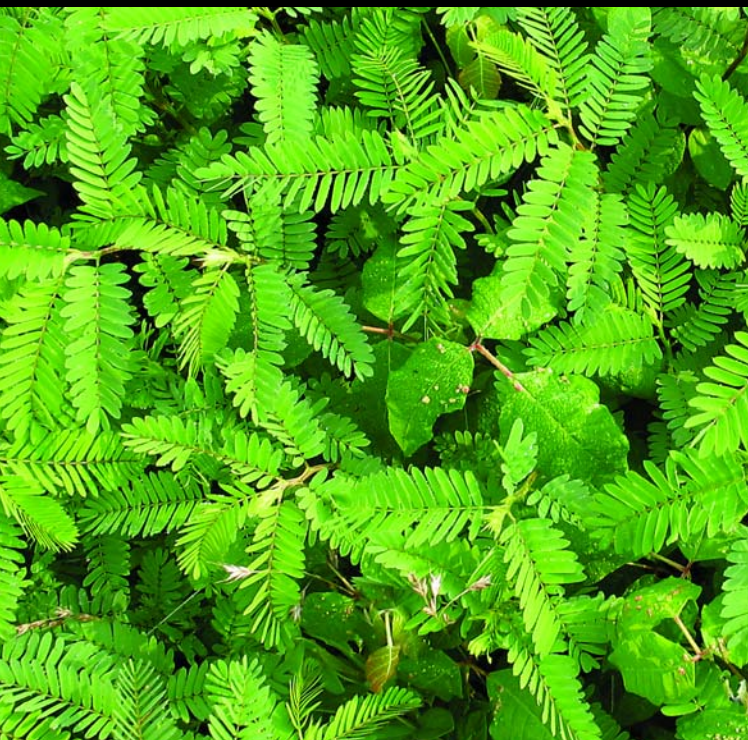
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Bobwhite Quail

Supplemental Food and Cover Plantings for Bobwhite Quail in Mississippi



The northern bobwhite, commonly called the “bobwhite quail” in Mississippi, is an important game species whose populations have been declining for 30 years throughout the southeast. This publication provides specific information on managing resources you have and establishing new supplemental plantings to benefit quail.

One common question people interested in bobwhite quail ask is, “What should I plant to help the birds?” Although supplemental plantings may be an important part of management, the importance of supplemental plantings for quail often is misunderstood. A successful quail manager must understand all of the bird’s annual habitat requirements, determine which requirements are missing on the land, and implement a comprehensive management program to provide for those needs.

If you do not have a comprehensive quail management strategy, supplemental plantings won’t have much of an impact. For example, if your property does not have adequate nesting or brood-rearing cover, planting food plots probably will not increase the number of coveys you find during the hunting season. For detailed information about bobwhite quail and their management, pick up “Ecology and Management of the Northern Bobwhite” from your county Mississippi State University Extension Service office, or find it online at <http://msucares.com/pubs/publications/pub2179.htm>. Also, the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) has information about bobwhite quail management on its website at www.mdwfp.com.

Once you have developed a comprehensive management program, you may use supplemental plantings to meet specific goals and objectives. Quantity, quality, and availability of food can occasionally limit quail populations. Abundant foods, especially those available during the stress period of late winter/early spring, can help quail begin the summer reproductive period in better condition. Additionally, birds that spend less time feeding might be less vulnerable to predators during late winter when cover is sparse and there are more migratory birds of prey.

Supplemental plantings can also provide brood or nesting cover.

MANAGE EXISTING RESOURCES

Agricultural fields - Where small grains are grown, one way to provide quail with supplemental food and cover is simply to leave a border of crop standing around the edge of a field. This is a cost effective way to provide a variety of agricultural foods, some of which can be difficult to cultivate in small patches because of intense deer browsing. In situations where lands are leased for farming, contracts can be developed to require the farmer to leave a small portion of the crop standing, typically in exchange for a reduced land rental rate. Even strips as narrow as 10 feet wide can provide a lot of quail food on field edges.

Another effective management practice in agricultural settings is to leave a 20-foot or wider border of native vegetation around all field borders. Allowing natural herbaceous vegetation (grasses, weeds, and such) to grow along agricultural field borders can provide excellent nesting and brood-rearing cover for quail. You should maintain these borders of native vegetation every 2 to 3 years by burning, disking, or selective herbicides to keep them in herbaceous cover and keep out woody brush.

Native food plants - In many cases, you can produce important quail foods without actually planting anything! Two very effective and affordable tools available to the quail manager include prescribed burning and disking. Prescribed burning is perhaps the cheapest way to manage quail habitat. Normally done in winter, prescribed burns can remove undesirable woody plants and stimulate important herbaceous ones. And, prescribed burning is a versatile technique you can do in grasslands or woodlands. However, in grassland areas dominated by fescue, bermudagrass, or other exotic plants, burning alone may not improve quail habitat. In these situations, you may have to use herbicides or other tools to create good habitat.

Perhaps second in importance only to prescribed burning, disking also is a valuable tool for quail management. In grassland areas, you can disk to disturb the soil and stimulate the growth of new plants. Most old-field areas contain lots of dormant seeds in the soil. Because disking can “release” these seeds in the soil, you can use this technique to change plant composition and structure in grasslands and produce better quail habitat. You can disk in the spring or fall, but be aware that timing affects plant response. Disking in fall tends to favor legumes like partridge pea and forbs such as ragweed. Spring disking encourages many grass species. Disking is best done in strips on a 2-3 year rotation (Figure 1). Always disk along the contour of a field to reduce the risk of soil erosion.

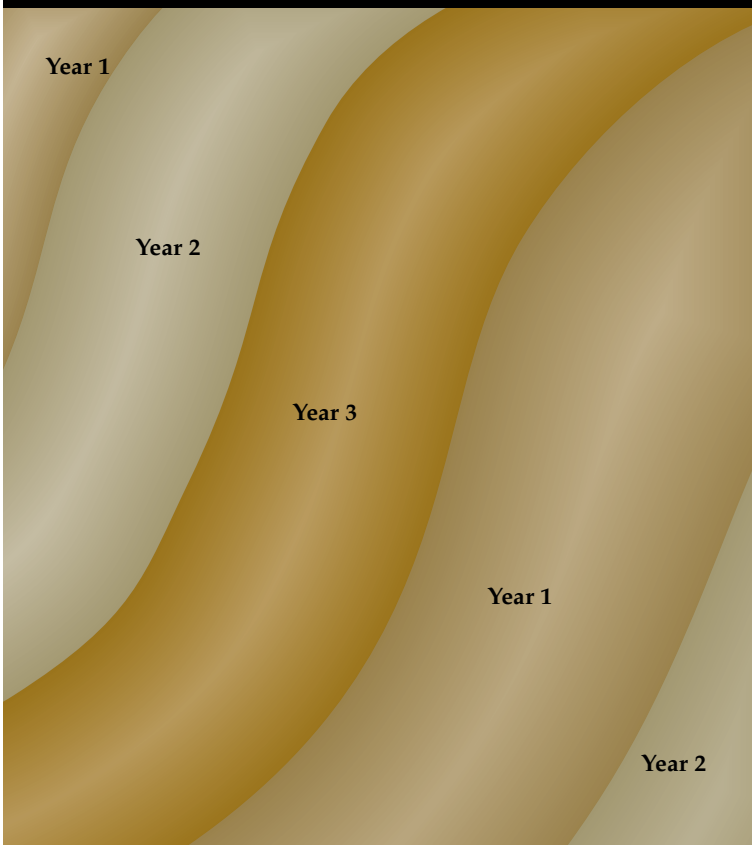


Figure 1. Example of disked strips on a 3-year rotation. Be careful to disk along elevation contours to reduce erosion.

ESTABLISH NEW PLANTINGS

Food plot design - Before deciding which plants to include in your food plots, you should first consider the number, size, shape, and location of the plots. Food plot size and shape are important because they influence the amount of edge around a plot, which occurs where different types of habitat come together. Because quail depend on edge habitat, your management practices should create as much edge as possible across your property. Planting several smaller food plots, rather than a few large ones, and making those plots an irregular shape maximize the amount of edge and thus make food plots more valuable for quail. In addition, you should carefully consider and plan where to establish food plots. For example, the best food plots are next to areas with good escape cover. Also, you should know the soil types on your property and understand the requirements of different plants before selecting the location and type of food plot to plant. Once you decide on the number, size, shape, and location of food plots, you may then select which plants to propagate.

Rotational plantings - When establishing annual food plots, you should consider rotating your food plots each year and leaving some portion of the plot unplanted or fallow. In some cases, quail benefit more from the native weed community found in a fallow food plot than from the actual food planting itself. An example of this technique would be to establish strip plots of grain sorghum along the border of a grass field. The next year, leave that plot undisturbed and establish a similar strip plot beside the fallow plot. The soil disturbance associated with preparing a good seedbed for planting encourages growth of many beneficial grass and weed species. Also, these fallow areas create a habitat that harbors plenty of insects necessary for broods. They also provide bare ground to let quail chicks move around.

Reseeding Annual Plantings - A number of reseeding annual plants can be established to provide important quail food. With proper management, these plants can be maintained for several years without replanting. Of all these plants, partridge pea and kobe lespedeza may be the most popular across the Southeast. While these legume seeds are fairly expensive, it is important to remember that a single planting can provide food for several years with proper maintenance.

Partridge Pea

Soil Adaptation: Most Mississippi soils, but avoid extremely wet sites.

Planting Date: February - March.

Planting Rate: Broadcast 10-15 lbs./acre. Cultipack or lightly harrow to cover.

Fertilization: 200-300 lbs./acre 0-20-20, or as recommended by soil test.



Other Considerations: Partridge pea stands usually do well for a few years but require maintenance to persist several years. You can maintain partridge peas by burning and disking in January and February.

Kobe Lespedeza

Soil Adaptation: Suited to most soils; does not grow well on deep sands or very wet soils.

Planting Date: Early spring (2 to 4 weeks before last spring frost is considered optimum).

Planting Rate: Broadcast 30-40 lbs./acre; cover lightly.

Fertilization: 200-300 lbs./acre 0-20-20, or as recommended by soil test.

Other Considerations: Best results when pH is 5-6.5.

Effective maintenance includes spring burning or disking where previous year's plot was grown.

Florida Beggarweed

Soil Adaptation: Well- to moderately-drained sandy loam soils.

Planting Date: April - May.

Planting Rate: Broadcast 10-15 lbs./acre.

Fertilization: 300-500 lbs./acre 5-10-15, or as recommended by soil test.

Other Considerations: May volunteer annually following soil disturbance.

Wild Reseeding Soybean

Soil Adaptation: Best on well-drained soils of average or better fertility.

Planting Date: April 15 - June 1.

Planting Rate: 20-25 lbs./acre broadcast, cover about 1 inch; 8-10 lbs./acre drilled.

Fertilization: 300-400 lbs./acre 0-14-14, or as recommended by soil test.

Other Considerations: Disking in early spring can encourage regeneration in previously planted areas.

Annual Plantings

Several annual plantings are beneficial to quail, and most are relatively inexpensive to start. Although new plants and plant varieties are constantly marketed for wildlife management, the traditional plantings are still the most effective and affordable.

Millet (Browntop)

Soil Adaptation: Most upland soils and bottomland soils with a water table less than 4 inches from the surface.

Planting Date: June - August.

Planting Rate: 20 - 30 lbs./acre broadcast, or 8-15 lbs./acre broadcast.

Fertilization: 300 - 400 lbs./acre 13-13-13, or as recommended by soil test.

Other Considerations: Generally produces mature seed within 60 days. Plant on clean, well established seedbed.



Millet (Proso)

Soil Adaptation: Suited to most Mississippi soils but does not grow well on sites with excessive moisture. Relatively drought tolerant.

Planting Date: Late May - July.

Planting Rate: 20-35lbs./acre broadcast; or 12 -15 lbs./acre drilled.

Fertilization: 200-300 lbs./acre 13-13-13, or as recommended by soil test.

Other Considerations: Plant on clean, well established seedbed.

Sorghum (including milo)

Soil Adaptation: Adapted to a wide range of soils, best suited to well-drained sites with pH 5.5 - 6.5.

Planting Date: April 15 - May 30.

Planting Rate: 15-20 lbs./acre broadcast, covered about 1 inch; or 8 - 10 lbs./acre drilled.

Fertilization: 300 lbs./acre 13-13-13, or as recommended by soil test.

Other Considerations: Do not select bird-resistant varieties for wildlife purposes.

Egyptian Wheat

Soil Adaptation: Grows well on most soils, best suited to moderately to well drained soils.

Planting Date: April - July.

Planting Rate: 15 lbs./acre broadcast, covered 1 inch; or 5 lbs./acre drilled in 36 inch rows.

Fertilization: 200 lbs./acre, or as recommended by soil test.

Other Considerations: Not a true wheat, but rather a tall (often more than 7 feet) member of the sorghum family.

Plant in patches to provide both food and cover.

Laredo Soybean

Soil Adaptation: Moderate to well-drained soils.

Planting Date: May - Early June.

Planting Rate: Broadcast 50 - 60 lbs./acre on a firm, clean seedbed and cover 1 inch; or drill 30 lbs./acre (20-30 inch rows, with 8-10 inch spacing).

Fertilization: As recommended by soil test

Other Considerations: Produces hard, black seed, often viable into late winter. Not a good choice for small plots in areas of high deer density, although Laredo may be less susceptible to heavy deer use than some production soybeans.

Shrub Plantings

Quail rarely move more than 150 yards from quality woody cover, so shrubs are a very important habitat component for quail. You can use shrub plantings such as bicolor lespedeza and American plum to provide both food and cover for quail and other wildlife. You can also use shrubs to "break-up" extensive open areas, such as large crop fields, into smaller management units.





Shrub Lespedeza (bicolor, thunbergii, and others)

Soil Adaptation: Best on well-drained sites, not suited to very deep sands or some prairie soils with high pH.

Planting Date: March - April.

Planting Rate (seeds): Broadcast 15 lbs./acre scarified and inoculated seed; or drill 10 lbs./acre of scarified and inoculated seed in 36 inch rows.

Plant Spacing (seedlings): Plant seedlings 24 inches apart in 36 inch rows.

Fertilization: 400 lbs./acre 0-20-20, or as recommended by soil test.

Other Considerations: Mowing in early February can restore older stands of shrub lespedeza by encouraging regrowth. Ask your seed supplier about deer resistant varieties if planting in areas with high deer density.

Landowners should be cautioned that shrub lespedeza, particularly bicolor, can become an invasive plant in some areas.

American Plum

Soil Adaptation: Best on well-drained soils.

Planting Date: April - May.

Plant Spacing: Plant seedlings on 5' x 5' grid, or in compact clusters of 3-4 seedlings.

Fertilization: As recommended by soil test

Warm Season Grasses

Establishing native warm season grasses (NWSG) to benefit quail is increasingly becoming a popular management practice. While NWSG, such as switchgrass, big and little bluestem, Indiangrass, Eastern gammagrass, and broomsedge are not important food plantings, they provide excellent quality nesting cover for quail and other grassland birds. NWSG benefit quail because they are bunch grasses. They grow upright with mostly bare ground between clumps or bunches of grass. This provides overhead cover for protection and material for nest construction, but it also lets young quail move through the cover.

Establishing NWSG can be difficult and expensive. Generally, you should plant NWSG in May and June on a clean, well-prepared seedbed. Use a cultipacker to smooth and compress the soil before and after planting. NWSG seeds may be broadcast with some success, although drilling is considered the preferred method of seeding. Some NWSG species can be planted with conventional equipment; for example, switchgrass can be planted with a grass seed box on a normal grain drill, and Eastern gamagrass can be drilled using a corn planter. However, many NWSG species have bearded or fluffy seeds that will not pass through conventional equipment and thus require



specialized drills or broadcast seeders. If you are interested in establishing NWSG on your property, contact your plant material provider, the Natural Resources Conservation Service, or MDWFP for additional technical information.

Management of Deer Plantings to Benefit Quail

Many landowners who plant food plots for deer also have interests in quail and other wildlife. You can help quail by selecting the proper plant material for deer plots. Many traditional deer plantings can provide quality brood-rearing cover for quail. Cool season mixes of clovers and cereal grains such as wheat and oats can benefit both deer and small game. However, using ryegrass in fall plantings is generally not beneficial to quail, since the ryegrass tends to choke out other vegetation in the plot. Ryegrass also tends to form a dense mat of vegetation the next summer, which limits the use of the plot by small quail chicks.

You can make existing deer food plots more beneficial for quail through planned management. Leaving a small portion of larger deer food plots fallow can improve the value of these areas for quail. For example, you might plant a 10-acre deer food plot in the fall. The next year, you could leave 1 acre on the north end of the field fallow, and plant the southern 9 acres. The second year, you could plant 9 acres on the north portion of the field, and leave 1 acre fallow in the south end of the field. The weed communities in these fallow areas provide food and cover for quail, and this rotational management makes enhancing larger deer plots for quail relatively simple. If mowing is part of your management plan for deer food plots, avoid it through June to protect nesting hens.

Develop a comprehensive plan.

Remember that quail can benefit from supplemental plantings, but the greatest benefits occur if food plots are part of a comprehensive management plan. Managers must understand quail seasonal habitat requirements, identify limiting factors on their property, and address those factors with a management program. Contact the Mississippi Department of Wildlife, Fisheries and Parks (Small Game Coordinator Dave Godwin, 662-325-5119) or the Mississippi State University Extension Service for information and technical guidance with quail habitat management.





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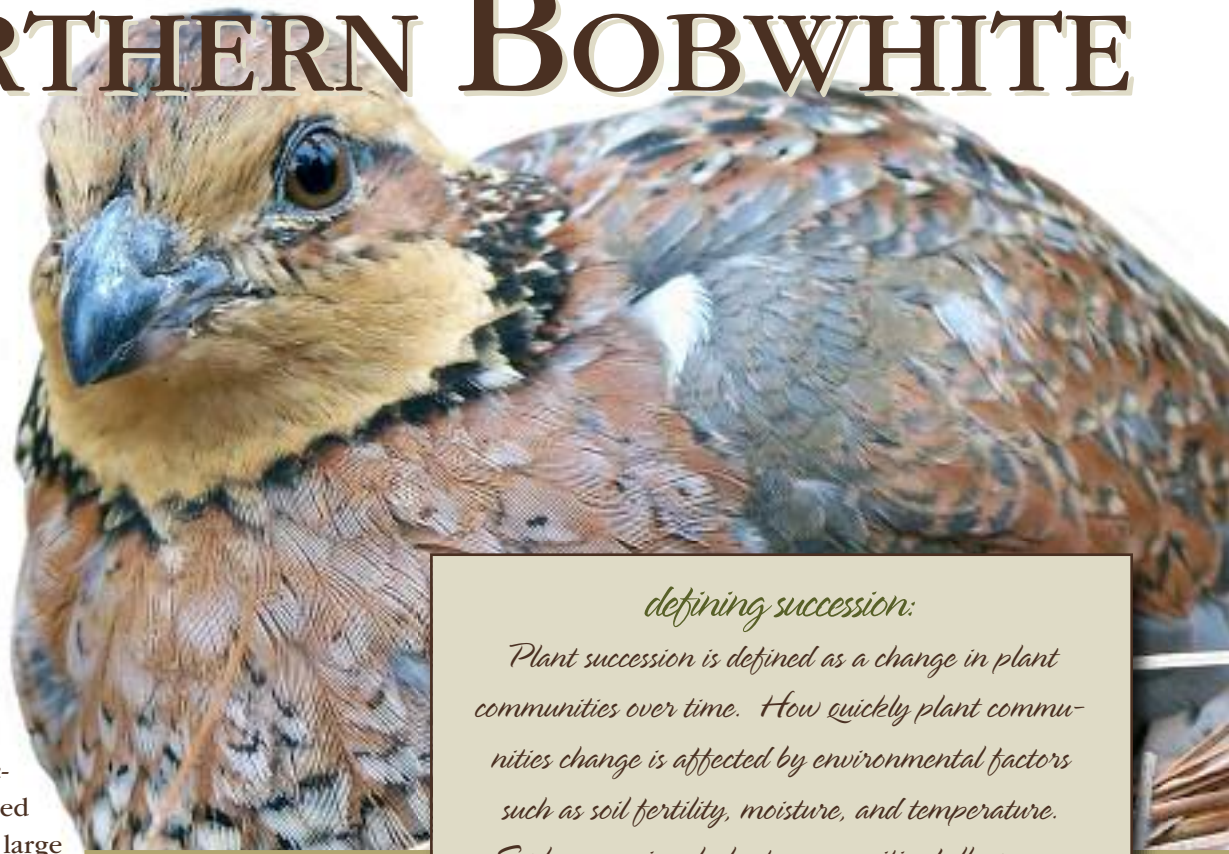
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ecology & management of the **NORTHERN BOBWHITE**



A abundant bobwhite populations were once an accidental byproduct of land management practices as early settlers carved out small family farms in large expanses of southeastern forestland. Just as human activity once accidentally created good habitat for bobwhites, changes in the ways we use land have diminished bobwhite habitat quality. In Mississippi and other southeastern states, bobwhite and other wildlife species that depend on early successional plant communities have declined over the last several decades to historically low population levels (*Refer to figure on page 2*).

The main cause of the decline in bobwhite populations has been loss of habitat associated with advanced natural plant succession (closed-canopy forests), industrialization of farming and forestry, reduced use of prescribed fire, and extensive conversions of native plant communities to non-native, invasive grasses such as fescue and bermudagrass. Other factors (such as predation and increasing isolation of remaining bobwhite populations), along with deteriorating habitat quality, further contribute to bobwhite population declines.

defining succession:

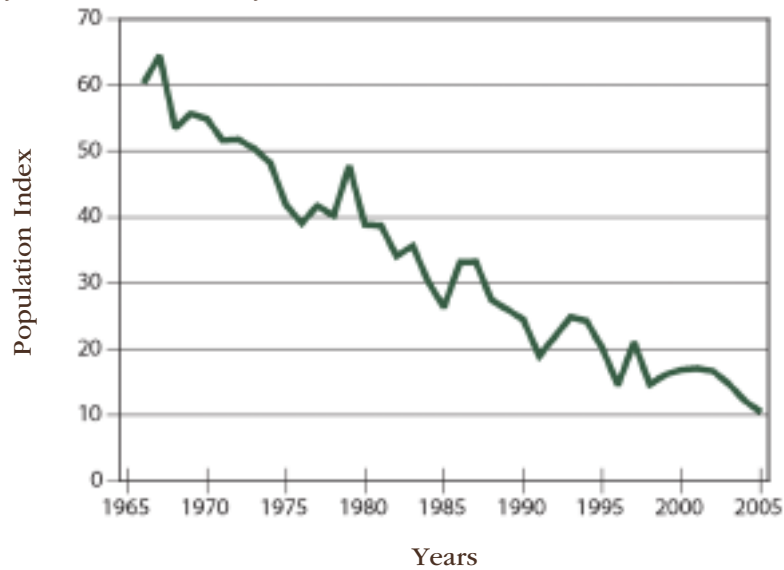
Plant succession is defined as a change in plant communities over time. How quickly plant communities change is affected by environmental factors such as soil fertility, moisture, and temperature. Early successional plant communities follow some form of environmental disturbance and are characterized at first by annual grasses and forbs. In most areas of the Southeast, annual plant communities quickly progress to perennial grasses and forbs within a few years. Within four to five years of no disturbance, early successional plant communities are lost as shrubs and trees colonize the site. Early successional plant communities are maintained by disturbances such as fire, hurricanes, tornadoes, or tillage. The goal of bobwhite management is to mimic natural soil or vegetation disturbances, typically by tree harvest, prescribed fire, or disking, to maintain early successional plant communities.



"The intensification of timber and fiber production have reduced available bobwhite habitat in forested regions."



Northern Bobwhite population trend measured by counts of calling males along 25-mile Breeding Bird Survey routes in Mississippi, 1966 to 2005.



Agriculture has been a two-edged sword for bobwhite. Early agricultural development created habitat, but intensification of agriculture destroyed habitat. In recent decades conversion of farmlands back to forestland has further eliminated habitat.

Bobwhites thrive in habitats composed of native grasses, forbs, and shrubs. Early agriculture in Mississippi provided habitat for many grassland wildlife species in the form of weedy field margins, fence rows, and other odd areas. Interconnected, small family farms created millions of acres of small agricultural fields and unimproved pastures that once provided nesting, brood-rearing, and protective cover for bobwhites. Since the end of World War II, agricultural production methods have progressively become more extensive and intensive, and chemical control of weeds and insects has increased dramatically.

Grazing practices have also changed significantly over the years. Livestock once grazed on native grasses and other native vegetation. Farmers moved livestock among native grass fields and woodlots producing a patchwork of grazed and ungrazed areas. Today, most pastures and hay fields have been converted to "improved" stands of non-native grasses such as fescue, bermudagrass, or bahiagrass, and are intensively grazed by

animals confined to smaller areas. Non-native grasses provide poor habitat for bobwhites and most other wildlife.

Average farm sizes in Mississippi increased from 54 acres in 1942 to 262 acres in 2005, while the number of farms decreased from 269,000 to 42,200 during the same period of time. As farming became more intensive and industrialized, less productive acreage and less competitive farms were removed from production.

The 1980's saw some of the greatest losses of cropland acreage in Mississippi and other regions of the United States. During this time, hundreds of thousands of former cropland acres were simply abandoned and allowed to grow up in woods or were converted to hardwood or pine plantations or non-native grasslands (such as fescue). These broad-scale land-use changes, many of which have been subtle over time, eliminated large expanses of interconnected grassland wildlife habitat associated with farming in Mississippi.

Just as agricultural practices have changed, forestry practices have also changed. The intensification of timber and fiber production (such as short rotation, high tree-density pine plantations and greater use of chemical site preparation for forest regeneration) have reduced available bobwhite habitat in forested regions.

ANNUAL CYCLE



Spring Breakup

In early spring, coveys break up, and male birds begin their familiar “bob-white” whistle to attract females.

Pair Bonds

Individual males and females will form pair bonds that may last for a single nesting attempt, multiple nesting attempts, or the entire breeding season.

Winter Covey

From fall through early spring, birds live in a social unit called a covey. Winters are difficult for bobwhite because the weather is cold, food is scarce, and predators are abundant. At night, bobwhite roost on the ground in a circle to conserve energy and for security. Only three to five birds in each covey will survive to spring.

Winter

Fall Shuffle

In early fall, broods live together in large groups of 20 to 30 birds. By October, birds will have settled into winter coveys of 12 to 15 individuals. The population (number of birds in an area) is highest at this time of year.

Summer Life

The chicks grow rapidly and begin to fly in as little as 2 weeks. They spend their days feeding, taking dust baths, hiding from predators, and resting.

Hatching & Brood-Rearing

After the eggs hatch, the male or female leads the chicks to brood habitats. Young chicks eat mostly insects because they contain the protein and nutrients chicks need to grow. The parent protects the chicks from danger and keeps them warm. A family of bobwhite chicks is called a “brood.”

Summer

Nesting

Bobwhite build their nests on the ground in a clump of dead grass to camouflage it. The female will lay about 12 eggs. The male or female incubates the eggs for 23 days. Nesting is a dangerous time because many predators eat eggs and adults. Only one of every three nests hatches.

Courtship and Nesting

Early spring is a time of dispersal for bobwhites preparing for reproduction. Habitat use shifts from shrubby and woody habitats used in winter to more open, grassy portions of the landscape. During the breeding season, it is not uncommon for about 25 percent of the population that survives the winter to move to new areas more than 2 miles from their winter range. These birds are likely looking for mates and new habitats.

The familiar two- or three-note “bob-white” whistle of males in early spring to attract a female is the earliest sign the reproductive season is starting. Courting pairs form first in March and April. Pairs form and break, then re-form throughout the breeding season, from May to September. In one breeding season individual bobwhites may pair and try to nest with as many as three different mates.

Prescribed burning of pastures and upland forests was a common practice in Mississippi. Its use has declined because of misunderstanding and negative public perception of fire, increased human population density, and potential liability risks associated with smoke and fire. Bobwhites do not tolerate the thick vegetative conditions that develop in forests that are seldom burned. Decreased use of prescribed fire is one of the main factors that have contributed to bobwhite declines in the Southeast.

Life History and Ecology

Understanding bobwhite life history and ecology provides the background for managing this bird. By understanding the various aspects of a bobwhite’s life and seasonal habitat needs, it is easier to understand how to manage bobwhite habitat.

“Pairs form and break, then re-form throughout the breeding season, from May to September.”



Bobwhite have a long breeding season, often lasting more than 150 days. This long breeding season provides opportunities for multiple nesting attempts and contributes to the bobwhite's high reproductive potential. Individual nesting attempts may require from 35 to 48 days from making the nest to hatching. Peak hatch is around mid July. Some broods may hatch as early as early May and as late as early October. Nests are incubated by either the male or the female, but bobwhites rarely share incubation duties. Females incubate most of the early-season nesting attempts, but males incubate an average of 25 to 30 percent of all nests. Male incubation is most common during the middle of the breeding season. Often the female initiates and incubates a clutch, while the male incubates a clutch the female laid earlier. Bobwhites readily re-nest when nests are destroyed by predation, weather, or human activities. Some females may produce more than one brood per season.

Bobwhites usually select a nest site where native grasses are the main plant type. Good nesting cover has fairly dense, upright grass cover close to areas with ample bare ground concealed by overhead grass, forb, and shrub cover. These more open, weedy areas provide foraging habitat for the newly hatched chicks.

Male bobwhites build nests in a slight depression in the soil, using available grasses and debris, which often include broomsedge or pine straw. Nest building takes about a day, and the hen generally lays about one egg daily until she has produced the complete clutch of eggs (average clutch is 12 eggs). This usually requires from 15 to 20 days after the nest is built, often with a slight delay between building and the beginning of egg-laying.

Within two to five days of laying the last egg, the female or male starts incubation. Both attending adults and nests are highly vulnerable to mortality during incubation. Predators, agricultural machinery, or weather events destroy

about 55 to 70 percent of nests. The attending adult is killed in about 25 percent of nest failures. Because females incubate 70 to 75 percent of nests, they typically experience greater mortality than males during the nesting season.

If the nest is successful, the eggs hatch after about 23 days of incubation. Once hatching begins, most chicks emerge within one to two hours. About 33 percent of birds succeed on the first nesting attempt, and bobwhite hens may re-nest two to three times, whether the first brood was successful or not. Despite this high reproductive potential, not all pairs successfully produce a brood because of weather, predation, and other disturbances. Through repeated re-nesting, about 75 percent of the birds surviving the breeding season ultimately hatch one or more clutches.

Brood-Rearing

When bobwhite chicks hatch, they are covered in down, with eyes open, and can move around. Newly hatched chicks weigh about 0.25 ounces and are not much larger than bumblebees, but they can forage for themselves soon after hatching.

As soon as the chicks are dry, the hen leads them away from the nest to begin foraging on insects and other invertebrates. They are very alert, move around on the ground quite readily, and cannot fly for the first two weeks after hatching. Attending adults watch the chicks closely, and the brood may cover from two to 100 acres during the flightless period. Hens take the chicks to insect-rich areas with overhead cover for protection from predators, intense heat, or wet conditions and in which small chicks can move freely along the ground and through vegetation to feed. Annual plant communities provide good brood cover.

The first two weeks after hatching are the most critical, because 50 percent or more of chicks may be lost to predation or bad weather. The attending adult broods, or covers the chicks with its wings during the night and much of the

"Good nesting cover has fairly dense, upright grass cover close to areas with ample bare ground concealed by overhead grass, forb, and shrub cover."





"Hens take the chicks to insect-rich areas with overhead cover for protection from predators, intense heat, or wet conditions and where small chicks can move freely along the ground and through vegetation to feed."

day to keep them warm and protect them from predators. Bobwhites are dedicated parents and hesitate to leave flightless chicks, even when attacked by a predator. Although predation is high during incubation, adult mortality associated with attending flightless chicks is twice as great as incubating a nest.

Between weeks two and six, chicks develop juvenile plumage and flight abilities. By six weeks of age, chick diets shift from only insects to insects along with seeds, berries, and other plant material. At eight weeks, hens are readily identified from cocks by the brown feathering in the throat patch, whereas cocks have a white throat patch and a black eye stripe and collar. At 12 to 16 weeks, the size of young closely resembles that of adults. By the age of 21 weeks, bobwhites have the plumage they wear into the next breeding season. Juveniles can still be identified from adults for a full year by the more-pointed ninth and tenth primary wing feathers and buff-colored tips of the greater primary coverts.

Summer life for birds of all ages consists of daytime activities of traveling, feeding, dusting to clean feathers, and

loafing. They may feed during early morning, rest during mid morning, loaf, sleep, and dust during the middle of the day, and feed during the two to three hours before dark. The bobwhite's preferred way to travel is on foot. Flying requires more energy than walking and running and exposes birds to predators such as hawks and owls. Shrubby cover such as plum thickets or briar patches provide both secure loafing cover and escape cover for bobwhites during these daily activities.

Covey Structure

By late summer bobwhites begin to show the characteristic night roosting habits of forming a circle on the ground with tails together and heads pointing out. This may have important social, escape, and heat conservation benefits.

In late summer and early fall, birds begin to mix from brood to brood and form coveys, or social groups, of 20 to 30 birds. These coveys may reduce to groups of 10 to 15 birds as each covey settles into its winter range. This period is often called the "fall shuffle," and populations have reached their peak for the year. As fall and winter arrive, food is most abundant, birds move about less, and the tight-knit coveys are 75 to 80 percent juvenile birds. Depending on habitat quality, each covey may require from 20 to 160 acres or more to meet its needs.

As much as 50 to 75 percent of the early fall population may die by the following spring. As winter progresses, cover and food resources become more limited. Protective cover such as plum thickets or briar patches throughout an area can provide critical cover after grass and forb covers have deteriorated during winter.

For birds that survive winter, longer daylight and warmer weather in spring trigger the gradual breakup of coveys. The bobwhite calls begin in earnest, and pairing begins again as the next breeding season arrives.



annual plant community

"During the 'fall shuffle,' populations have reached their peak for the year. As fall and winter arrive, food is most abundant, birds move about less, and the tight-knit coveys are 75 to 80 percent juvenile birds."



Plant Succession



“Bobwhite habitat is no longer an accidental byproduct of land use but must be intentionally created.”

Habitat Management

Although bobwhites can adapt to grasslands, agricultural crops, and woodlands if properly managed, too much of one results in lack of another and reduces habitat quality. Many modern land use practices simplify the landscape by producing too much of one plant community or land use type while excluding others. For example, intensive agricultural and forestry practices emphasize food and fiber production but eliminate the patchy landscape bobwhites require.

With the gradual (and sometimes radical) land use changes that have occurred in Mississippi during the last half-century, proactive bobwhite habitat management has become imperative to maintain harvestable populations of bobwhites and, in some cases, just to maintain localized populations. Bobwhite habitat is no longer an accidental byproduct of land use but must be intentionally created.

Open Lands

Open lands include agricultural land uses such as row crops, pastures, hay fields, Conservation Reserve Program (CRP) grasslands, and nonagricultural grasslands such as prairies and old fields. Because of the open nature of these land uses, they are often the easiest habitats to manage for bobwhite, and existing bob-

white “seed” populations are usually associated with these land uses. Many effective habitat management tools are available to create or enhance bobwhite habitat in open lands. One or more of the following management options that are compatible with production goals can be used to increase the amount of usable bobwhite habitat in cropland habitats.

Old fields provide suitable bobwhite habitat for two to three years after abandonment because grasses, forbs, and shrubs colonize fields when they are no longer cultivated. Many crop fields were removed from agricultural production and allowed to go back to natural grass cover during the early to mid 1980’s. This accounts for why this period of time experienced some brief bobwhite population booms. However, plant succession causes abandoned fields to “grow out” of bobwhite habitat within a few years.

Without soil disturbances from prescribed fire or disking, abandoned fields are invaded by brush and characterized by heavy litter (such as dead grass) accumulation, thick vegetation at the ground level, and little bare ground and plant diversity. Like abandoned fields, crop fields converted to pine or hardwood plantations provide suitable bobwhite habitat for a short time; but as trees cap-

ture the site and canopy closure prevents sunlight from reaching the forest floor, ground cover conditions favorable for bobwhites are quickly lost.



brush invasion in an old field



dense, perennial grasses

"Without soil disturbances, abandoned fields are invaded by brush and characterized by heavy litter accumulation, thick vegetation at the ground level, and little bare ground and plant diversity."

In modern agricultural systems, the availability of idle, native herbaceous vegetation most often limits bobwhite populations. In these landscapes, developing suitable, idle vegetation and/or converting non-native, invasive grasses such as fescue and bermudagrass to native warm-season grasses (NWSG) are essential parts of bobwhite habitat management.

Converting cropland to NWSG and forbs can produce quality bobwhite habitat, but this management option is feasible only if you do not want to continue cropping particular fields. An alternative

Native Forbs with Commercial Availability

- Ragweed (*Ambrosia artemisiifolia*)
- Partridge pea (*Chamaecrista fasciculata*)
- White prairie clover (*Dalea candida*)
- Purple prairie clover (*Dalea purpurea*)
- Illinois bundleflower (*Desmanthus illinoensis*)
- Smooth ticktrefoil (*Desmodium laevigatum*)
- Stiff ticktrefoil (*Desmodium obtusum*)
- Florida beggarweed (*Desmodium tortuosum*)
- Narrow leaved sunflower (*Helianthus angustifolius*)
- Common sunflower (*Helianthus annuus*)
- Maximilian sunflower* (*Helianthus maximiliani*)
- Oxeye (*Heliopsis helianthoides*)
- Roundhead lespedeza (*Lespedeza capitata*)
- Slender lespedeza (*Lespedeza virginica*)
- Coneflowers (*Rudibida* spp.)
- Blackeyed susan (*Rudbeckia hirta*)

* Not native to Mississippi, but native to western United States; not known to be invasive in Mississippi.

Native Grasses with Commercial Availability

- Big Bluestem (*Andropogon gerardii*) – Adapted to more neutral soils (such as prairie and Delta)
- Broomsedge (*Andropogon virginicus*) – Adapted to almost all soils in Mississippi; readily colonizes many sites naturally; limited commercial availability
- Sideoats Grama (*Bouteloua curtipendula*) – Adapted to a variety of soil types
- Sand Lovegrass (*Eragrostis trichodes*) – Adapted to poorer, dry soils
- Switchgrass (*Panicum virgatum*) – Adapted to a variety of soil types
- Little Bluestem (*Schizachyrium scoparium*) – Adapted to a variety of soil types
- Indiangrass (*Sorghastrum nutans*) – Adapted to a variety of soil types
- Purpletop (*Tridens flavus*) – Adapted to poorer, dry soils
- Eastern Gamagrass (*Tripsacum dactyloides*) – Adapted to a variety of soil types

* For more information on native warm-season grasses, see Extension Publication 2435, Native Warm-Season Grass Restoration in Mississippi.



native warm-season grasses and forbs

"Conversion of five to 10 percent of cropland acreage to native grass and forb field buffers can increase local bobwhite populations by 200 percent."



native warm-season grass and forb field buffer along a crop field edge (summer)



native warm-season grass field buffer in winter



field buffer dividing grazing paddocks (fenced to protect from livestock), managed for bobwhite cover

practice is rotational fallow field crop management (often called flex-fallow), but this management option temporarily removes some acreage from production and reduces cropping potential.

Native grass and forb field buffers established along field edges are a flexible grassland habitat management practice for cropland. Field buffers let landowners create wildlife habitat and continue cropping their fields by sacrificing only minimal amounts of cropland. Field buffers should be at least 30 feet wide for bobwhite habitat, and wider buffers are usually better (buffers usually range from 30 to 120 feet wide). Conversion of five to 10 percent of cropland acreage to native grass and forbs field buffers can increase local bobwhite populations by 200 percent.

Similar to croplands, converting pasture/hay lands to NWSG can greatly increase the value of these production systems for bobwhite habitat. NWSG can be very productive hay and grazing lands, but you must carefully use rotational grazing to avoid overgrazing.

As with cropland, idle field buffers around pastures and hay fields can provide habitat for bobwhites. Pasture/hay buffers let producers sacrifice small amounts of forage production lands. You can create these buffers by fencing out portions of pastures and leaving margins of hay fields uncut. Field buffers along pastures and hay fields require regular maintenance if these forage lands contain bahiagrass, bermudagrass, and/or fescue. If these non-native forage grasses are present, you have to treat the buffer with herbicide to eradicate non-native grasses, and desirable vegetation has to be established. Regular herbicide treatments along the field and buffer edge are necessary to control spread of invasive grasses into buffers from the field margin.

In Mississippi nearly one million acres of former cropland have been enrolled in the Conservation Reserve Program (CRP). Many CRP contracts were not specifically developed for early successional wildlife habitat. CRP grass covers, both whole-

field and conservation buffer enrollments, were often established in non-native grasses such as fescue or bermudagrass. These CRP conservation covers may be converted to bobwhite habitat by eradicating non-native grasses with appropriate herbicides and establishing native grasses and forbs (these stands may be eligible to re-enroll in CRP as a native grass cover). Management activities on CRP lands must be part of an approved Conservation Plan of Operation, so consult with USDA-Farm Service Agency (FSA) personnel before beginning management activities.

Old fields and CRP grasslands that were allowed to regenerate to native vegetation but were not actively managed can also be renovated for grassland wildlife habitat. Because many of these idle grass fields have not been actively managed to maintain early successional habitat, woody brush or non-native, invasive vegetation has moved into these grasslands and reduced their bobwhite habitat value.

Woody brush such as cedar, sweetgum, and green ash and non-native, invasive vegetation such as kudzu and bermudagrass often require herbicidal treatment for long-term control. Controlling non-native, invasive vegetation is more economical and effective if you treat invasive species when they first appear. This is especially true of cogongrass, which is ranked as the seventh worst weed in the world. It is more common in South Mississippi, but isolated infestations have been detected throughout Mississippi. Learn to identify this invasive species, and if you find it, control it. For more information about detecting and controlling cogongrass, contact one of the agencies listed in the "Technical Assistance" section of this publication on the back cover of this publication or the Mississippi Department of Agriculture and Commerce (<http://www.mdac.state.ms.us/index.asp>), Bureau of Plant Industry, Plant Pest Programs, Mississippi State, MS 39762-5207 (662.325.7765).

Although mowing or clipping is the most common practice used to manage vegetation on CRP and other grass stands, it produces poor grassland wildlife habitat. Mowing reduces cover height, favors perennial grasses, and creates a dense litter layer along the ground. If bobwhites and other grassland wildlife habitat are a priority, mow only to control brush or to maintain roads.



Mowing reduces cover height, favors perennial grasses, and creates a dense litter layer along the ground.



Strip-disking and prescribed fire are the main tools for properly managing established native grass stands for bobwhites. Prescribed burning should always be conducted by a certified prescribed burn manager, who develops a written burn plan and gets appropriate permits before burning. Check with the appropriate county office of the Mississippi Forestry Commission for more information about prescribed burning regulations. Another reference on prescribed fire, entitled “Prescribed Burning in Southern Pine Forests: Fire Ecology, Techniques, and Uses for Wildlife Management” (Publication 2283), is available through the Mississippi State University Extension

Service (<http://msucares.com/pubs/index.html>). A good reference on light disking for wildlife habitat entitled, “Light Disking To Enhance Early Successional Wildlife Habitat in Grasslands and Old fields: Wildlife Benefits and Erosion Potential” is available through the Mississippi USDA-Natural Resources Conservation Service or from the Natural Resources Enterprises website (<http://www.naturalresources.msstate.edu/>).

Disking can be done from October through March. Fall disking tends to promote hard-seeded forbs and legumes, whereas spring disking promotes annual grasses. Fall disking may be more effective in stimulating important food plants for bobwhite. On sites with an agricultural history, spring disking may promote agricultural pest species. Creation of an annual plant community does not require a seedbed-quality site preparation. Light disking (one to three passes with the disk set at three to five inches deep) can effectively stimulate germination of desirable annual plants. Prescribed burning is generally done winter to early March, but weather conditions will determine when prescribed burns should be conducted.

Rotational strip-disking maintains a mixture of annual and perennial plant communities. To minimize erosion, strip-disk on the contour. You can implement strip-disking on a two- to three-year rotation, disking half to one third of fields each year in a strip pattern. This rotational pattern of soil disturbance maintains one-, two-, and three-year old plant communities and produce bobwhite nesting and brood-rearing cover next to one another within each field. You can rotationally burn fields in a similar strip fashion to disking, or you can divide larger fields with disked strips into halves or thirds, burning each block every two or three years.

Disking and prescribed fire produce annual plant communities that provide essential food and cover resources for bobwhites and other grassland wildlife. Annual plant communities are character-

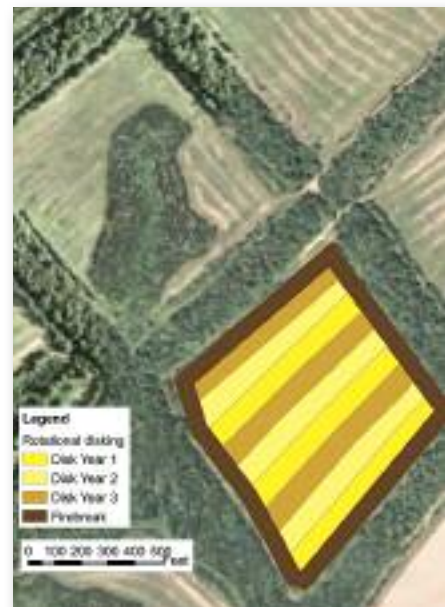
prescribed burning



strip disking



vegetation response after prescribed burning or strip disking



ized by grasses and forbs (especially legumes) that occur after a soil disturbance. Some examples of annual plants include ragweed, partridge pea, and panic grasses. Annual plants produce an abundance of seeds many birds and small mammals use. They also support diverse insect communities that provide critical nutrients for nesting birds and growing chicks. You can plant commercially available forbs (especially legumes) to enhance grassland stands that are lacking an adequate forb component. (Refer to *Native Forbs with Commercial Availability* on page 7.)

Although you do not want woody brush to dominate native grass stands for bobwhite habitat, you do want to protect or create some scattered patches of shrubby cover. Scattered thickets of native shrubs like wild plums, dogwoods, winged sumac, and vines such as blackberry provide escape and loafing cover for bobwhites. Protect existing shrub thickets (cut fire breaks around thickets if you use prescribed burning), or plant seedlings to enhance protective cover in native grass stands. Maintain or create about 10 to 20 percent of grasslands (including cropland field buffers) in shrubby cover. If you are creating scattered shrub thickets by planting, develop thickets about 100 to 300 yards apart. Because of the protective cover they offer during winter, these shrub thickets often

serve as “covey headquarters.” Coveys somewhat center their daily activities about these shrubby thickets to stay in close contact with secure cover.

You can improve woody habitats next to crops or grass fields (such as fencerows and small woodlots) for bobwhite habitat by what is commonly referred to as “edge feathering.” Edge feathering produces favorable bobwhite cover in much the same way as a forest clear cut. Bobwhites often move into young forest clearcuts because grasses, forbs, and shrubs thrive for several years after timber harvests remove large trees that shade the ground. These clear cuts often provide ideal bobwhite habitat for about three to five years. Edge feathering requires removing most of the larger trees to let sunlight reach the ground, favoring growth of native grasses, forbs, and shrubs.

“Scattered thickets of native shrubs provide escape and loafing cover for bobwhites.”



edge feathering

Native Shrubs To Protect or Plant

- American Beautyberry (*Callicarpa americana*)
 - Flowering Dogwood (*Cornus florida*), Gray Dogwood (*C. racemosa*)
 - Eastern Red Cedar (*Juniperus virginiana*)
 - Wild Plums (*Prunus americana*, *P. angustifolia*, and others)
 - Winged Sumac (*Rhus copallinum*), Smooth Sumac (*R. glabra*)
 - Blackberry and Dewberry (*Rubus* spp.)
 - Blueberry, Sparkleberry, Huckleberry (*Vaccinium* spp. and *Gaylussacia* spp.)
 - American Holly (*Ilex opaca*), Yaupon (*I. vomitoria*)
 - Wax Myrtle (*Myricaceae cerifera*)
-

You can use cut trees for timber or firewood or leave them on the site. You can partially cut some trees so the tree falls over but stays partly attached to the stump. This way, the tops and limbs remain alive for some time. Stump sprouts from cut hardwoods produce thickets that can be beneficial for bobwhite escape cover.

If you edge feather next to grassland field buffers or large patches of native grassland, a narrow cut (15 to 20 feet wide) may be satisfactory. But if edge feathering is the only habitat management practice you plan, a wide cut (30 feet or wider) is necessary. You can leave scattered mast producing trees (such as oaks, pines, cherries) in the feathered edge for additional food resources. You can enhance these areas by planting native grasses, forbs, and shrubs if a desirable plant community does not establish naturally.

Pine Forests

Pine forestlands are the main forest systems managed for bobwhite habitat in Mississippi, although upland hardwoods can also be managed for bobwhite habitat. Areas that are mostly forestland may be more difficult to manage for bobwhite habitat, especially if bobwhite populations have been absent for some time. However, large tracts of upland forest managed for bobwhites can be very productive. Proper pine forest management on a large scale offers some of the greatest opportunities to increase bobwhite habitat and populations in many areas of Mississippi.

Several habitat management tools are available to create or enhance bobwhite habitat in pine forests. Reducing tree density is the first step in developing the grass and forb ground cover bobwhites and other grassland wildlife require. Most pine forests in the Southeast do not support bobwhite because they are too heavily stocked with trees that form a closed canopy. Thinning reduces stem density and

opens the forest canopy, letting more sunlight reach the ground and stimulating growth of ground-layer vegetation.

In Mississippi most species of pines can be commercially thinned for the first time at 13 to 18 years of age, depending on the site. Basal area, or the total cross-sectional area of wood in the stand, is relatively easy to measure and relates well to herbaceous ground cover in forest stands. Typical timber thins reduce basal area to about 70 square feet/acre, but thinning stands to a basal area of 50 square feet/acre or less produces better bobwhite habitat. If bobwhite habitat is a greater priority than timber production, a basal area as low as 30 square feet/acre produces best habitat. In most cases periodic thins are necessary to maintain lower basal areas as trees continue to grow after each thin. Individual landowner objectives vary, so consultation with a registered forester and a wildlife biologist can help determine the best balance that meets both wildlife and timber objectives.

Just as thinning stimulates growth of grasses and forbs, it also favors growth of hardwood brush and trees that shade out desirable grasses and forbs if left unmanaged. Prescribed fire on a two- to three-year rotation is the most cost-effective tool to control undesirable brush invasion. When fuel conditions are appropriate for burning, thinned pine stands should be prescribe-burned during winter to early spring. Prescribed burning should always be conducted by a certified prescribed burn manager, who will develop a written burn plan and get permits before burning. Check with the Mississippi Forestry Commission office for more information about prescribed burning regulations. If prescribed fire is not an option, light disking on a two- to three-year rotation between thinned trees during fall or winter is an alternative for relatively clean sites. Always be especially cautious when disking in woodlands to avoid damaging tree trunks and roots and to avoid personal injury or equipment damage.



Soil disturbance, such as prescribed fire or disking, enhances habitat quality for bobwhites and other grassland birds because it inhibits woody brush growth, promotes annual plant communities, reduces plant residue and increases bare ground in the forest floor. Plant communities that develop after fire or disking also produce quality food and cover for deer, rabbits, turkeys, and other wildlife. If soil is not disturbed, plant community composition changes over several years, and annual plants are replaced by perennial forbs and grasses and, eventually, woody plants. By planning soil disturbances on a two- to three-year rotation, you can manage plant succession to develop a complex of different habitats that meet the seasonal habitat requirements of a number of wildlife species. For example, first-year burn areas typically produce good bobwhite brood cover by reducing litter accumulation and stimulating growth of annual plant communities that are rich in insects, whereas areas that have not been burned for two to three years provide better nesting cover because these areas will have more perennial grass and litter cover for building and hiding nests.

You can develop a rotational burning plan by creating 30-acre or smaller burn units and burning half to a third of these units one year, another half to a third the next year, and so on. Thus, you only burn a given unit every two to three years, but you burn some portion of the property each year. You can develop a rotational disking plan similarly. Disk a half to a third of suitable areas each year in a rotational way so you disk all suitable areas every two to three years.

Often, fire has been kept out of pine stands for so long that you can no longer control invasive hardwood species with low-intensity prescribed fires or disking. After thinning pine stands, if hardwood tree species dominate the ground or middle-canopy vegetation layer, you may have to treat these stands with a selective herbicide such as Imazapyr (such as Arsenal AC®).



Thinned pine stand that was not managed with selective herbicide or prescribed fire.



Thinned pine stand managed with selective herbicide and prescribed fire.

You enhance chemical control of invasive hardwoods when you use prescribed fire in the dormant season after applying herbicide (wait at least 6 months after application before burning for greatest herbicide effectiveness). Once you control these hardwood species with herbicide, future fire or disking treatments on a two- to three-year rotation should provide better control of hardwood invasions.

With some planning, you can protect some mast/fruit producing hardwoods and shrubs (such as wild plum, dogwoods, and oaks) from prescribed fire and herbicide treatments. These scattered hard and soft mast producing trees and shrubs can provide food and cover resources for bobwhites and other wildlife.

You should control invasive, non-native vegetation (for example, kudzu or cogongrass) in forest stands with herbicide treatments. Herbicidal control of all types of invasive vegetation is more economical and effective if you treat invasive species when they first appear. Contact a



woodland strip disking

wildlife biologist or forester to develop a plan for controlling invasive vegetation. Cogongrass, especially, is extremely invasive and seriously harmful to native plants and wildlife habitat. Landowners should learn to identify this invasive species, and if they find any, they should work to control it. For more information about detecting and controlling cogongrass, contact one of the agencies listed in the “Technical Assistance” section on the back cover of this publication or the Mississippi Department of Agriculture and Commerce (<http://www.mdac.state.ms.us/index.asp>), Bureau of Plant Industry, Plant Pest Programs, Mississippi State, MS 39762-5207 (662.325.7765).

A good way to produce more grassland wildlife habitat in forestland is to create forest openings. For bobwhites, 10 percent or more of forested acreage should be maintained in early successional openings. You can create these in established woodlands by clear cutting one- to five-acre patches throughout forest stands. You can easily create openings during commercial thinning of pine stands. Plan ahead and have a forester mark out forest openings when marking timber for thinning.



“A good way to produce more grassland wildlife habitat in forestland is to create forest openings. For bobwhites, 10 percent or more of forested acreage should be maintained in early successional openings.”

For mid-rotation pine plantations, you can create interconnected forest openings in a hub-and-spoke design. The hub-and-spoke opening has a central opening (hub) with open lanes (spokes) radiating through the pine stand, like a wagon wheel. You can create hub-and-spoke openings by removing several adjacent rows of trees when you thin a pine plantation. Hub-and-spoke lanes should be at least 30 feet wide to maintain grassy cover for bobwhites. The maximum width of lanes depends on how much timber acreage you are willing to remove from production (generally, the wider the lanes, the better). You can also use hub-and-spokes as fire breaks for prescribed burning of mid-rotation pine stands.

You can also develop forest openings by widening or heavily thinning woodland roadsides and keeping log-decks or skid trails open. You can use forest openings for permanent or rotational food plots planted to appropriate supplemental food crops. Openings can also be used as log-decks during later timber harvests. Use prescribed fire or disking on a two- to three-year rotation (described above) to manage forest openings.

Supplemental Food Plantings

Supplemental food plantings, or food plots, may not always be necessary, but food plantings may provide some critical food resources during late winter and early spring when food is most limited. For bobwhite management, you should favor hard seeded food plantings such as partridge pea, beggarweeds, or lespedezas (other than sericea). Leave grains such as corn and sorghum standing, so more seed will be carried on the stalk later into fall and winter.

In many cases you can produce important bobwhite foods without planting anything. As mentioned earlier, two very effective and affordable tools for bobwhite management are prescribed fire and light disking. Some sites have a good existing seedbank of forbs (especially legumes) and annual grasses that are



“For mid-rotation pine plantations, you can create interconnected forest openings in a hub-and-spoke design.”



“Food plots may not always be necessary, but food plantings may provide some critical food resources during winter when food is most limited.”



good bobwhite foods. After prescribed burning or light disking an area, a wildlife biologist can quickly determine whether a site has an abundance of natural food plants, or if enhancing the seed-bank through plantings is necessary.

A number of reseeding annual plants can be established to provide important bobwhite food. With proper management, these plants can be maintained for several years without replanting. Of all these plants, partridge pea and kobe lespedeza may be the most popular across the Southeast. Although these legume seeds are fairly expensive, it is important to remember that a single planting can provide food for several years if you manage stands with prescribed burning or light disking from fall to winter.

Where grain crops are grown, one way to provide bobwhites with supplemental food and cover is simply to leave a border of crop standing around the edge of a field. This is a cost effective way to provide a variety of agricultural foods, some of which can be difficult to cultivate in small patches because of intense deer browsing. Crop strips as narrow as 10 feet wide can provide a lot of bobwhite food on field edges. These strips will be more effective, though, if you leave them next to field buffers described earlier. If you lease lands for farming, you can have a contract developed to require the farmer to leave a small portion of the crop standing, typically in exchange for a reduced land rental rate.

Food plot size and shape are important because they influence the amount of edge around a plot, which occurs where different types of plant communities come together (such as where a forest is next to a field). Planting several small food plots, rather than a few large ones, and making those plots an irregular shape maximizes the amount of edge and thus make food plots more valuable for bobwhites.

Carefully consider and plan where to establish food plots. For example, the best food plots are next to areas with good escape cover, such as a plum or briar thicket. If you do not have escape cover, you can develop shrubby thickets next to food plots.

When establishing annual food plots, think about rotating food plot plantings each year and leaving part of the plot unplanted or fallow. In some cases, bobwhites benefit more from the native plant community in a fallow food plot than from the actual food planting itself. An example of this would be to establish strip plots of grain sorghum along the border of a grass field. The next year, leave that plot undisturbed and establish a similar strip plot beside the fallow plot. The soil disturbance created by preparing a good seedbed for planting encourages growth of many beneficial grass and weed species. Also, these fallow areas create a habitat that allows bobwhite chicks to move around freely and harbors plenty of insects for chicks to feed on.

More information on bobwhite food plantings is in Extension publication 2325, Supplemental Food and Cover Plantings for Bobwhite Quail in Mississippi (<http://msucares.com/pubs/index.html>). A wildlife biologist can also provide more information on managing food plantings for bobwhites.

Native and noninvasive, introduced plants for supplemental food plantings

Natives

- Ragweed (*Ambrosia artemisiifolia*)
- Partridge pea (*Chamaecrista fasciculata*)
- Smooth ticktrefoil (*Desmodium laevigatum*)
- Stiff ticktrefoil (*Desmodium obtusum*)
- Florida beggarweed (*Desmodium tortuosum*)
- Roundhead lespedeza (*Lespedeza capitata*)
- Slender lespedeza (*Lespedeza virginica*)

Introduced or cultivated

- Kobe lespedeza
- Korean lespedeza
- Browntop millet
- Sorghum or milo
- Egyptian wheat
- Corn
- Soybeans
- Field peas (also called Cow peas)
- Sunflowers
- Wheat or oats and clovers (for bobwhites, plant clovers at 10 lbs/acre or less); cool-season planting, leave undisturbed throughout the summer

Landscape-level Habitat Management

The kinds of habitats and resources bobwhites need must be developed at proper scales to maintain populations. Because bobwhites are not migratory, they need large portions of the landscape maintained in suitable habitat. Some science-based estimates suggest 2,000 to 4,000 acres of usable habitat is required to sustain viable populations in a given area. Relatively small (less than 1,000 acres), isolated land holdings managed for bobwhite can be productive habitat, and small acreages managed for bobwhite can help survival and reproduction. However, populations inhabiting small acreages are more susceptible to random environmental catastrophes (such as drought, ice storms, etc.), and processes such as gene flow and successful dispersal of individuals among populations may be minimal. Smaller properties managed for bobwhite habitat are more effective if several are managed within a mile of one another.

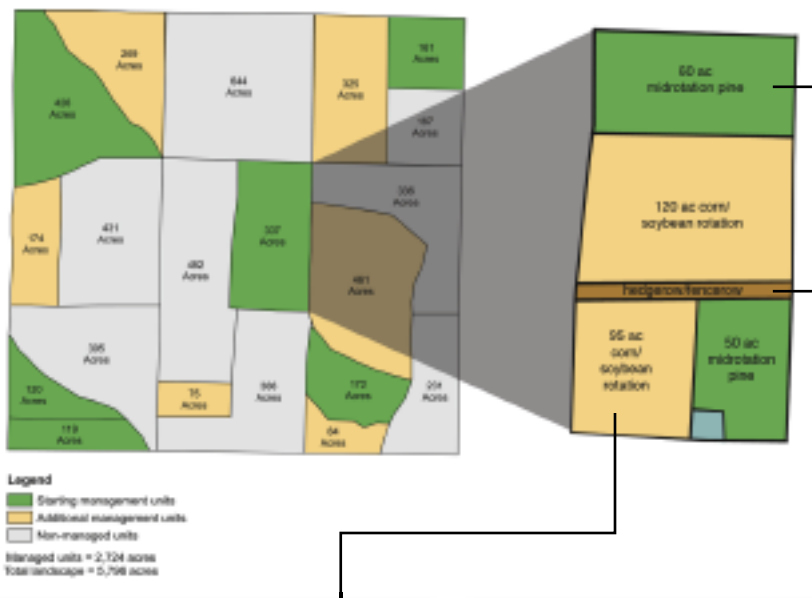
The figure on the right shows the concept of landscape-level habitat management. Each shape represents a landowner's property (acreage given inside the polygons) within the total 5,800-acre landscape. The green properties represent landowners who are actively managing for bobwhite habitat. The figure indicates 1,335 acres are being actively managed, which seems like a lot of habitat. However, when you look at the whole landscape, it is clear these are relatively isolated "islands" of habitat.

Assume some landowners next to green habitat management properties have also gotten involved in bobwhite management through local promotional efforts or habitat initiatives. The brown properties represent additional properties managed for bobwhite habitat. The amount of managed property has more than doubled (2,724 acres managed), and now much more interconnected habitat makes it easier for bobwhites to move between managed properties.

This illustration is very simple, since population response is a function of the quality and quantity of habitat and whether or not there are existing "seed" populations of birds in the landscape. However, it demonstrates the concept of "landscape-scale management" by positively affecting a large part of the overall landscape.



pine woodland management



field buffers along row crop fields



edge feathering along the interface of woods and fields

Since bobwhite populations respond better to management over several thousand acres, landowners with smaller acreages may want to consider working with a group of neighboring landowners to form a landowner wildlife management cooperative. A cooperative combines small acreages of neighboring landowners to create larger tracts of managed habitat (as illustrated by the landscape-scale management figure above). Forming a landowner cooperative requires that a group of neighboring landowners share common wildlife management goals and

"Smaller properties managed for bobwhite habitat are more effective if several are managed within a mile of one another."

effectively work together to achieve those goals. A good starting reference on developing a landowner cooperative is Extension publication 1637, *Wildlife and Forestry Landowner Cooperatives* (<http://msucares.com/pubs/index.html>). A wildlife biologist or registered forester may be able to provide more specific information on developing a successful landowner cooperative.

Conservation Programs for Private Landowners

Before beginning management of a property for bobwhites, have a bobwhite habitat management plan in place. Agricultural producers can work with a wildlife biologist to develop a farm-wildlife plan that includes habitat management practices that are economical and practical for farm operations. Forest landowners can develop an integrated forest-wildlife management plan with a wildlife biologist and a registered forester to implement practices that accomplish both wildlife habitat and timber management objectives. Several conservation programs can assist private landowners with implementation costs of farm and forest wildlife management practices. You can find contact information for the agencies that administer each of these programs in the “Technical Assistance” section on the back cover of this publication.

Financial assistance for habitat management may be available through one or more USDA conservation programs. The Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), and Conservation Security Program (CSP) are available for landowners with eligible land uses. CRP, EQIP, and CSP are available to landowners with land in agricultural production; landowners managing forests for forest products such as timber are eligible for EQIP, but the property must meet criteria to be considered a farm. CRP provides conservation practices for field-level management. EQIP and CSP are more oriented toward

whole-farm management. Management practices available through EQIP depend on the county where a property is located. CSP is limited to producers in specific watersheds, and different priority watersheds are chosen for CSP every year. For landowners who have acreage enrolled in existing CRP grass (such as CP10) or forest (such as CP11) conservation covers, mid-contract management cost-shares are available for prescribed fire, herbicide application, and light disking. Contact the Farm Service Agency office for more information regarding CRP. For landowners interested in whole-farm management programs, contact the Natural Resources Conservation Service (NRCS) office for more information on EQIP or CSP.

The Wildlife Habitat Incentives Program (WHIP) is available to any private landowner. WHIP offers cost-shares for a wide variety of habitat management practices to develop bobwhite habitat in both open lands and nonindustrial private forestlands. Some of the practices WHIP cost-shares include prescribed fire, herbicidal control of invasive vegetation, native vegetation establishment, and forest regeneration. Contact the NRCS office about WHIP.

The Forest Resource Development Program (FRDP) is available to any non-industrial private forest landowner. FRDP provides cost-shares for forest management practices such as herbicidal control of invasive vegetation and forest regeneration. The Healthy Forests Reserve Program (HFRP) assists private landowners in restoring rare forest ecosystems (such as longleaf pine) through active management and stewardship. HFRP provides landowners with conservation easements and cost-shares for appropriate forest management practices. Contact the NRCS office about HFRP or the Mississippi Forestry Commission office for more information about and FRDP.

The Landowner Incentive Program (LIP) provides state wildlife agencies with



“Several conservation programs can assist private landowners with implementation costs of wildlife management practices. Planning ahead helps accomplish specific management goals.”

funds to enhance, restore, and protect imperiled habitats and benefit at-risk wildlife species on private lands. In Mississippi the longleaf pine region of the southeast, the Blackland Prairie of the northeast and central sections, and bottomland hardwood areas of the Delta were chosen as those of greatest conservation need under LIP. Mississippi's LIP will cost-share practices such as site preparation, prescribed burning, tree and native warm season grass plantings, and herbicide applications. Biologists from the Mississippi Department of Wildlife, Fisheries and Parks and Wildlife Mississippi provide technical guidance to landowners who participate in LIP.

Wildlife Mississippi also has prairie and longleaf pine restoration programs available to eligible landowners. Contact Wildlife Mississippi for information about their prairie and longleaf restoration programs.

Delta Wildlife provides technical assistance and cost-share for habitat development to landowners in the Delta region. Contact Delta Wildlife for information about their habitat management programs.

You can apply many of the same habitat management practices with each program, but there are differences in eligibility and financial incentives under each program. Depending on land uses, you may be able to apply a combination of conservation programs for greatest conservation and financial benefits. Remember, planning ahead helps accomplish specific management goals by applying a suite of programs and practices that accomplish management objectives and make the most financial sense.

Population Monitoring and Harvest Considerations

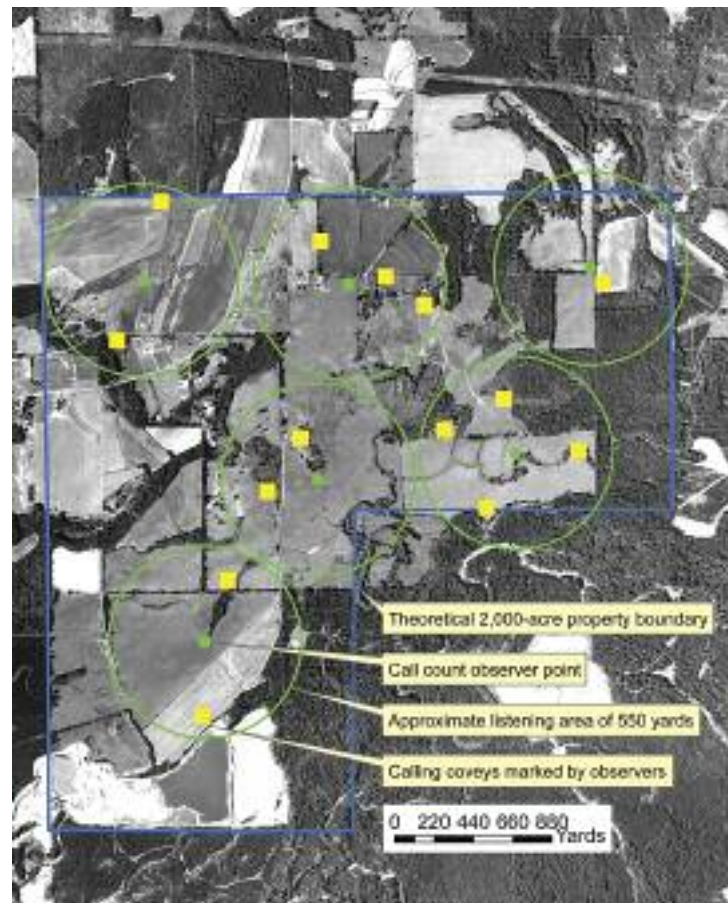
Fall Population Estimation

Population monitoring allows you to evaluate the effectiveness of your habitat management program. You can use covey-call surveys to estimate fall bobwhite population sizes. Covey-call counts

should be conducted from mid October to mid November. The best calling period is usually during last two weeks of October. Covey-call counts should be conducted on days with little to no cloud cover or wind and high barometric pressure. Coveys typically call about 30 minutes before sunrise, and most coveys in an area start calling about the same time.

To conduct a covey-call count, get an aerial photograph or other type of map of the property where you can accurately determine locations to station observers. Having some copies of the map is also helpful to mark calling covey locations during the count. Distribute observer point locations around the property in places where observers can effectively hear calling coveys. Do not put survey points in areas that are not good bobwhite habitat or where there is a lot of noise (as in a closed-canopy pine plantation or along a busy highway). With practice, observers with good hearing can

hear calling coveys to a distance of about 550 yards (0.3 miles), which equals an effective survey area of about 200 acres. This hearing distance was estimated for relatively flat, open habitats – fields or open woods – and thus should apply to most areas managed for bobwhites in Mississippi. Space each call count observer point at least two times the estimated hearing distance (1,100 yards) from any other count point to reduce chances of more than one observer counting the same coveys.



It is best to survey all count points on the same morning (on smaller acreages, a couple of observers may be enough to survey all points). It is also a good idea to survey each point two to three different mornings, and use the average or greatest count of coveys at a given point for population estimates. On some larger properties, there simply are not enough observers to survey all points in a single morning. In this situation, survey the area in blocks each available morning based on number of available observers.

To use these covey counts to estimate bobwhite population sizes, flush as many coveys as you can find to estimate covey sizes, or you can assume that 12 birds is a reasonable estimate of average covey sizes. Once you estimate the average size of coveys, multiply the number of coveys you counted by the average covey size. This gives you an estimate of bobwhite population size. You can get more accurate estimates from covey-call surveys by adjusting for the proportion of coveys that do not call. More details and information on advanced applications of the covey-call count technique are available on the Tall Timbers Research Station website (visit <http://www.ttrs.org/> and follow the "Research Programs, Game Bird" link).

Harvest Management

If you are interested in managing a property for hunting bobwhites, carefully consider harvest rates. After you make some estimates about bobwhite population sizes, you can decide how many birds to take during the hunting season. Some harvested birds would have died due to predation or bad weather, but others would have lived to the breeding season if not harvested. Thus, hunting can negatively affect populations if not carefully managed, because hunting almost always removes some birds that would have survived until the breeding season, with an opportunity to reproduce.

The best way to control harvest is to remove only a certain percentage of the

estimated fall population. For example, covey-call counts (using methods discussed previously) in October suggest population size is about 100 birds, and perhaps it is acceptable to the manager to harvest 20 percent (20 birds, including cripples) of this fall population. Assuming that 30 to 60 percent of the remaining birds were lost to other sources of mortality, a population of 32 to 56 birds would be carried into the breeding season. This is a somewhat simplified scenario, as some birds will move in and out of the population.

In the Southeast, managers should limit harvest to no more than 20 to 25 percent of the fall population as a general rule. If the surrounding landscape is more favorable to bobwhites, you may allow more liberal harvests in the 20 to 25 percent range. If a given property is essentially an "island" of bobwhite habitat surrounded by relatively unfavorable habitat, you should harvest more conservatively.

Summary

Bobwhites thrive in habitats characterized by native grasses, forbs, and scattered shrubs. Historically, annual burning of fields, grasslands, and open pine forests, along with associated moderate livestock grazing and cropping, provided the right patchwork or "mosaic" of early successional habitats that bobwhite and other grassland wildlife required. As human activity once accidentally created optimal habitat for bobwhites, changes in the ways people use lands have contributed to declining bobwhite habitat quality. Millions of acres of small agricultural fields that once provided nesting, brood-rearing, and protective cover for the bobwhite have been converted to less favorable land uses such as intensive agricultural production, closed-canopy forests, and urban development. By understanding the various aspects of a bobwhite's life and seasonal habitat needs, it is easier to understand how to apply management tools and prescriptions to produce desirable bobwhite habitat.



Open lands, including agricultural habitats, Conservation Reserve Program grasslands, and nonagricultural grasslands are often the easiest habitats to manipulate for bobwhite management because of the relative ease of developing grassy cover and because existing bobwhite “seed” populations are usually associated with these habitats.

Bobwhite habitat in open lands can be enhanced by developing suitable idle habitats, conversion of non-native, invasive grasses such as fescue and bermudagrass to native warm season grasses and forbs, rotational fallow field crop management, establishment of native grass and forb field buffers around edges of crop fields, and edge feathering. Strip-disking and prescribed fire are useful tools for managing native grass stands for bobwhite habitat. Although dense infestations of woody brush in grass fields are undesirable, creating and protecting some scattered patches of shrubby cover is desirable. Actively managing habitats maintains the combination of plant communities that meet bobwhite seasonal habitat requirements.

Forestland may be more difficult to manage for bobwhite habitat, especially if bobwhite populations have been absent for some time, but large tracts of managed upland forest can be productive bobwhite habitat. Proper pine forest management on a large scale offers some of the greatest opportunities to increase bobwhite habitat and populations in many areas of Mississippi. Habitat management tools used to create or enhance bobwhite habitat in forestlands include thinning to reduce tree density, creating forest openings, regular soil disturbances (prescribed fire or disking) to maintain grassy ground cover conditions, and selective herbicide as necessary to control hardwood brush invasions.

Supplemental food plantings or food plots may provide some critical food resources for bobwhites in late winter and early spring when food resources become limited. In some cases, bob-

whites benefit more from the native plant community in a fallow food plot than from the food planting itself. Once you determine the number, size, shape, and location of food plots, you can select the types of plants to propagate.

The seasonal habitats bobwhites require need to be developed at the right scale to maintain populations. Relatively small (less than 1,000 acres), isolated land holdings managed for bobwhite can be productive habitat, and smaller acreages managed for bobwhite might have locally positive effects on survival and reproduction. However, smaller habitat areas are probably more effective if several land holdings within a mile of each other are managed for bobwhite habitat. Since bobwhite populations respond more effectively to management over several thousand acres, landowners with smaller acreages may want to consider working with a group of neighboring landowners to form a landowner wildlife management cooperative.

Consult with qualified natural resource management professionals (such as wildlife biologists and registered foresters) to develop a comprehensive resource management plan. Several conservation programs are available to landowners seeking financial assistance to develop bobwhite habitat. Working with natural resource management professionals can make it easier to determine program eligibility and select conservation programs that accomplish your resource management objectives.

Finally, understanding bobwhite population dynamics and harvest management helps prevent poor resource use decisions. Carefully managing bobwhite harvest helps ensure long-term bobwhite population sustainability.

Sources of Information

The following websites or offices have additional publications and information about bobwhite and other wildlife management:

Delta Wildlife – <http://www.deltawildlife.org/>

Mississippi Department of Wildlife, Fisheries and Parks – <http://www.mdwfp.com/>

Mississippi State University Extension Service – <http://msucares.com/> (You can get many wildlife and forest management publications by visiting the website or your county Extension office.)

Mississippi State University Natural Resources Enterprises – <http://www.naturalresources.msstate.edu/> (You can get many wildlife and forest management publications by visiting the website.)

Quail Forever – <http://www.quailforever.org/>

Quail Unlimited – <http://www.qu.org/>

Wildlife Mississippi – <http://www.wildlifemiss.org/>

Technical Assistance

The following agencies are available to provide wildlife and forest management planning or technical assistance:

Mississippi Department of Wildlife, Fisheries and Parks
Website: <http://www.mdwfp.com/>
Phone: 601.432.2400

Delta Wildlife, Inc.
Website: <http://www.deltawildlife.org/>
Phone: 662.686.3370

Wildlife Mississippi
Website: <http://www.wildlifemiss.org/>
Phone: 662.686.3375

Mississippi Forestry Commission (MFC) has foresters to assist landowners with forest management planning.
Website: <http://www.mfc.state.ms.us/>
Phone: 601.359.1386

Mississippi State University, Wildlife and Fisheries Extension
Website: <http://msucares.com/>
Phone: 662.325.3174

Mississippi State University, Forest and Wildlife Research Center
Website: <http://www.cfr.msstate.edu/fwrc/>
Phone: 662.325.2952

USDA-Farm Service Agency administers the Conservation Reserve Program.
Website: <http://www.fsa.usda.gov/>
Phone: 601.965.4300

USDA-Natural Resources Conservation Service has wildlife biologists and foresters to assist landowners with wildlife and forest management planning.
Website: <http://www.ms.nrcs.usda.gov/>
Phone: 601.965.4339

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Strip Disking and Other Valuable Bobwhite Quail Management Techniques



The bobwhite quail (northern bobwhite, *Colinus virginianus*), is one of the most exciting game birds in the Southeast. A covey rise of 12 or more birds in front of a dog's nose has increased the heart rates of thousands of bobwhite hunters over the decades that man has enjoyed this sport.

For the past several decades, though, bobwhite numbers have been declining, and for the last 10 years, population declines have been as much as 7 percent per year in certain places. Changing land use practices and habitat conditions (food and cover problems) account for most of the downward trend in bobwhite numbers, but other factors, such as predation, disease, and environmental toxicants may play significant roles. In parts of the South, where bobwhites have been managed intensively, bird populations have remained stable, which indicates the bobwhite quail can be managed successfully if you use proper techniques to create essential habitats.

Habitat Requirements

In the southeastern United States, bobwhite are closely tied to early successional plant communities. Early successional plants are the annual weeds, grasses, and shrubs that develop in the first several years after some kind of disturbance. The disturbance may be a disking, fire, cultivation or fallowing, or such.

Bobwhites have specific habitat requirements that vary seasonally according to environmental and biological processes. Various stages of the agricultural/fallow/idle old-field cycle meet different seasonal habitat needs of bobwhites. For example, they nest in idle native grasslands (broomsedge field), raise their broods in weedy areas, and use low shrubby cover for protection from predators and weather. Habitat



management programs for bobwhites should create and maintain each of these plant communities that meet specific seasonal habitat needs. In the past, bobwhite were an accidental byproduct of forest and agricultural management practices. However, in modern landscapes, restoration of bobwhite populations requires intentional management.

Habitat Management

Planned periodic disturbance is the key to creating and maintaining bobwhite habitat. Because of the long growing season, fertile soils, and abundant rainfall in the Southeast, undisturbed agricultural lands can rapidly develop into dense young forests not suitable for bobwhites. Management practices that are beneficial for bobwhites generally involve setting back plant succession to very early stages, similar to those found in fields one or two years after cultivation. In the South, habitats, whether open fields or wooded areas, that are allowed to grow up longer than three to four years without some type of soil or vegetative disturbance quickly grow out of good bobwhite habitat.

Typically, management practices for open fields include prescribed burning annually or every two years, bush-hogging, disking, planting agricultural crops, and protecting some areas that grow up into brushy escape cover. For wooded areas, the same management practices apply, but concentrating on opening up or daylighting canopies by selective thinning or clearcut timber harvests (to encourage understory plant growth) is important. Prescribed burning on a one- or two-year rotation is critical in pine forests for controlling the leaf and needle litter layer and hardwood understory and for promoting growth of legumes.

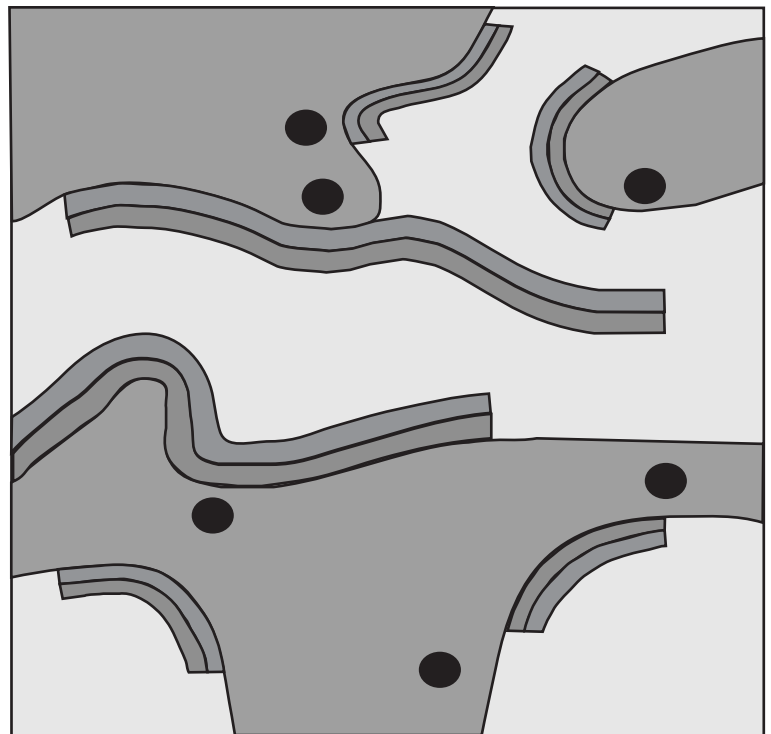
Bobwhite thrive in complex landscapes that resemble a patchwork of small crop fields, old fields, grasslands, and brush. Mixing different habitat types (nesting, broodrearing, feeding, or escape cover) close by is a must. Small patches






of various habitat types, such as brushy fence rows and ditch banks, should be left within cropland or old-field areas. Small woodlots should be bordered by transition zones of brushy cover that gradually fades into an opening or field. Artificial brush piles or windrows can be placed in large fields to break them into smaller units and increase habitat diversity. The goal is to create a patchwork of types, well interspersed. This interspersed patchwork increases the proportion of the landscape bobwhites can use.

Strip Disking

Although bobwhite populations have declined, many landowners in the Southeast have significant opportunities to create habitat and restore populations. Hundreds of thousands of acres of old fields and young forests may provide excellent bobwhite habitat. But many of these habitats are in poor shape for bobwhites because they have grown up into thickets of less desirable grasses and brush that are too dense for birds to use. Many don't have a desirable plant mix.

Bobwhites like to have their feet touch bare ground because this makes it easy for them to feed on seeds and insects. The key to bobwhite management



	Native woods		Disk 30-50 foot wide strip on odd years
	Artificial brushpiles or half-cut trees bent to the ground		Disk 30-50 foot wide strip on even years
	Native herbaceous vegetation		

is a balance between a mix of bare ground that lets bobwhites feed and travel freely and vegetation that provides food, nesting habitat, and protection from predators.



Thick sod or dense vegetation that hinders bobwhite feeding can be renovated in old-field habitats with a tractor and disk. The technique simply involves disking strips through a field or open woods in the fall or spring. These strips should be 30 to 50 feet wide and separated by undisked strips of 60 to 100 feet. Disked strips should be as long as possible and should follow the contour of the land to prevent erosion. The undisked areas will provide nesting habitat, while the adjacent disked areas that later grow up into succulent forbs and legumes will provide habitat that is rich in insects and seeds.

Strip disking should be thought of as a rest/rotation system. After a year has passed, disk the previously undisked areas and let the previously disked areas grow for up to two years. This system develops a mix of vegetation that is zero to one, one to two, and two to three years old. Do not let areas get older than three years.

Strip disking enhances habitat quality in a number of ways, including releasing grass-bound fields, reducing litter accumulation, creating bare ground, stimulating germination of desirable seed-producing plants, and increasing insect populations by as much as four times. It will maintain nesting cover and produce adjacent brood habitat on a scale that will positively impact bobwhite populations. It will provide more insects and plenty of natural seeds at a much lower cost than planting food plots, although planting some of the strips to grains or legumes will further enhance habitat quality by providing additional winter food resources.

Although planting winter food resources is an important management tool and can enhance local habitat quality, vegetation succession management is the single most important aspect of bobwhite habitat management in the Southeast. Strip disking is an efficient and cost-effective vegetation management tool and should be broadly implemented to enhance bobwhite habitat quality.

As an example of successful strip disking, one Mississippi landowner kept records between 1987 and 1991 that show an increase in covey numbers from 16 to more than 100 partly because of switching to this management technique. Although not a cure-all for bobwhite quail, strip disking can be a valuable management technique that may help return the bobwhite to good population numbers.

Conservation Reserve Program

Strip-disking is an approved management practice on grass fields enrolled in the Conservation Reserve Program (CRP). In fact, the USDA-Farm Services Agency will cost-share (50 percent) strip-disking on CRP as a mid-contract management practice. To qualify for this cost-share CRP contract, you must visit your USDA Service Center (USDA-FSA/NRCS office) and request that your CRP conservation plan of operation (CPO) be modified to permit strip-disking. For further information, see the USDA-FSA Mid-Contract Management Guidelines and USDA jobsheets MS-CRP-05 and MS-ECS-645-09.



Revised by **Dr. Wes Burger**, Professor, Department of Wildlife and Fisheries.

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Pasture Management for Bobwhite Quail¹

William M. Giuliano, James F. Selph, Emma V. Willcox, and Adam S. Willcox²

Like many agricultural practices, livestock grazing is often blamed for the loss and degradation of wildlife habitat, including that of bobwhite quail (Figure 1). However, in many rangeland systems, this is not necessarily the case, and grazing can actually be an effective habitat management tool. Fred Guthery, a Texas-Oklahoma quail biologist of more than 30 years, summed it up best when he said:

“No habitat management tool is more powerful than the cow. Give her a little salt, supplement and water, and she manages millions of acres of bobwhite cover. Like any powerful tool, she can be harmful or helpful, depending on how she's applied.”

Applied properly, grazing can create and maintain quality quail habitat, which includes small patches of nesting cover (warm-season, bunchgrasses such as bluestems), foraging habitat (weeds such as ragweed), and escape cover (shrubs such as saw palmetto) mixed among each other, like patches in a quilt. This is often referred to as the Crazy-Quilt and is necessary for healthy and abundant quail populations (Figure 2).



Figure 1. Bobwhite quail. Credits: J. Vanuga, USDA-NRCS, www.forestryimages.org. (2003).

Native Range

Whether it's pine flatwoods, cabbage palm-wiregrass prairie, or any other type of rangeland system, as grazing intensity changes, so does the plant community. From a cattle forage standpoint, native range in a pristine state, such as one with natural fire regimes and little or no livestock grazing, is considered “excellent.” Highly desirable and palatable native grasses, collectively called “decreasers” because they tend to decrease in abundance and distribution as grazing intensity

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Figure 2. Healthy quail populations require small patches of nesting cover (bunchgrasses), foraging habitat (weeds), and escape cover (shrubs) mixed among each other, like patches in a quilt—often referred to as the Crazy-Quilt. Credits: W.M. Giuliano. (2005).

increases, typically dominate these systems (Figure 3). In Florida, these often include creeping and chalky bluestem, lopsided Indiangrass, switchgrass, and maidencane. Most rangeland systems in this condition typically have relatively few species of forbs (broad-leaved, herbaceous plants) and sparsely-distributed, low-growing shrubs. Some Florida rangelands are an exception to this general rule, because the dominant or co-dominant native grass is wiregrass, which may dominate the range in the absence of grazing, and maintains or increases its dominance with moderate levels of grazing. While these types of areas provide excellent nesting cover for quail, they are poor-fair in the foraging and escape cover necessary for abundant quail populations.

As grazing intensity increases, the preferred native grasses decrease in abundance, while less palatable grasses (such as broomsedge and bottlebrush threawn) and forbs, called increasers, become more abundant and widely distributed (Figure 3). Often thought of as weeds, many of these species produce and attract abundant and nutritious quail foods, such as seeds and insects, while providing excellent foraging cover and some escape cover. Certain legumes (such as partridge pea and beggarweeds) are particularly valuable increasers for quail because of their high protein content and associated insect communities. The increased soil disturbance from having more livestock hooves in an area may also improve soil conditions for these

“weed” species, accelerating their establishment. In addition to increases in these “weeds,” shrubs and woody vegetation (such as saw palmetto and wax myrtle), known as invaders, begin to proliferate as competition from native grasses is reduced by grazing (Figure 3). These types of plants are valuable for quail as escape cover from both predators and weather. Livestock grazing also reduces grass density and biomass in the area, improving conditions for quail. Dense vegetation, particularly at the ground level, can inhibit quail movements and reduce foraging efficiency and the quality of nest sites. Moderate levels of grazing typically lead to this more open and diverse rangeland community that produces the best quail habitat, and is considered good-fair condition, in terms of livestock forage.

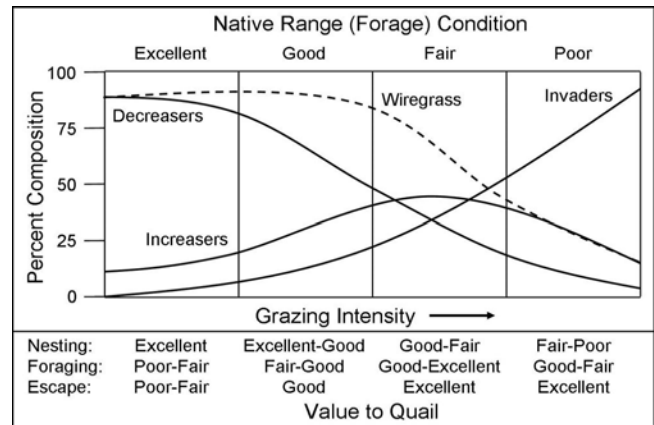


Figure 3. In the absence of other land management practices (for example, prescribed burning of shrubs), increases in grazing intensity have relatively predictable effects on plant communities—decreasers such as chalky bluestem and lopsided Indiangrass decline in abundance; increasers such as broomsedge, many “weeds,” and wiregrass at first increase and then decline in abundance; and invaders such as saw palmetto continually increase in abundance. Moderate grazing intensities tend to lead to a mixture of plant types, providing for all of the bobwhite's habitat needs (nesting, foraging, and escape cover) and good-fair forage conditions for cows. Credits: W.M. Giuliano. (2006).

When grazing intensity is heavy, livestock often eliminate the preferred native grasses (decreasers). As cattle turn to the less palatable grasses and weeds (increasers), including wiregrass and broomsedge, these also decline in prominence. And in the absence of fire and other control treatments, shrubs and woody vegetation (invaders) rapidly spread in an area. While this situation provides excellent escape

cover conditions and fair-good forage conditions for quail, it provides little or no nesting habitat and will result in low quail numbers. Lacking most grasses, these areas are also poor in forage condition for livestock (Figure 4).



Figure 4. Heavy grazing, when non-forage species are not being controlled through prescribed fire and other treatments, often removes native grasses and weeds, allowing shrubs such as saw palmetto to dominate the range. While this situation provides excellent escape cover conditions for bobwhites, it provides little or no nesting habitat and will result in low quail numbers. Lacking most grasses, these areas are also poor in forage condition for livestock. Credits: W.M. Giuliano. (2004).

Alternatively, heavy grazing, particularly when invaders are being controlled, may lead to the typical “golf course effect,” providing little forage for cattle and no food or cover for quail (Figure 5).



Figure 5. Heavy grazing, particularly when shrubs and other non-forage plants are being controlled, may lead to the typical “golf course effect,” providing little forage for cattle and no food or cover for quail. Credits: W.M. Giuliano. (2006).

Unfortunately for quail, many of our rangelands in Florida are in either excellent or poor forage condition. Excellent forage condition comes about through intensive range management (for example, overly frequent prescribed fire, herbicide use, and mechanical treatments) or lack of grazing. Poor conditions result from overgrazing and lack of fire. The ideal situation for quail exists with good-fair range conditions for cows, because this creates an environment that includes all that a bobwhite needs: food and foraging cover, nesting cover, and escape cover, all in small patches interspersed with each other—the Crazy-Quilt. The further we get from both excellent and poor range conditions for cows, the more quail the area can support. While only a moderate stocking rate can be applied and still maintain these ideal habitat conditions for quail, it does have advantages from a livestock management perspective. By maintaining moderate stocking rates and good-fair range conditions for livestock, ranchers avoid having to manage intensively the range. To sustain the heavy grazing necessary at high stocking rates, fertilization, prescribed fire, and mechanical treatments are necessary to maintain forage grasses and remove the less palatable increasers and invaders. In addition, healthy bobwhite populations, obtained only with moderate grazing intensities, can lead to increased hunting opportunities and the possibility of deriving income from quail harvests.

Improved or Tame Grass Pasture

Much of the native rangeland in Florida is being or has been “Improved.” This may increase forage production for cows but makes most of the area unsuitable for quail. Typically, improvements include the eradication of native grasses, forbs, shrubs, and trees, and the establishment of large monocultures of exotic forage grasses such as bahiagrass. While some of these grasses, including bahiagrass, produce abundant seed that is used by quail, no single food can satisfy the nutritional requirements of bobwhites. Diverse plant communities produce a greater abundance and diversity of plant foods, as well as attracting a greater abundance and diversity of insect foods for quail. The eradication of forbs, shrubs, and trees also removes most of the foraging and escape cover for bobwhites. If the grass used in an improved pasture

is a bunchgrass that is similar to our native grasses in structure, it may provide good nesting habitat. However, given that foraging and escape cover are usually not present in the pasture, it will receive little or no use because the birds prefer to nest within a short walk or flight from feeding and escape cover (typically less than 200 feet). Therefore, most quail use of improved pastures occurs on the periphery, where birds have access to food and cover, reducing the total useable habitat for bobwhites and the overall number of birds on a ranch (Figure 6).



Figure 6. Most bobwhite use of improved or tame grass pastures occurs on the periphery, where birds have access to more abundant food and cover (particularly shrubs for escape), reducing the total useable habitat for quail and the overall number of birds on a ranch. Credits: W.M. Giuliano. (2005).

How Do We Get There

Unfortunately, there is no magic stocking rate or number of animal units that will always provide moderate grazing intensity and the Crazy-Quilt that bobwhites need. How many animals are needed, how long they graze, how often are in an area, and at what time of year, are all factors that need to be considered; and all will change from one pasture to the next, and even within large pastures due to differences in soil conditions, vegetation, and climate. This is further complicated by other management activities that affect plant communities, including prescribed fire, mechanical treatments such as roller-chopping, herbicide applications, and fertilization. All is not lost, however, as most experienced range managers can predict grazing impacts of various stocking rates given normal conditions.

Although very little is known about the impacts of grazing on bobwhites in Florida, studies of quail in other rangeland systems and on similar species within the State tell us several things:

- All other things being equal, rotational grazing is better for bobwhites than continuous grazing. In pastures without cows, birds and nests will not be disturbed and vegetation will have a chance to grow, providing better food and cover. Even a simple system, where animals are rotated off native range prior to nesting season (early spring) and put on tame grass pasture, will benefit quail. Except for the periphery, little or no nesting occurs in large tame grass pastures, so putting cows in these areas has little impact on bobwhite populations. However, even on poor native range, removing cows will reduce disturbance and allow vegetation to regrow, providing foraging, escape, and nesting cover.
- Higher site productivity means that more animal units can be supported while keeping grazing intensity and impacts moderate. So, better soils and climate can mean more cows and quail.
- Shorter duration grazing on an area is better for bobwhites because it minimizes the time cows are disturbing birds and allows more time for plant growth.
- The less often an area is grazed, the better it is for quail because it minimizes the frequency of cows disturbing birds and allows for more time of plant growth.
- Timing grazing in an area to avoid the nesting season, allow plant regrowth prior to nesting, and produce seeds for food can benefit bobwhites.

Other practices can also be employed to enhance pastures, both native and tame, for quail:

- *Mobile Heavy Spot Grazing*—Either temporarily fencing livestock in small areas, or attracting dense concentrations of animals to water sources, salt, supplements, hay, or recently burned areas will lead to intense disturbance of the soil, overgrazing, and excessive nutrient

(feces) inputs. If done for at least a couple of months, this will greatly defoliate and often kill all the vegetation in the area, including most tame forages such as bahiagrass. When this intense disturbance is removed, an abundant and diverse weed patch will form providing excellent foraging habitat as well as nesting and escape cover. By moving such sites around large pastures, excellent bobwhite habitat can be created.

- *Strip Improvements*—Rather than converting (improving) entire pastures from native to tame pasture, improve 100–200-yard-wide strips that alternate with native range. This will create more edge on tame sites, the only areas typically used by birds, and leave more native range in the area, which is better quail habitat.
- *Exclosures*—Temporarily fence small areas within large pastures to exclude livestock. Abundant and diverse weed patches will form in the areas, providing excellent foraging habitat as well as nesting and escape cover. By moving such sites around large pastures, excellent bobwhite habitat can be created.
- *Fences*—Let the weedy and shrubby vegetation grow along pasture boundary fences. Abundant and diverse weeds and shrubs will form in the areas, providing excellent foraging habitat as well as nesting and escape cover. These areas will also serve as protected, travel corridors that allow quail to move safely between different parts of the ranch.

All of these practices will increase the plant species and structural diversity, and patch interspersion in pastures, making a more quilt-like community.

Ironically, “improving” pastures for cows through intensive management, and converting native vegetation to tame grass pasture is not an improvement at all for the bobwhite. However, there are techniques, even for tame grass pasture, that benefit quail and will allow cows and quail to coexist—the key is to create and maintain a Crazy-Quilt (Figure 7).



Figure 7. Livestock and quail can coexist on Florida's pastures rangelands. In fact, applied properly (that is at moderate intensities), grazing may be the best tool to create the Crazy-Quilt habitat necessary for healthy and abundant quail populations. Credits: W.M. Giuliano. (2005).

Field Borders

WILDLIFE TRENDS

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Conservation Buffers

By: *Wes and Leslie Burger*

The long-term success of wildlife populations in the Southeastern United States is largely in the hands of private landowners. Nearly 80% of the total land base in the Southeast is privately owned forests, agricultural lands, and rural properties. As demand for food and fiber products has increased and technology advanced, agricultural practices have intensified. The result has been farm consolidation and larger fields, monocultural production, loss of idle fields, conversion and loss of native grasslands and wetlands, and reduction in overall landscape diversity. In other words, the environment has been simplified and there



A native warm season grass field bordering a soybean field provides nesting and brood rearing cover during the breeding season, increases usable space and supports winter grassland songbirds. Photo courtesy of USDA-NRCS.

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are now fewer places for wildlife to exist and thrive. In response to these land use changes, an entire suite of early successional wildlife species is slowly disappearing from the landscape. Among these species is the northern bobwhite which has declined by more than 70% (3.8%/year) over the last 3 decades.

However, many agricultural producers value wildlife and are interested in improving wildlife habitat on their properties, if the management practices can be implemented without compromising their agricultural production goals. Agricultural producers are the stewards of our working lands. Conservation practices that are easily integrated into production systems, achieve multiple environmental benefits, enhance wildlife habitat and improve whole-farm profitability are most likely to be adopted by producers. Conservation buffers uniquely meet these criteria. Conservation buffers are narrow strips of land maintained in permanent vegetation designed to trap pollutants, reduce water and wind erosion, and provide other environmental benefits, including wildlife habitat. The National Conservation Buffer Initiative, launched in 1997 by the USDA, encourages the use of conservation buffers by agricultural producers and other landowners. This initiative utilizes USDA conservation programs to assist landowners in developing or enhancing wildlife habitat using cost shares and incentive payments to offset direct costs or lost revenue associated with changes in production systems.

Conservation Buffers

Conservation buffers are a suite of management practices that can be implemented individ-

ually or in concert with other buffer or agricultural practices, including conservation tillage, nutrient management, and pest management. There are many kinds of conservation buffers including: filter strips, riparian corridors, shelterbelts, grass waterways, contour grass strips, alley cropping, vegetation barriers, and field borders. Each of these buffer types accomplishes specific objectives such as: soil erosion reduction, herbicide retention, water quality improvement, and wildlife habitat provision. The environmental benefits of a buffer will change in relation to its type, surrounding landscape, hill slope position, vegetation structure, and management.

Conservation buffers, particularly forested riparian buffers along streamsides, improve water quality and aquatic habitat by reducing soil and agri-chemical runoff, stabilizing creek banks, and reducing water temperatures. They also provide important nesting, feeding and protective cover for birds and smaller mammals. Similarly, alley cropping and windbreaks, narrow strips of trees that border fields or divide larger fields into small units, provide reduction in wind erosion and comparable wildlife benefits. Conservation buffers provide



Riparian buffer and herbaceous buffer along drainage ditch intercepts agrichemicals, stops erosion and improves water quality. Photo courtesy of Haren Brasher, MSU-FWRC.

travel corridors, linking patches of similar habitat and facilitating movement of animals through inhospitable landscapes.

Although riparian buffers that include trees, shrubs and grass likely provide the greatest multiple environmental benefits, gains in soil erosion reduction and water quality can also be accomplished with grass filter strips, waterways, and contour strips. Four-meter-wide grass strips, regardless of plant species, have been shown to reduce herbicide leaving fields by 66-95%. The type of grass species does, however, substantially affect wildlife habitat value. Sod-forming grasses such as Kentucky Tall Fescue and Bermuda grass have been traditionally used for erosion control, but their dense structure is not nearly as beneficial to wildlife as native warm season grasses, such as Eastern gama grass, big bluestem, little bluestem, Indian grass and switch grass.

Management practices also influence wildlife habitat value. For example, frequent mowing will diminish wildlife value, whereas periodic burning (2-3 year rotation) can enhance wildlife value.

Buffer Function and Position

The various types of conservation buffers should be located in different positions in the field, depending on what function or purpose the buffer is to serve. For example, riparian buffers and grass filter strips are usually used on the down slope side of crop fields, adjacent to rivers, streams, or lakes. Their primary purpose is to retain sediments and herbicides and improve water quality. Grassed waterways, terraces, and contour strips are placed within the field, relative to topographic or drainage features. They are designed to slow and direct



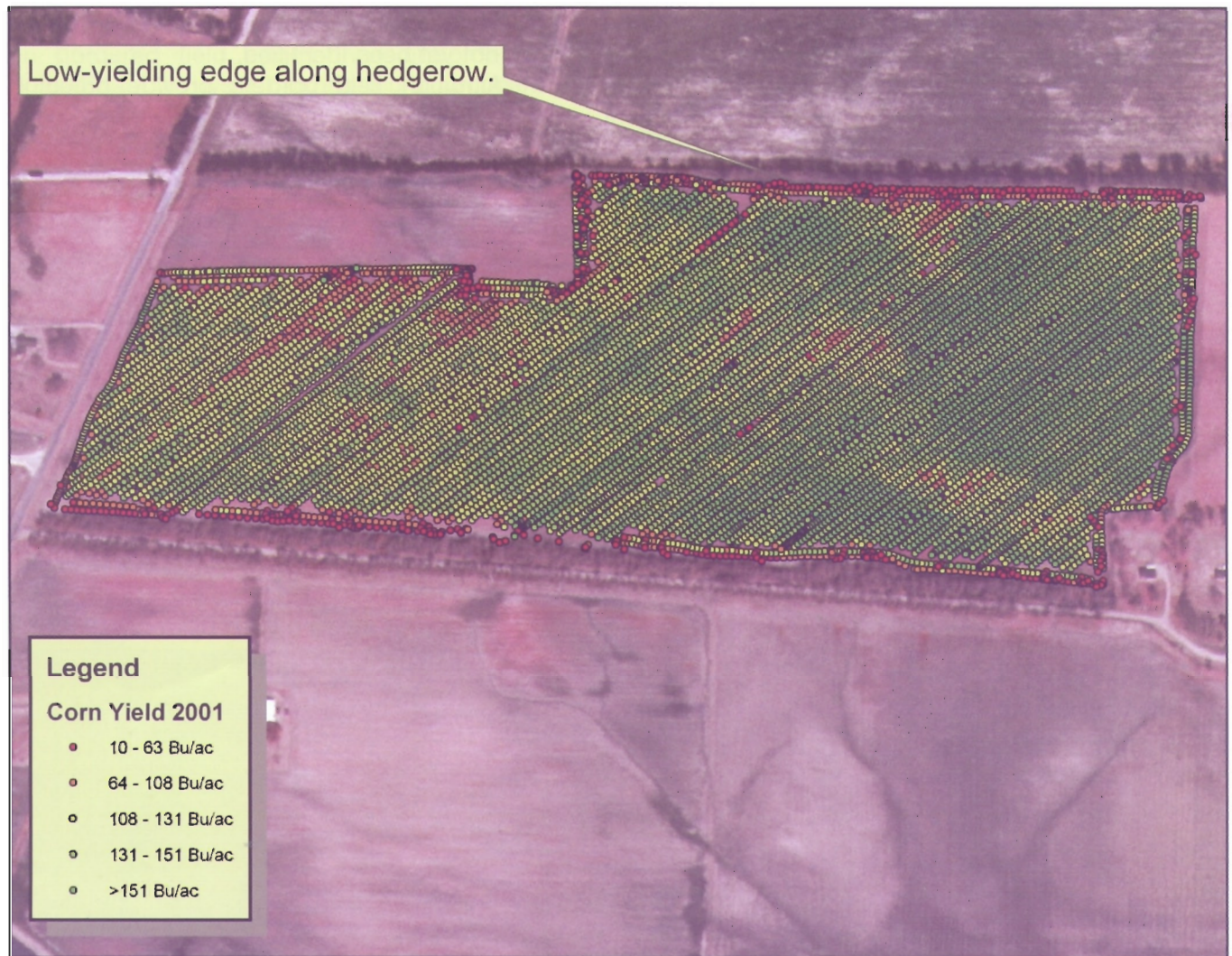
Herbaceous field border dominated by ragweed provides excellent brood habitat during the breeding season and cover and food during the fall and winter. Photo courtesy of Wes Burger, MSA-FWRC.

water flow, trap sediments, and reduce erosion. In contrast, field borders are designed primarily for wildlife habitat and can be used around the entire field edge. A field border consists of 20-150' wide strips of idle, herbaceous vegetation maintained between the crop and adjacent non-crop habitat. Field borders may also make good economic sense. Research in North Carolina and Mississippi has shown that field borders can replace low-yielding field margins with a subsidized conservation practice, increasing overall economic return. Use of GPS-equipped yield monitors can help producers to identify poorly producing areas of a field. For example, figure 1 shows corn yield on one

Mississippi farm in relation to an adjacent wooded plant community and Figure 2 demonstrates the type of situation in which replacing a low yielding edge with a conservation buffer can increase farm profitability. Because creation of wildlife habitat is a primary function of field borders, the rest of this article will focus on field border benefits and design.

Wildlife Benefits of Field Borders

Managed herbaceous field borders provide habitat for many farm wildlife species. For example, studies in North Carolina have shown that Northern Bobwhite were nearly 2 times



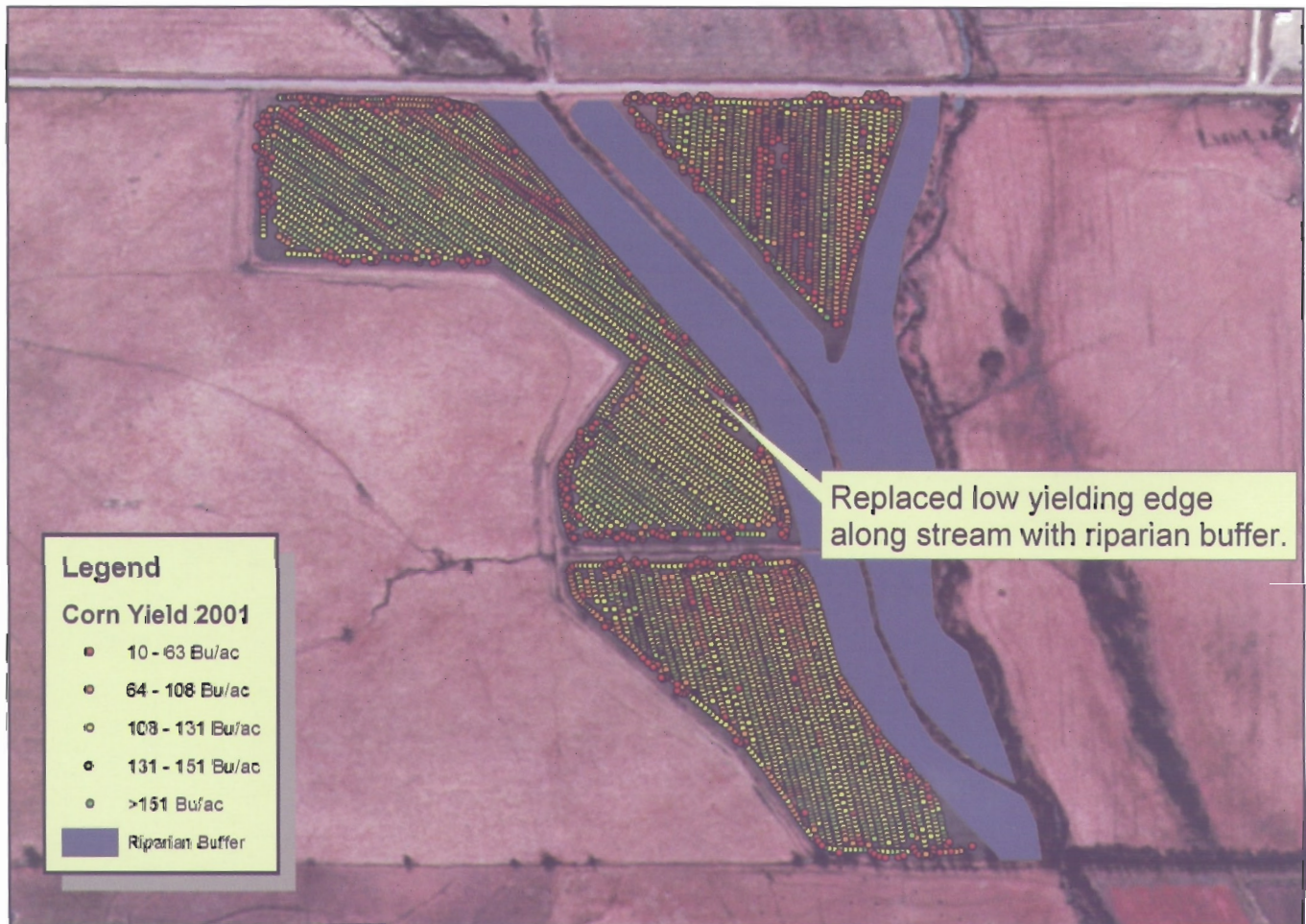
Competition for sunlight, water and nutrients produces low corn yields adjacent to hedgerow. These areas are often negative profit regions if costs of production exceed return. The producer can increase field and farm-level profits by taking these areas out of production and enrolling them in an incentivized conservation practice.

more abundant on row-crop farms with field borders compared to farms without borders. Research in Mississippi demonstrated a 69% average increase in local fall bobwhite populations from converting as little as 5-6% of row crop acreage to field borders. On one 1600 acre working farm, a 6% change in land use (crop lands to field borders) resulted in a 16% increase in usable space for bobwhite. This disproportionate response occurs because the field border not only provides habitat but also increases the utility of adjacent croplands.

Wintering and nesting songbirds also respond positively to the habitat provided in field borders. In Mississippi, 53 bird species were documented using field borders during the breeding season. The most common species included Mourning Dove, Northern Cardinal, Indigo Bunting, Dickcissel, Red-

winged Blackbird, and Common Grackle. Dickcissel and Indigo Bunting were nearly twice as abundant on fields with field borders, as compared to fields with no borders. The herbaceous vegetation in field borders provides nesting, foraging, loafing, and roosting cover for these species. Numerous studies have shown that in agricultural landscapes, the density of bird nests in strip cover is very high relative to other available patch types, but the nest success for some species is quite low. Narrow buffers are easily searched by nest predators which tend to forage along edges. Ongoing studies are demonstrating that birds nesting in wider borders (90-150') have higher nest success than those in narrow field borders (10 - 30'), but an optimal or sufficient border width has not yet been identified.

Although field borders provide breeding



Example of a low-yielding area next to a stream corridor that the producer removed from production and enrolled in CCRP CP22 riparian buffer.

season habitat for some songbird species, their greatest value may occur during winter. During winter, herbaceous communities in the Southeast provide important wintering habitat for numerous short-distance grassland migrants, many of which are exhibiting regional declines. A North Carolina study demonstrated that crop fields with conservation field borders supported substantially greater abundance of wintering sparrows than adjacent fields with mowed field margins. One Mississippi study documented 71 different bird species using field borders during winter. In this study, the most abundant species were Red-winged Blackbirds, American Pipits, Song Sparrow, Savanna Sparrow, and American Robins. Winter sparrows were 9-times more abundant on bordered field edges than unbordered. Song Sparrows were 6-times more abundant and Savanna Sparrows were 2-times more abundant on bordered field edges. During winter, the annual weeds in field borders provide food for seed-eating birds and the vertical structure provides roosting and thermal cover.

Field Border Establishment

Field borders can be created by planting a native grass community or by seeding a cover crop and allowing natural succession to revegetate the area. The least expensive method of establishing field borders is to plant a fall, small grain cover crop (wheat or oats), over-seed with a legume in winter (lespedeza, partridge pea, etc.), then allow the plant community to succeed naturally. On most sites in the Southeast, this combination will produce a diverse native community of broomsedge, legumes, and broad-leaved forbs within 2-3 growing seasons. However, if the producer has access to a native grass drill, a prairie grass community can be established within 1-2 growing seasons by drilling a mixture of big-bluestem, little bluestem, Indian grass, and switch grass. Inclusion of native legumes (partridge pea, Illinois bundle flower, etc) and wildflowers (Maximillian sunflower, cone flower, Liatris, black-eyed Susan, etc) will enhance the visual appeal and wildlife value. Regardless of the



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establishment method, periodic management will be required to maintain an early successional plant community. Woody vegetation should be controlled with periodic disturbance, such as disking or prescribed fire, but not during the growing season.

Programmatic Assistance

Numerous USDA conservation programs can assist producers and landowners with installation of conservation buffers. Conservation buffers can be cost-shared under the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Wetlands Reserve Program (WRP), and Conservation Reserve Program. However, the programmatic "workhorse" for conservation buffers is the Continuous Conservation Reserve Program (CCRP). CCRP provides cost-share and incentive payments (Signup Incentive Payments, Practice Incentive Payments, and annual rental payments) for a diversity of buffer practices, and unlike regular CRP the land does not need to be highly erodible (HEL) to be eligible. Furthermore, under CCRP eligible land can be enrolled at any time instead of simply during a short enrollment period (hence the name "continuous"). Cropland is eligible for the CCRP if it was planted or considered planted to an agricultural commodity in 4 of the 6 years between 1996 – 2001. Additionally, certain marginal pastureland is eligible for some CCRP practices. Individual CCRP cover practices (CP) are designed to achieve specific environmental benefits and eligibility varies among CPs. For example CP21 Grass Filter Strips and CP22 Riparian Forest Buffers are designed to be used on the down slope side of fields adjacent to a perennial stream, ditch, or water body. CP5 Field Windbreaks, CP8 Grass Waterways, CP15 Contour Grass Strips, and CP16 Shelterbelts are implemented within fields. In August 2004 USDA announced the availability of a new CCRP practice called CP33 Habitat Buffers for Upland Wildlife. This practice provides incentives and cost-share to establish 30 – 120' native grass and legume buffers around row crop fields. Incentives include \$100/ac

Signup Incentive Payment, an annual per acre rental payment, 50% cost-share on establishment costs, and 40% Practice Incentive Payment on establishment costs. CP33, in particular, provides a tremendous programmatic tool for creating wildlife habitat in agricultural landscapes. For more information on these programs, contact your local USDA Service Center or see <http://www.fsa.esda.gov> or <http://www.nres.usda.gov>. Landowners and producers will achieve greater wildlife benefits from federal farm programs if they work with a knowledgeable wildlife biologist to develop a comprehensive farm conservation plan with wildlife as a specific objective.

Conservation buffers are common-sense conservation practices that provide landowners and producers with tremendous flexibility and incentive to develop a conservation cropping system that meets production objectives, improves environmental quality, enhances wildlife habitat, and helps farmers be good stewards of our natural resources.

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Leslie Burger has B.S. and M.S. degrees in Biology from Murray State University and University of Missouri, respectively. She has conducted field research from the Galapagos Islands to Hudson Bay, and several places in between. She has held professional positions with the Missouri Department of Conservation as an assistant research biologist and Vertebrate Ecologist. She currently works full time home schooling the Burger's 3 sons.

Grassland Bird Response to Agricultural Field Borders



RESEARCH ADVANCES
Forest & Wildlife Research Center



In the Southeast, privately owned rural lands constitute almost 80% of the total land base with timber and agriculture as the primary land uses. Consequently, the health of wildlife populations in the Southeastern United States is largely determined by the land management decisions of private landowners. These privately owned forests and farmlands not only produce food and fiber products to meet growing global markets, they also provide essential habitats for hundreds of wildlife species.

However, increasing demand for food worldwide and advancing technology have resulted in dramatic intensification of agricultural practices and changes in our agricultural systems. Notable changes have included farm consolidation, larger field size, single-crop production, loss of idle non-crop plant communities, conversion of native grasslands to row crops or exotic forage grasses, and wetland loss. All of these factors have contributed to a reduction in overall landscape diversity, leaving fewer places where wildlife exist and thrive.

Agricultural producers are the stewards of some of America's most important natural resources and are often interested in enhancing wildlife habitat value if management practices can be implemented without compromising their agricultural pro-

duction goals. Enhancement of farmlands for grassland birds can be accomplished by incorporating conservation buffers as part of a comprehensive resource management system.

Conservation buffers are practical cost-effective conservation practices which provide multiple environmental benefits (increased herbicide and nutrient retention, reduced soil erosion) while providing habitat for grassland birds. Conservation buffers are vegetative barriers (grass, shrubs, trees) strategically located within or at the edge of crop fields to protect elements of the natural environment from effects of weather and human activities. Within intensive agricultural production systems, conservation buffers may be the only source of semi-permanent grassland habitat for nesting birds. Idle herbaceous field borders are one type of conservation buffer, but unlike other buffer practices, such as riparian buffers and filter strips, field borders can be deployed around the entire field margin, instead of just along down-slope edges. Field borders are intentionally managed non-crop herbaceous plant communities along crop field edges to provide environmental and wildlife habitat benefits. Field borders are often employed in addition to existing field edge habitats such as fence rows and drainage

ditches and may vary in species composition or width depending upon the objectives for their establishment.

Field borders may offer opportunities for enhancing farmlands for numerous grassland birds throughout the United States. Scientists in the Forest and Wildlife Research Center have extensively studied the use of field borders to enhance bobwhite quail habitat. However, little information is available on nongame grassland bird use of field borders. If field borders are to be implemented on a nationwide basis to enhance grassland bird habitat within agricultural production systems, as encouraged through many government sponsored conservation programs, information regarding grassland bird use of field border habitats is required. In this study, scientists measured the effects of field borders on populations of breeding and wintering grassland birds and northern bobwhite in the Black Belt prairie of northeastern Mississippi.

The studies were conducted on three privately owned working farms located within the Black Prairie physiographic region in Clay and Lowndes counties, Mississippi. Primary agricultural practices were rowcrop, forage, and livestock production. During early spring 2000, experimental field borders were established along agricultural field margins (fence rows, drainage ditches, access roads, and contour filter strips) on half of each farm. Across these farms an average of 6% of rowcrop field area was converted to field border habitats. This amounted to 1-2% of the land base of each farm.

Producers were paid a monetary incentive similar to those used in common USDA conservation buffer programs at the end of each growing season for land placed into field borders. Furthermore, producers were required not to mow, herbicide, or disk field borders during the duration of the study.

Grassland Songbird Response to Field Border Management

Researchers measured summer and winter abundance and diversity of grassland birds relative to field border management practices during June-July 2002 and February 2002 – 2003.



American Robin

Breeding Season Songbird Response

During breeding season surveys, 53 species of birds (1443 individual birds) were observed on experimental fields. The 6 most abundant species were Red-winged Blackbird (20%), Indigo Bunting (15%), Dickcissel (13%), Mourning Dove (8%), Northern Cardinal (7%), and Common Grackle (6%).

Dickcissel and Indigo Bunting were nearly twice as abundant where field borders were established, regardless of adjacent plant community type or width. Dickcissels and Indigo Buntings have been declining at 4 percent per year and 1.5 percent per year, respectively, during the previous 24 years in the Black Prairie region, so field border habitats may contribute to regional conservation. Although Indigo Buntings are primarily a forest bird, the field borders provided a herbaceous plant community along existing wooded edges making these areas more favorable for foraging, loafing, and nesting sites. Field borders provide vertical and horizontal vegetation complexity and may enhance the suitability of existing linear habitats (ditch banks, fencerows, road edges) for Dickcissels.

Species richness was greater along bordered than non-bordered transects, however diversity did not differ. Overall bird abundance was greater along bordered linear habitats than similar non-bor-

Indigo Bunting





Northern Cardinal

dered edges. However, addition of field borders along larger patches of grasslands or woodlands did not alter the number of birds using these edges. We speculate that in linear habitats characteristic of modern agricultural landscapes, field borders provided greater plant structure and diversity, thus supporting a greater number individuals and species. Although our results are based on 1 year of data, we believe that the magnitude of observed field border effects suggests that field borders may increase the abundance of selected species of grassland/shrub birds during the breeding season.

Wintering Songbird Response

During winter surveys, 71 species of birds were observed on experimental fields. Of the 17,562 individual birds, the 5 most abundant species were Red-winged Blackbird (45%), American Pipit (11%), Song Sparrow (7%), Savannah Sparrow (6%), and American Robin (5%).

Wintering sparrows were one group of birds that seemed particularly responsive to the presence of field borders. Many sparrow species breed on grasslands in the Midwest and winter in agricultural landscapes in the Southeast. Most sparrows are ground foragers and their use of linear habitats often depends on vegetation structure. Collectively, across most adjacent plant communi-

ties, we observed greater densities of Song, Field, and Swamp sparrows along bordered transects than non-bordered transects. Song Sparrow and Swamp Sparrow densities were greater where field borders were established along existing grasslands. Whereas the addition of herbaceous field borders adjacent to grasslands may seem redundant, most grasslands within our study farms were monotypic stands of cool-season, exotic forage grasses and provided little vertical structure and few quality food producing plants. Song Sparrow densities were also greater along field borders adjacent to wooded strip habitats than comparable wooded strips without a field border.

After crops were harvested, field border habitats provided suitable cover and food resources for many sparrow species. Field borders in our study were recently established (<3 years old) and consisted primarily of seed producing grasses and forbs coupled with a relatively open understory. This combination likely facilitated ground-based foraging. Additionally, field borders may provide escape cover in close proximity to foraging sites within the crop stubble. Therefore, we believe that field borders may enhance the value of existing grasslands and crop fields by producing additional foraging habitat and providing escape cover in close proximity to waste grain food sources.

Northern Bobwhite Response

Previous studies have demonstrated that field borders may increase forging efficiency of bobwhite chicks, use of rowcrop fields, breeding season survival, usable space, and local abundance. Although during our study autumn and breeding season bobwhite density at bordered and non-bordered farms were not statistically different, the average autumn density at bordered sites was about 66% greater and the average number of males during the breeding season was about 23% greater than non-bordered sites. These relative effect sizes were similar to those from previous field border studies. We evaluated the net effect of field borders on the proportion of the landscape usable by bobwhite by developing a space-use based habitat model constructed from utilization distributions of radio-marked bobwhite. We applied

Song Sparrow



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Karen Brasher, editor

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the habitat suitability model to an agricultural landscape in Clay County, MS and simulated usable space before and after 6% of the row crop was converted to 20' field borders. A 6% change in land use increased usable space for bobwhite by nearly 15%. Thus, a relatively small change in land use, disproportionately alters usable space in the landscape for bobwhite and may elicit an even larger proportional population response.

Summary

Within intensive agricultural landscapes, field borders provide important idle herbaceous cover for grassland and early successional birds. Field borders may provide nesting, foraging, roosting, loafing, and escape cover. During winter, field borders may provide important habitat in southern agricultural systems where most short distance migrants overwinter. Field borders

provide important habitat for many grassland birds due to their greater abundance of food (weed seeds) and more complex vegetation structure compared to non-bordered field margins.

Field borders should be maintained as early successional communities through periodic disturbance (e.g. winter disking) to maintain seed producing plants, vegetation structure, and arthropods for grassland birds.

Resource management systems that support both birds and farm operators are important for maintenance of a diverse farmland bird population. However, implementation of conservation practices rest solely upon farm operators. Only cost-effective farmland conservation practices that accrue multiple environmental benefits while enhancing farmland wildlife will gain widespread acceptance and implementation.

A Guide to Conservation Reserve Program: Northern Bobwhite Quail Habitat Initiative

- Only 9,400 acres of field borders available for enrollment in Mississippi.
- Cropland must be suitably located and adaptable to the establishment of bobwhite quail
- Conservation practice CP33: Habitat Buffers for Upland Birds can be applied around field edges of eligible cropland.
- This is a continuous conservation reserve program.
- Field borders must be a minimum of 30' to a maximum of 120' wide
- Incentives include \$100 per acre sign up, 50 percent cost share and 40 percent practice incentive payment.
- Contact the USDA Farm Service Agency for further information.

Acknowledgements

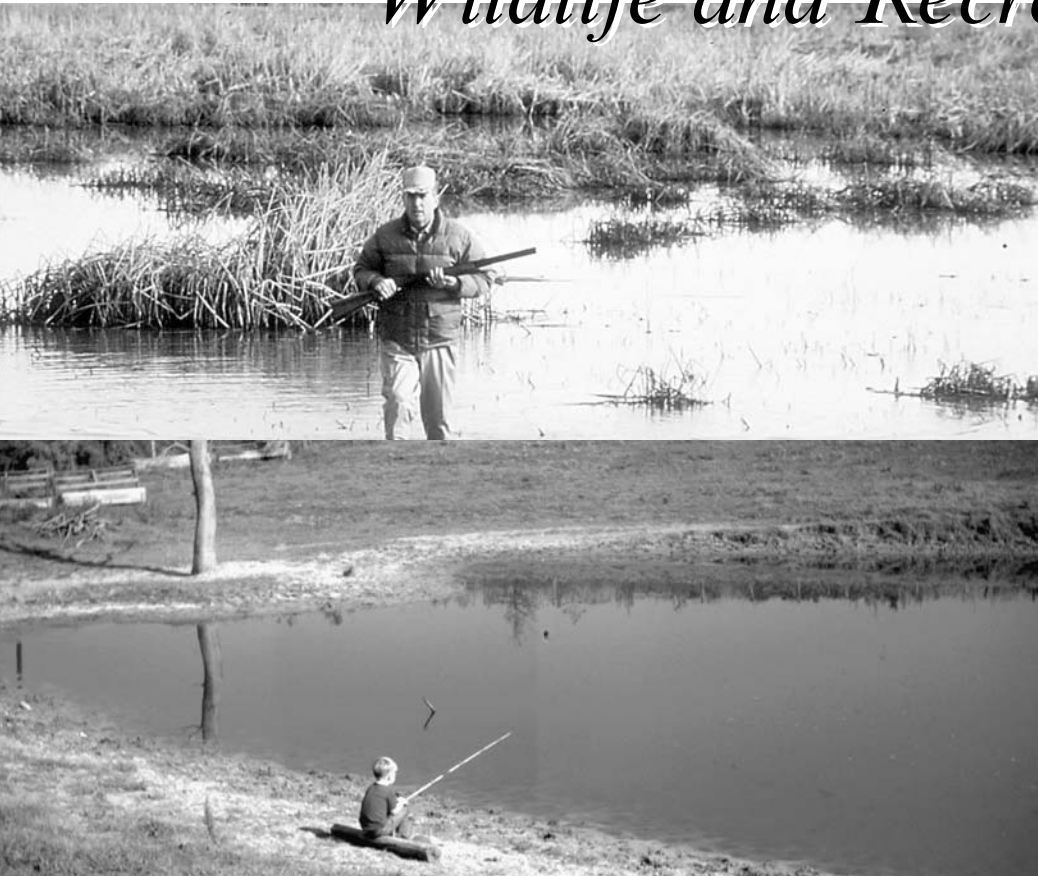
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Mourning Dove

NATURAL RESOURCE ENTERPRISES

Wildlife and Recreation



MOURNING DOVE MANAGEMENT FOR LANDOWNERS

For landowners interested in starting a natural resource-based alternative enterprise in the Southeast, managing fields planted to food plots for use by mourning doves (*Zenaida macroura*), and other wildlife species can be an attractive option.

One thing that makes it an attractive option is that it is not necessary to obligate large land areas to have a successful dove field. Other positive aspects include the small financial investment required, the direct and indirect benefits to other wildlife species, and the high level of social interaction and tradition associated with dove hunting.

The mourning dove is the most popular game bird in the country, with an annual harvest greater than all other game birds combined. In Mississippi, the mourning dove annual harvest is greater than any other game bird species. It is the number two most hunted small game species, second only to squirrels in numbers of hunters. Its quick flight, erratic movement, and its quality for eating make it popular among both hunters and wildlife enthusiasts.

Managing for doves can provide landowners enjoyment and an alternative source of income in the fall and winter.

NATURAL RESOURCE ENTERPRISES

LIFE HISTORY

Mourning doves are medium-sized migratory birds that range from Alaska to most of South America. Recent surveys estimate there are approximately 500 million doves in the United States. Their song is a low-toned, mournful cooah, coo, coo, coo. The call of doves is a common sound in rural and suburban backyards, although it can easily go unnoticed. Although mourning doves are migratory birds, they will stay in warm climates, such as Mississippi, year-round. Whether they migrate or stay in one place year-round depends on their habitat and forage needs being met and the early winter's not being too severe.

Doves return to their breeding grounds in late winter. If there is an unusually heavy snowfall or temperatures near zero, many birds may die from freezing or not being able to find food. In Mississippi, early migrants may begin nesting as early as late February, and nesting increases through April. Clutch size averages two eggs per nesting cycle but can be as many as four eggs. For the first three days after the young hatch, the parents feed them crop milk, a highly nutritious liquid. After this, the young are fed seeds. The mourning dove nesting cycle takes approximately 33 days, beginning with nest building and incubation and ending with the fledglings leaving the nest. To maintain population numbers, pairs of birds try five or six nestings and often produce three or four broods in three to six nesting cycles per year. Generally five or six young will be raised per pair each year.

Mourning doves have a short lifespan, living on average just longer than one year. The mortality rate for first-year doves is between 60 and 75 percent, and adults have an average mortality rate of 50 to 60 percent. This is similar to rabbit, quail, and many other small game wildlife species. Because of their naturally high mortality rate, many doves that are not taken by hunters will die over the course of winter because of exposure, disease, or starvation. Hunters can annually harvest 15 percent of the mourning doves in the fall seasons without impacting the population as a whole.

Other doves that may be found using managed dove fields in the Southeastern United States include the Eurasian collared-dove (*Streptopelia decaocto*) and the ringed turtle-dove (*Streptopelia*

risoria). The Eurasian collared-dove (considered an exotic species) is becoming fairly common in some areas because of its rapid colonization of different parts of North America. The domesticated ringed turtle-dove is much less common and seems to be less capable of increasing its population once released into the wild. Both these species are most often observed in and around cities or suburban areas, but recently the Eurasian collared-dove has been found in rural areas where doves are hunted.

State regulations vary from state to state as to taking these exotic species during migratory bird hunting seasons. Be sure to check with your state wildlife agency regulations before taking such birds during regulated dove hunting seasons. Currently (2004) in Mississippi, you can harvest the Eurasian collared-dove during dove seasons, and this does not count against the specified bag limit of mourning doves.

The Eurasian collared-dove is considerably larger than the native mourning dove, has squared rather than pointed tail feathers, and is pale in color overall as compared to a mourning dove. Seen flying near each other, it is quite easy to tell the difference in species. The ringed turtle-dove is smaller than the Eurasian collared-dove but still slightly larger than the native mourning dove. The colors of this domesticated dove vary, but the overall appearance is usually very pale, almost white, and is very much different in coloration from the native mourning dove. Although the Eurasian collared-dove is larger, and paler, and its flight pattern is slightly different from that of mourning doves, when prepared for the table in the same manner as mourning doves, the taste is very similar.

For information about proper care of harvested doves in the field and preparation for freezing and for the table, contact the MSU Extension Wildlife and Fisheries Office at (662) 325-3174 or check the website: <http://msucares.com/wildfish/>.

HABITAT AND FOOD

About the only things mourning doves eat are seeds and plants, although doves will sometimes eat insects. Their main diet is seeds from agricultural crops (grains), native grasses, and weeds. Mourning doves are poor scratchers and will not scratch for seeds. They feed primarily on open ground.

PLANTING AND HARVESTING

Fields prepared for doves need to have some disked open areas to keep weeds from becoming established and going to seed. When managing your land for mourning doves, try to have foraging habitat near nesting sites. Doves will travel for food, but they prefer local food sources.

In Mississippi, nesting space is generally not a limiting factor. The preferred nesting habitat for doves is in trees or tall shrubs with an average height of 15 feet from the ground. A nesting site needs to provide cover from predators as well as protection from the sun in summer months and cold in late winter or early spring. In late winter, early nesting doves prefer coniferous trees for nesting to hide them from predators.

Doves require fresh water for drinking. There must be a pond, puddle, or stream near their nesting sites for access to fresh water daily, ideally in the morning and evening. The water source should be in an area with little vegetation. This gives them easy access to the water's edge and good visibility to be able to drink and watch for predators at the same time.

Mourning doves prefer seeds from the following plant species:

American sweetgum	Japanese millet
barley	Johnsongrass
barnyard grass	lespedeza
bristlegrass	pine seed
browntop millet	poke weed
buckwheat	primrose millet
Carolina cranebill	rye
common ragweed	sedges
corn	sesame
cowpeas	soybean
croton	Sudan grass
crowfoot	sunflower
Egyptian wheat	wheat
dove proso millet	wild peas
grain sorghum	

You should begin preparing a field that will provide food for doves and other wildlife species in early spring. By the time late summer arrives, some grains will have begun to shatter to provide food for the returning doves now beginning to flock to available food sources.

Plant a variety of grains, such as sunflower, browntop millet, and sorghum to increase the seed availability to the doves from early fall through winter. As an example, Mississippi Department of Wildlife, Fisheries, and Parks, in cooperation with Mississippi State University Extension Service, planted a demonstration field in 2003. The demonstration field alternated rows of browntop millet, sunflower, and bare ground. Two weeks before dove season, the rows between the millet and sunflower were disked to create bare ground that removed weeds that had grown since planting and provided open areas for doves to alight for feeding and to find grit. Also, leaving bare ground between rows made finding downed birds much easier for the hunters.

Here is a suggested planting sequence for mourning doves: Plant two strips of browntop millet, disk one strip for bare ground, plant one strip of sunflower, disk one strip for bare ground, and so forth. Repeat this sequence throughout the field.

- browntop millet
- browntop millet
- bare ground
- sunflower
- bare ground
- browntop millet
- browntop millet
- bare ground
- sunflower
- bare ground
- browntop millet
- browntop millet

If you plan to harvest grain crops, leave several rows unharvested, to provide seed through the winter for birds and other wildlife. Browntop millet will reseed if not disturbed or manipulated and allowed to mature. Simply disk the field lightly in the spring and fertilize. The millet seed left behind from the previous year will germinate and provide a good stand that can substantially lower your second-year planting costs. If you leave unharvested strips of millet and sunflower, this will provide food and cover for returning doves, coinciding with the split second and third hunting seasons.

Disk unplanted strips two to three weeks before dove season to ensure the open ground doves prefer to alight and walk around on. Disking also lets doves get to the seed that has shattered and is on the ground next to the planted strips. Disking at least two weeks ahead gives the birds enough time to recover from this habitat disturbance. For further information on the feeding preferences and planting recommendations for mourning doves and other wildlife species of the Southeast, see the Wildlife Food-Planting Guide for the Southeast, Extension Publication 2111.

If you don't want to use sunflower, either because of competing wildlife, such as deer eating the sunflower, or for some other reason, substitute a nonbird resistant variety of grain sorghum, milo, or Egyptian wheat. To correct a serious anticipated weed problem before planting, using Extension herbicide recommendations for selective species control as provided in Publication 1532, the 2004 Weed Control Guidelines for Mississippi.

ESTIMATED COSTS

Costs for preparing a dove food plot as a wildlife enterprise will vary greatly, depending on the type of seed you plant, how you manage the standing crop, whether you provide cold drinks and water or other amenities to the hunters, whether you provide flagged stands, and if you will provide a meal and/or lodging after the hunt. To recover costs and make a profit, you should think about all of these factors when deciding what you will charge to hunt on your land.

You can use the following figures to calculate the cost of preparing a dove field: plant browntop millet at a rate of 8 pounds per acre if drilled, 10

pounds per acre if broadcast; and for best results, have a soil test before planting to determine the right fertilizer and possibly lime that will need to be added. If you don't have a soil test, 300 pounds per acre of 6-12-12 fertilizer for the browntop millet and 13-13-13 for the sunflower will be adequate on most soils.

An average 10-acre field of browntop millet and sunflower planted in strips will have the following estimated costs: seed will cost \$10 to \$12 per acre (varies, depending on time of the year you buy it, variety, and brand). Fertilizer prices can range from \$350 to \$400, depending on the fertility of the soil. Lime prices vary from \$45 to \$60 per ton (depending on the quality of the soil, it is best to have this tested before planting). Equipment and labor is estimated at \$30/hr for 8 hours of preparation, planting, and disking before season, or a total of \$240. Estimated total cost: \$700 (this is probably a higher estimate than average). Cost of herbicide applications, if needed, would be added to these costs.

LIABILITY INSURANCE

Liability is a real concern for landowners allowing access to their land. Landowners who charge a fee need more protection for themselves and the hunters or other recreational users who access their land. If there is any doubt as to the potential for litigation from allowing fee access for dove hunting or other recreational use, it is advisable to seek the advice and counsel of an attorney. You can buy liability insurance separately or add it as a rider to an operation policy you already have. Consider developing a waiver or including a release agreement that must be signed by everyone who hunts on your property. If there are any risk factors, such as old well sites, downed power lines, dead trees that may fall, or other risks that could be seen as landowner negligence, you should inform users or solve the problems before allowing access to your property.

When getting insurance, you should be aware that liability insurance covers loss caused by negligence but not loss caused by a willful act of the insured. Negligence is one of the conditions that can be greatly reduced on most private lands through risk planning. Anyone who allows public use of his or her land for recreational use, whether

or not a fee is charged for access and/or use of the property, should consider getting sufficient liability insurance coverage. Liability insurance companies generally limit the total liability of the insurance company to a specific sum per occurrence, which may be much less than the liability incurred by the insured, but it does reduce the risk of loss.

If you already have insurance on your property, you can work with your present insurer to see if a rider can be added as a supplement to the policy you already have to get adequate liability coverage. Others who plan to lease their land to an individual or group may require the lessee(s) to get liability insurance as a part of their written lease agreements. A number of insurance companies offer a rider for coverage of public recreational use or for hunting clubs. If you have questions about the need for liability insurance for the type of natural-resource enterprise you are considering, you may want to consult your attorney.

REGULATIONS

The mourning dove is a federally-regulated migratory bird, but because it is also a widely hunted game species, it requires certain restrictions on hunting. When you are hunting mourning doves, the maximum allowed bore size of a shotgun is 10 gauge, the shotgun must not hold more than three shells at any given time, and it is illegal to use bait or live decoys to attract doves. Federal regulation requires that grains used to attract doves must be planted in a standard agricultural manner. Changing the field after the grain has matured, by disking or bush hogging is allowed, as long as you don't add grain of any type to the field. It is illegal to place piles of grain or to add other grain of any type into the field. If there is any question about the way grain in the field has been manipulated, you can contact the U.S. Fish and Wildlife Service enforcement agent or State Wildlife Agency enforcement officers and ask them to conduct a field check before hunting season to make sure you comply with existing regulations.

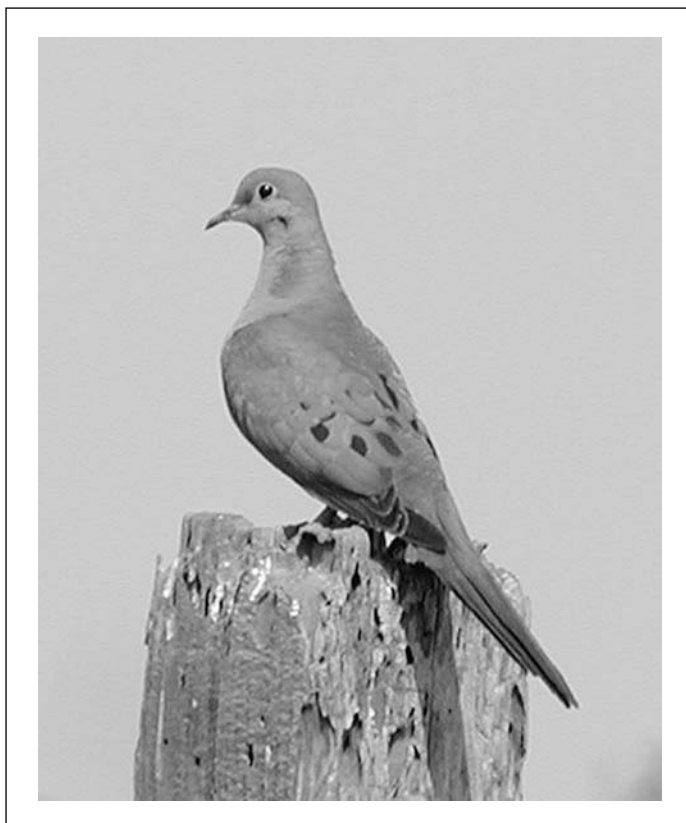
It is important for all hunters who will be allowed access to your land to know the rules and regulations that apply to the hunt, and it is essential they abide by them. Have all hunters show up at a set time and location before they enter the field to

discuss rules and regulations you expect them to obey while on your property. This discussion would include the following:

1. Inform hunters of shooting hours, for example: 30 minutes before sunrise until sunset. Plan either a morning or afternoon shoot, but do not allow both the first day, or you will find yourself having birds stay around only a very short while. To keep birds returning to a prepared field, set up morning or afternoon hunts only once or twice a week and never on two days in a row. Ideally, it is best to alternate one hunt per week in the morning and, if desired, another in the afternoon later on in the week.

2. To avoid confusion and potential over harvesting of the birds coming to the field, all hunters who are finished shooting or who have shot their limit should leave the field as soon as possible afterward. The legal bag limit is 15 mourning doves in Mississippi, and the possession limit is 30, except on the first day of the season. The possession limit is not allowed on the first day of any of the three separate hunting seasons.

3. Legally, shotguns must not be able to hold more than three shells at any time when hunting doves (one in the chamber and two in the magazine



of pumps and semi-automatics). When hunting doves, except for use of side by side, over and under, or single shot shotguns, the hunter must plug his shotgun so that not more than two shells can be inserted into the magazine.

4. Hunters must have a valid state hunting license that is signed and on their person before going into the field or qualify for an exemption as dictated by the Mississippi Department of Wildlife, Fisheries, and Parks.

For comprehensive regulation information on mourning doves in Mississippi, contact the Mississippi Department of Wildlife, Fisheries, and Parks, Wildlife Division, 1505 Eastover Drive, Jackson, MS 39211. Website: www.mdwfp.com.

SAFETY

Safety is paramount to having an enjoyable dove hunt. Few things will sour hunter enthusiasm or enjoyment faster than being cited for a violation or having a hunter shot by another hunter shooting at a low-flying bird.

The following simple rules of thumb will help your hunt go smoothly and safely:

- ✓ Keep hunters separated a safe distance, which is at least 100 yards between hunters.
- ✓ Remind hunters never to shoot at low-flying birds or birds that alight in the field because of the danger of shooting a fellow hunter.
- ✓ Recommend that all hunters wear protective glasses.
- ✓ Never allow anyone in the field to drink or take alcohol into the field during shooting hours.

OTHER CONSIDERATIONS

Managing a dove field properly will provide many hours of shooting enjoyment as well as doves harvested for the grill or skillet. When designing your management strategy, include posting small signs with station numbers, and request that hunters stay near their posts while shooting. This will keep hunters from clustering in hot spots, such as areas where most birds fly into the field, which could lead to a hunting accident.

You need to post starting and ending times for morning and evening shoots, and hunters need to

follow them. The earlier all shooters leave a field, the more likely birds will keep returning to the field as long as food continues to be available. For example, hunters who begin shooting 30 minutes before sunrise and leave by 9:30 a.m. or earlier will enable doves to return to the field to feed. However, if doves are shot in the field until noon, many of the birds will find other places to feed. The more time hunters spend shooting doves in your field, the higher the likelihood that the number of returning birds will decrease significantly. The same principles also apply for afternoon hunts. While the birds may fly later in the afternoon on very hot days, it is still best to leave the field as soon as possible to let the birds return to feed before sunset. Once a shooter reaches his bag limit and leaves the field, invite another shooter to move to the empty station if he wants to, to increase his chance for shots.

If you want to shoot your dove field twice per week, it is best to space the hunts apart, for example on a Saturday, and either a Tuesday or Wednesday. Keeping hunts three or more days apart and limiting the number of hours hunters are in the field should keep birds returning to the field through the season.

FINDING DOWNED BIRDS

It is important for dove management, as well as good sportsmanship, that you make every effort to find downed birds. If you have a retriever, this should be easy. Let the dog do the work for you. Without a dog, though, more effort is needed. One strategy is to stop every time you shoot a bird and remove your shells. Do not reload until you find the downed bird to ensure you are not tempted to take another bird, thus having two birds down in different places. Disking strips into your field will also be helpful. It will let you see into the rows of vegetation and more easily find the downed bird.

ADVICE FOR HUNTERS

You should be ready to answer questions from novice hunters regarding hunting basics. When advising an inexperienced hunter, suggest he aim for birds within 20 to 30 yards, and pick shots based on his level of skill. The hunter's ability will determine how much time is needed in the field and how many

shots he takes to bag his limit. On average, a hunter will use about 75 shells to reach a 15-bird bag limit. This will vary greatly, based on experience and shooting skill. An excellent hunter skilled in wing-shooting may use 25 shells or fewer to take his limit.

The shot size, shotgun action type, and gauge are mostly based on personal preference. Most hunters select small shot sizes from 7 1/2 to 9's. The main point is that doves do not require magnum loads or large-sized shot. Also, shooting a light recoiling shotgun will make a large difference by the end of the hunt for a new hunter's comfort.

For the average hunter, shotgun choke is also a personal choice. Skeet or improved cylinder choke is generally more than enough for shooting doves. For a double gun, ideal chokes are improved cylinder and modified.

COMFORT AND FEES CHARGED

The first season is generally quite hot, and it is advisable for hunters to wear either camo or dull colored clothing. Besides dressing light, you may want to carry a small ice chest filled with cold water and sodas for drinking while in the field.

Depending on the facilities and fees charged, some landowners choose to provide water, soda, and/or a meal for the hunters. The costs to hunters can vary from as low as \$10 per shooter per hunt to more than \$100, depending on costs and amenities the landowner has provided to the hunters. To recover costs of preparing a dove field, landowners must know those costs. Some landowners with lodging and dining facilities offer package hunts for corporate or other groups at appropriate costs, which may be more than \$250 per hunter and may have facilities for a morning fishing trip and afternoon hunt

Currently, the most common prices seen advertised for a half-day dove hunt in Mississippi range from \$10 per hunter to \$150 per hunter. Again, this varies, depending on the services and amenities provided, and whether the hunt will be on land prepared by the landowner as a dove food plot or simply a harvested corn or wheat field.

HUNTER EXPECTATIONS

When paying to enter a dove field, hunters should expect the following:

- ✓ Everyone entering the field will practice safe hunting conditions. You won't know this unless all other hunters are friends who you know are experienced and ethical hunters.
- ✓ The landowner, or someone in charge of the hunt, should provide ground rules that include what the field size is limited to and where the property lines are.
- ✓ Alcoholic beverages are prohibited from the field during the hunt.
- ✓ All hunters have been informed not to shoot at low-flying birds or birds alighting in the field because of risk of shooting another hunter.
- ✓ Legal shooting hours will be adhered to.
- ✓ All hunters will make every possible effort to find all downed birds.
- ✓ Bag limits will be strictly adhered to.
- ✓ Harvested doves will not be cleaned in the field.
- ✓ Hunters will collect and take spent shells out of the field for proper disposal when they are finished shooting.
- ✓ Hunters will stay within the general area of their stations except to find downed birds.
- ✓ Hunters are expected to leave the field when they have taken their bag limit of birds, when they tire of shooting, or at a set time (when hunting in the morning – 9:30 to 10:00 a.m., no later than 15 minutes before sun set if hunting in the afternoon).
- ✓ If water or cold drinks are provided, how often will such beverages be provided.
- ✓ Everyone will be required to plug repeating shotguns to prevent their holding more than two shells in the magazine.



This publication is provided as an educational tool and reference source and is not a substitute for individualized legal advice regarding liability for fee recreational use of private lands for hunting or other related purposes. Lease agreements for recreational use of private lands should be written documents that have been prepared or reviewed by an appropriate attorney. The use of the information provided in this publication by any person constitutes an agreement to hold harmless the authors, Mississippi State University Extension Service, and the Mississippi Department of Wildlife, Fisheries and Parks for any liability, claims, damages, or expenses that may be incurred as a result of reference to or reliance on the information contained in this publication.

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Nongame birds

LANDSCAPING TO ATTRACT BIRDS

INTRODUCTION

Among the fondest and most memorable moments of childhood are the discoveries of songbirds nesting in the backyard. The distinctive, mud-lined nests of robins and their beautiful blue eggs captivate people of all ages. Likewise, the nesting activities of house wrens, cardinals, chickadees, and other common birds can stimulate a lifelong interest in nature.

As people learn to enjoy the beauty of birdlife around their home, they may wish to improve the “habitat” in their yard so that more birds will visit their property. You can attract birds by placing bird feeders, nest boxes, and bird baths in your yard, and by planting a variety of trees, shrubs, and flowers. These can provide good nesting sites, winter shelter, places to hide from predators, and natural food supplies that are available year-round.

BENEFITS OF LANDSCAPING FOR BIRDS

At least ten benefits can be derived from landscaping to attract birds to your yard:

Increased Wildlife Populations

You can probably double the number of bird species using your property with a good landscaping plan.

Energy Conservation

By carefully arranging your conifer and hardwood trees, you can lower winter heating and summer cooling bills for your house.

Soil Conservation

Certain landscape plants can prevent soil erosion.

Natural Beauty

A good landscaping plan will contribute to a beautiful, natural setting around your home that is pleasing to people as well as birds.

Wildlife Photography

Wildlife photography is a wonderful hobby for people of all ages.

Birdwatching

A fun hobby is to keep a list of all the birds seen in your yard or from your yard. Some people have counted over 190 species of birds in their yard!

Natural Insect Control

Birds such as tree swallows, house wrens, brown thrashers, and orioles eat a variety of insects.

Food Production

Some plants that attract wildlife are also appealing to people. Cherries, chokecherries, strawberries, and crabapples can be shared by people and wildlife.

Property Value

A good landscaping plan can greatly increase the value of your property by adding natural beauty and an abundance of wildlife.

Habitat for Kids

Some of the best wildlife habitats are the best “habitats” for young people to discover the wonders of nature. A backyard habitat can stimulate young people to develop a lifelong interest in wildlife and conservation.

BASICS OF LANDSCAPING FOR BIRDS

Landscaping for birds involves nine basic principles:

Food

Every bird species has its own unique food requirements, and these may change as the bird matures and as the seasons change. Learn the food habits of the birds you wish to attract. Then plant the appropriate trees, shrubs, or flowers that will provide the fruits, berries, grains, seeds, acorns, nuts, or nectar.

Water

You can probably double the number of bird species in your yard by providing a source of water. A frog pond, water garden, or bird bath will get lots of bird use, especially if the water is dripping, splashing, or moving.

Shelter

Birds need places where they can hide from predators and escape from severe weather. Trees (including hollow ones), shrubs, tall grass, and bird houses provide excellent shelter.

Diversity

The best landscaping plan is one that includes a wide variety of plants. This helps attract a greater number of bird species.

Four Seasons

It is necessary to provide birds with food and shelter during all four seasons of the year. Plant trees, shrubs, and flowers that will provide year-round food and shelter.

Arrangement

Habitat components need to be properly arranged. Consider the effects of prevailing winds (and snow drifting) so your yard will be protected from harsh winter weather.

Protection

Birds should be protected from unnecessary mortality. When choosing the placement of bird feeders and nest boxes, consider their accessibility to predators.

Picture windows can be death traps for birds. A network of parallel, vertical strings spaced 4 inches apart can be placed on the outside of windows to prevent this problem.

You also should be cautious about the kinds of herbicides and pesticides used in your yard. They should be applied only when necessary and strictly according to label instructions.

Hardiness Zones

When considering plants not native to your area, consult a plant hardiness zone map (they are in most garden catalogues). Make sure the plants you want are rated for the winter hardiness zone classification of your area.

Soils and Topography

Consult with your local garden center, university, or county extension office to have a soil test done for your yard. Plant species are often adapted to certain types of soils. By knowing what type of soil you have, you can identify the types of plants that should grow best in your yard.

PLANTS FOR WILD BIRDS

Seven types of plants are important for bird habitat:

Conifers

Conifers are evergreen trees and shrubs that include pines, spruces, firs, arborvitae, junipers, cedars, and yews. These plants are important as escape cover, winter shelter, and summer nesting sites. Some also provide sap, buds, and seeds.

Grasses and Legumes

Grasses and legumes can provide cover for ground nesting birds--especially if the area is not mowed during the nesting season. Some grasses and legumes provide seeds as well. Native prairie grasses are becoming increasingly popular for landscaping purposes.

Nectar-Producing Plants

Nectar-producing plants are very popular for attracting hummingbirds and orioles. Flowers with tubular red corollas are especially attractive to hummingbirds. Other trees, shrubs, vines and flowers can also provide nectar for hummingbirds.

Summer-Fruiting Plants

This category includes plants that produce fruits or berries from May through August. Among birds that can be attracted in the summer are brown thrashers, catbirds, robins, thrushes, waxwings, woodpeckers, orioles, cardinals, towhees, and grosbeaks. Examples of summer-fruiting plants are various species of cherry, chokecherry, honeysuckle, raspberry, serviceberry, blackberry, blueberry, grape, mulberry, plum, and elderberry.

Fall-Fruiting Plants

This landscape component includes shrubs and vines whose fruits are ripe in the fall. These foods are important both for migratory birds which build up fat reserves prior to migration and as a food source for non-migratory species that need to enter the winter season in good physical condition. Fall-fruiting plants include dogwoods, mountain ash, winter-berries, cottoneasters, and buffalo-berries.

Winter-Fruiting Plants

Winter-fruiting plants are those whose fruits remain attached to the plants long after they first become ripe in the fall. Many are not palatable until they have frozen and thawed numerous times. Examples are glossy black chokecherry, Siberian and "red splendor" crabapple, snowberry, bittersweet, sumacs, American highbush cranberry, eastern and European wahoo, Virginia creeper, and Chinaberry.

Nut and Acorn Plants

These include oaks, hickories, buckeyes, chestnuts, butternuts, walnuts, and hazels. The meats of broken nuts and acorns are eaten by a variety of birds. These plants also provide good nesting habitat.

HOW TO GET STARTED

Think of this project as "landscaping for birds." Your goal will be to plant an assortment of trees, shrubs, and flowers that will attract birds. If you plan carefully it can be inexpensive and fun for the whole family. The best way to get started is to follow these guidelines:

Set Your Priorities

Decide what types of birds you wish to attract, then build your plan around the needs of those species. Talk to friends and neighbors to find out what kinds of birds frequent your area. Attend a local bird club meeting and talk to local birdwatchers about how they have attracted birds to their yards.

Use Native Plants When Possible

Check with the botany department of a nearby college or university or with your Natural Heritage Pro-

gram for lists of trees, shrubs, and wildflowers native to your area. Use this list as a starting point for your landscape plan. These plants are naturally adapted to the climate of your area and are a good long-term investment. Many native plants are beautiful for landscaping purposes and are excellent for birds. If you include non-native plant species in your plan, be sure they are not considered “invasive pests” by plant experts.

Draw a Map of Your Property

Draw a map of your property to scale using graph paper. Identify buildings, sidewalks, powerlines, buried cables, fences, septic tank fields, trees, shrubs, and patios. Consider how your plan relates to your neighbor’s property (will the tree you plant shade out the neighbor’s vegetable garden?) Identify and map sunny or shady sites, low or wet sites, sandy sites, and native plants that will be left in place. Also identify special views that you wish to enhance--areas for pets, benches, picnics, storage, playing, sledging, vegetable gardens, and paths.

Get Your Soil Tested

Get your soil tested by your local garden center, university, or soil conservation service. Find out what kinds of soil you have, and then find out if your soils have nutrient or organic deficiencies that can be corrected by fertilization or addition of compost. The soils you have will help determine the plants which can be included in your landscaping plan.

Review the Seven Plant Habitat Components

Review the seven plant components that were described previously. Which components are already present? Which ones are missing? Remember that you are trying to provide food and cover through all four seasons. Develop a list of plants that you think will provide the missing habitat components.

Confer With Resource Experts

Review this plant list with landscaping resource experts who can match your ideas with your soil types, soil drainage, and the plants available through state or private nurseries. People at the nearby arboretum may be able to help with your selections. At an arboretum you can also see what many plants look like.

Develop Your Planting Plan

Sketch on your map the plants you wish to add. Trees should be drawn to a scale that represents three-fourths of their mature width and shrubs at their full mature width. This will help you calculate how many trees and shrubs you need. There is a tendency to include so many trees that eventually your yard will be mostly shaded. Be sure to leave open sunny sites where flowers and shrubs can thrive. Decide how much money you can spend and the time span of your project. Don’t try to do too much at once. Perhaps you should try a five year development plan.

Implement Your Plan

Finally, go to it! Begin your plantings and be sure to include your family so they can all feel they are helping wildlife. Document your plantings on paper and by photographs. Try taking pictures of your yard from the same spots every year to document the growth of your plants.

Maintain Your Plan

Keep your new trees, shrubs, and flowers adequately watered, and keep your planting areas weed-free by use of landscaping film and wood chips or shredded bark mulch. This avoids the use of herbicides for weed control. If problems develop with your plants, consult a local nursery or garden center.

And Finally...

Most of all, take the time to enjoy the wildlife that will eventually respond to your efforts at landscaping for birds.

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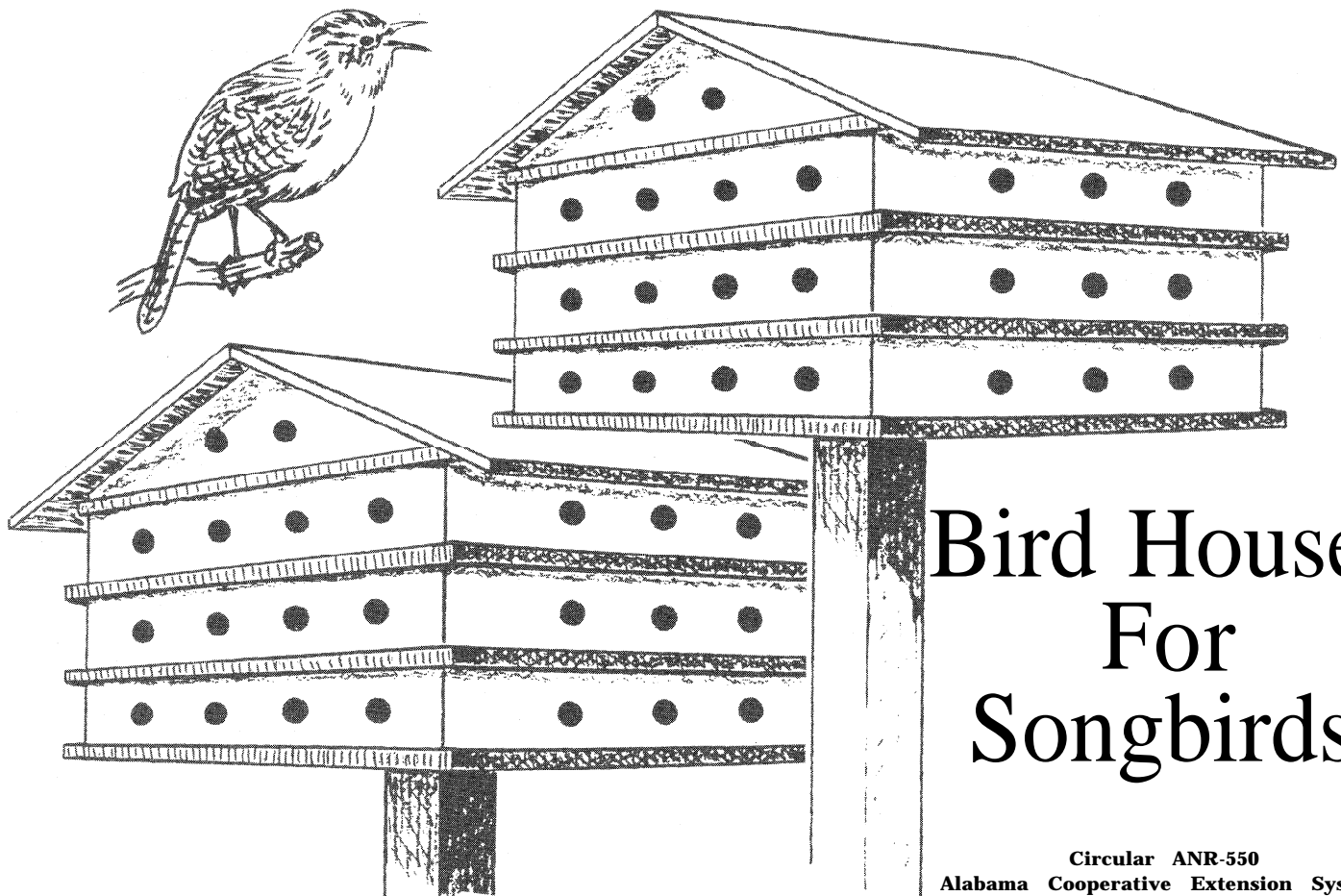
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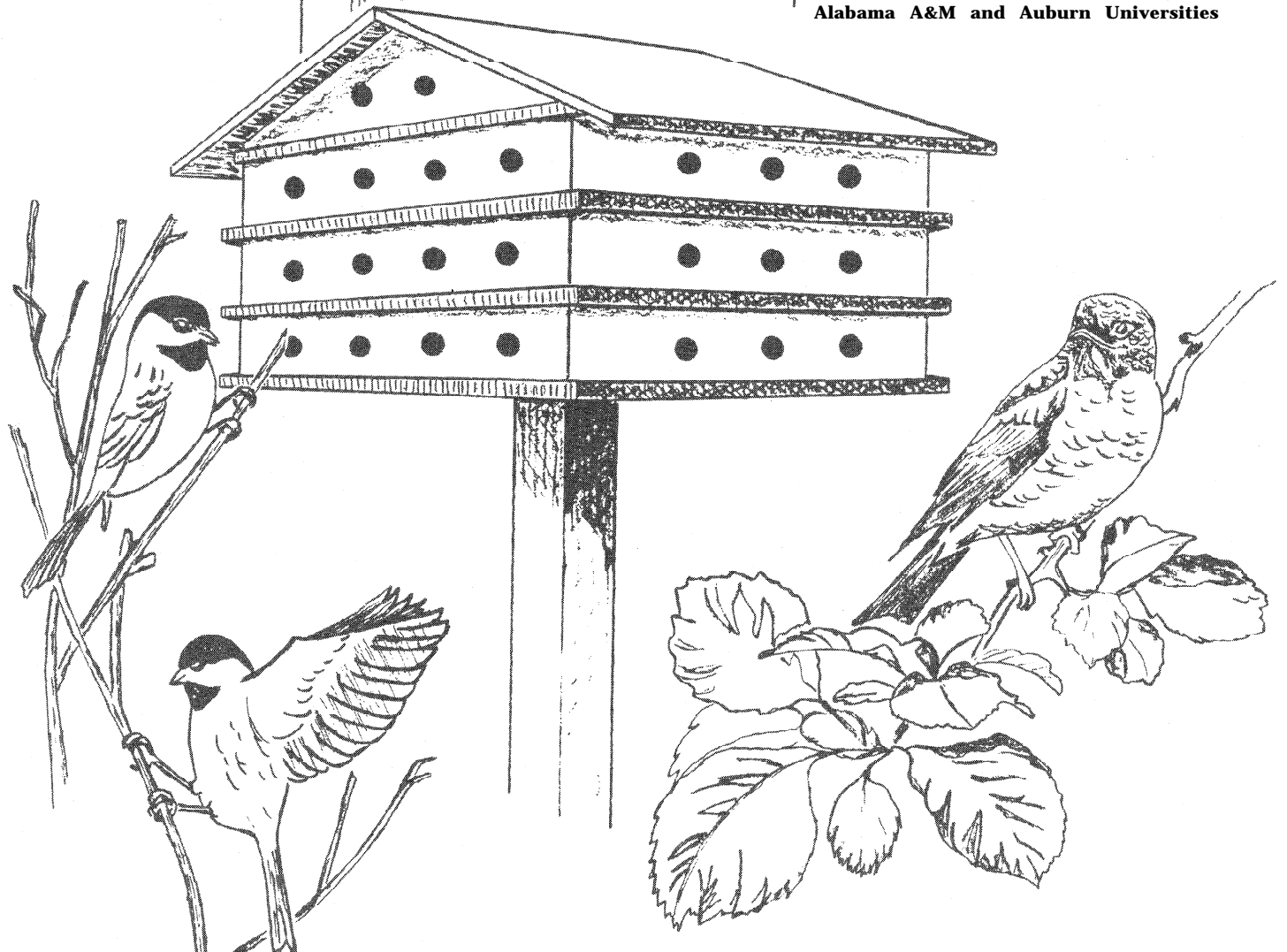
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Produced by the U.S. Fish and Wildlife Service



Bird Houses For Songbirds

Circular ANR-550
Alabama Cooperative Extension System
Alabama A&M and Auburn Universities



Bird Houses For Songbirds

H. Lee Stribling
Extension Wildlife Specialist

Bluebirds, robins, chickadees, titmice, wrens, and purple martins adapt easily to using bird houses. They will choose rural or urban yards alike where there is a small patch of suitable habitat. This may consist of homemade bird houses and berry baskets of hair, moss, cottonballs, and yarn. Or, it may be a patch of wild garden and trees. The birds' nest building and food gathering provide hours of entertainment to armchair bird watchers.

Nest Box Construction

Lumber.-Almost any grade of untreated lumber can be used to build nest boxes. Several types of wood, however, are more durable and desirable. Treated *lumber should not be used for nest boxes*. The most durable woods include cypress, cedar, and redwood. Pine, although less durable, is easier to work and somewhat less expensive than other wood. Exterior-grade plywood can also be used; it is recommended for roof boards, no matter what lumber is used to construct the nest box. Lumber should be at least 3/4 inch thick to provide insulation for the birds. Nest box dimensions and height for placement are shown in Table 1. Construction details of some boxes are shown in Figures 1 to 4.

Painting.-Painting is not necessary except for purple martin houses or others made of soft wood. Use a water-based exterior latex if the box needs paint. Do not install the box for at least 2 weeks after painting. Light shades of green, gray, and tan are the best choices for nest boxes. Only light colors should be used. Dark colors may cause boxes to overheat and injure eggs and young. Martin condominiums, which are usually placed in open areas, may be painted white to reflect even more light.

Table 1. Nest Box Dimensions And Heights For Box Placement.

Species	Box Floor (inches)	Box Depth (inches)	Entrance Height* (inches)	Entrance Diameter (inches)	Box Height (feet)
American robin**	7x8	8	—	—	6-15
Eastern bluebird	4x4	8-12	6-10	1-1/2	4-6
Chickadee	4x4	8-10	6-8	1 1/8	4-15
Tufted titmice	4x4	8-10	6-8	1-1/4	5-15
Crested flycatcher	6x6	8-10	6-8	1-3/4	5-15
Phoebes**	6x6	6	—	—	8-12
Brown-headed nuthatch	4x4	8-10	6-8	1-1/4	5-15
White-breasted nuthatch	4x4	8-10	6-8	1-3/8	5-15
Prothonotary warbler	5x5	6	4-5	1-3/8	4-8
Barn swallow**	6x6	6	—	—	8-12
Purple martin	6x6	6	1-2	2-X	6-20
Downy woodpecker	4x4	8-10	6-8	1-1/4	5-15
Hairy woodpecker	6x6	12-15	9-12	1-1/2	8-20
Pileated woodpecker	8x8	16-24	12-20	3x3	15-25
Red-headed woodpecker	6x6	12-15	9-12	2	10-20
Yellow-bellied sapsucker	6x6	12-15	9-12	1-1/2	10-20
Carolina wren	4x4	6-8	4-6	1-1/2	5-10
House wren	4x4	6-8	4-6	1-1/4	5-10

* Height of entrance above nest box floor.

** Use nesting shelf with open front.

Drainage and Ventilation.-Boxes should be ventilated by leaving narrow spaces between the roof and sides or by drilling two G-inch holes in the sides. Drainage holes may be drilled in the floor or 3/8-inch can be cut away from each corner of the floor (Fig. 2).

Nesting Baskets

In many urban areas it is difficult for birds to find nesting materials. Light materials placed in hanging berry baskets will be used readily by yard-nesting songbirds. Attach berry baskets to sturdy limbs with nylon cord. Place them out of reach of cats and dogs. Light materials such as dog hair, moss, cotton balls, yarn, and string can be placed in the baskets, and birds will use them throughout the breeding season.

Tenants For Your Bird Houses

Bluebirds.-Eastern bluebirds are one of Alabama's most beautiful year-round residents. The adult males are brilliant blue above and reddish or rust below with a white underbelly. Females are drab versions of the males.

Populations of these birds have grown rapidly over the past few years, mostly in response to people constructing and placing nest boxes. Bluebird Trails where boxes are placed along paths through good bluebird habitat have been established in many states. This partially compensates for the loss of preferred nesting sites such as wooden fence posts and cavity trees. Before bluebird boxes were erected in great numbers, starlings and house sparrows reduced the bluebird population by competing for and winning available nesting sites.

Bluebirds usually nest along woodland edges of open fields or other open areas. They are often seen along farm fields, golf courses, and pastures. Nest boxes placed along the edges of these areas are preferred nest sites. A good supply of insects and berries are essential to this songbird. It does not usually feed at bird feeders.

Nest boxes should be placed 3 to 5 feet above ground and at least 25 feet from the nearest tree. Nests should be removed from the boxes after each group of young birds (brood) has left the nest (fledged).

Robins.-American robins are not cavity nesters; they are platform nesters. Robins winter in Alabama but generally nest from central Alabama northward to Alaska. Migrating robins pass through Alabama in March on their way to northern nesting grounds.

Robins are fairly large songbirds that are often seen feeding on moist lawns. This bird population has actually grown in response to human development of habitats considered typical for robins. Now robins are found in a variety of habitats ranging from deep woodlands to inner city parks, all of which are ready sources for the fruits, berries, insects, and earthworms robins eat.

Robins' nests are not neat. They build of grass, twigs, and mud in orchard trees, shrubs, and on build&s. Highly compatible with human developments, robins will use man-made nesting platforms when available.

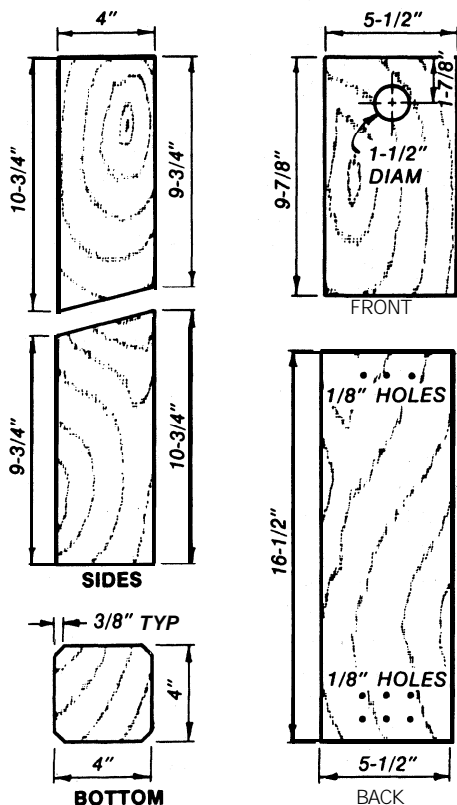
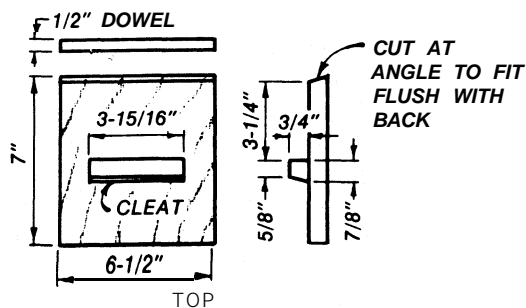
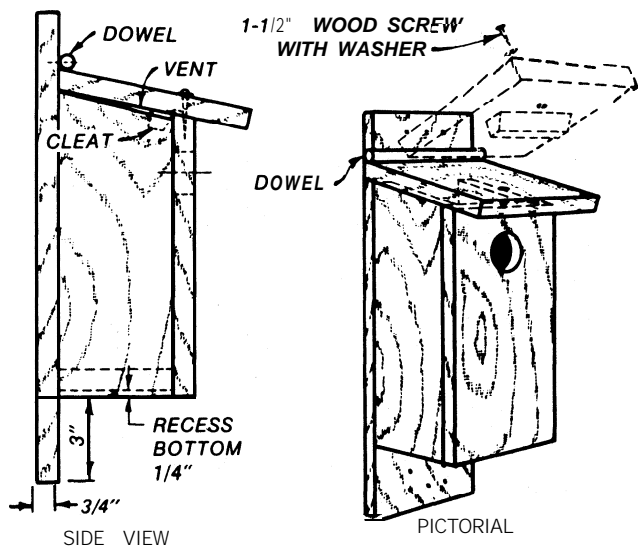


Figure 1. Construction details for a top-opening songbird nest box.

Nesting platforms should be placed on a tree or on a pole near a tree 6 to 15 feet above ground. Fairly open areas with protective shading are preferred.

Carolina Chickadee.-Carolina chickadees are friendly little birds that sing year-round. They have buzzy *Chickadee-dee-dee-dee* calls. Their black caps and bibs, white cheek patches, gray backs, and pale undersides are easily distinguishable from other local songbirds.

Chickadees are not migratory. And, they are common at the feeder. They live with equal ease in woodland habitats and in close association with human beings. In hot summer months, however, chickadees will often retreat to the cooler moist woodlands.

Chickadees consume numerous farm and garden pests. They search from daylight to dusk for their primary summer food items-insects. They also feed on seeds, berries, and other fruits.

Chickadees nest in decayed stumps, abandoned nest holes, or in nest holes they have excavated. They build nests of moss, feathers, and other soft materials. Nest boxes for chickadees should be placed 6 to 15 feet above ground near several large trees. Protective shading should also be provided.

Tufted Titmouse.-Common in most yards, the tufted titmouse is often seen with Carolina chickadees. And, like the chickadee, it feeds heavily at feeding stations. A year-round resident of Alabama, the tufted titmouse supplements its heavy insect diet with seeds and berries. Tufted titmice are mostly gray with a gray tuft or crest on the top of its head, white under parts, and very light orange sides. The song of the tufted titmouse is a loud and fairly rapid *peter, peter, peter*, repeated regularly.

In many ways similar to the chickadee, the tufted titmouse frequents a wide variety of habitats from woodlands to residential areas. A cavity nester, too, it often nests in deserted woodpecker cavities, natural tree cavities, and in nest boxes; it will even excavate a cavity if soft wood is available. Nest boxes for titmice should be placed 4 to 10 feet above ground on posts or trees located at woodland edges.

Wrens.-Carolina wrens and house wrens are small, nonmigratory songbirds that can be seen throughout the year in Alabama. Of these two birds, Carolina wrens are an especially desirable yard species because they tend to sing year-round. Their resonant *tea kettle* song is unmistakable. The distinct white eye lines and buff yellow under parts are characteristic of these wrens. The smaller house wren is more drab, with few distinguishing marks. The song of this species is bubbly but otherwise less distinctive than that of the Carolina wren.

Wrens feed almost exclusively on insects, spiders, and other invertebrates, but, in winter, Carolina wrens will sometimes use bird feeders stocked with small black sunflower seeds or suet.

Carolina wrens and house wrens are attracted to thickets and brush piles bordering open areas. They will often nest in yards near these brush piles. If nest boxes are not available, these birds will nest in almost any

available cavity. Carolina wrens are notorious for nesting in any available spot, including hanging potted plants and the pockets of clothing left hanging on the clothesline.

And, wrens are not choosy about man-made nesting places. Clay flower pots with slightly enlarged drainage holes provide excellent nesting cavities for wrens when placed flush with a vertical surface. Coconuts with suitably sized entrance holes (1 1/4 inches in diameter) are also readily used.

Wrens frequently construct dummy nests in the immediate vicinity of their actual nest sites. These dummy nests may serve to confuse predators or to reduce the chances of other birds nesting nearby.

Wren houses should be placed 6 to 10 feet above ground on poles. Place the poles in open areas near brush piles or thickets to attract the most wrens.

Purple Martins.-Although not generally considered a songbird species, purple martins are easy to attract and a favorite yard species in the southeast. These birds are noted for their tremendous appetites for mosquitoes and are well appreciated in most communities.

The fairly large, shiny, bluish-purple martins are migratory, spending the winter in South America. Purple martins send out scouts in mid-February to March to search out potential nest sites; the remaining colony members arrive later. Nest boxes must be erected before the scouts arrive to attract purple martins for a particular season.

Purple martins inhabit open woodlands and field edges usually near lakes or ponds. They feed on insects. Preferred nesting sites are woodpecker holes, natural tree cavities, caves, and man-made martin condominiums and gourd houses.

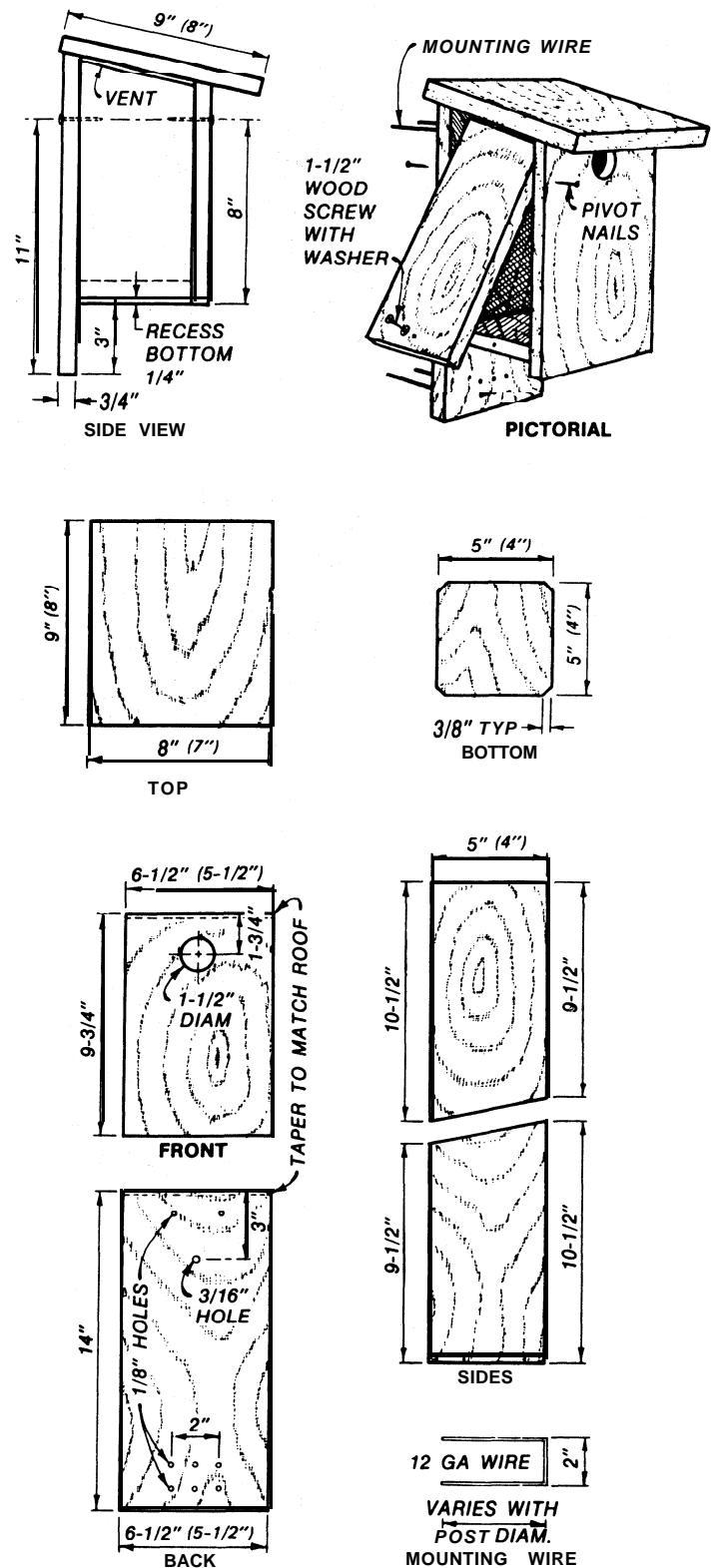
Purple martin houses should be placed on poles in fairly open areas 15 to 20 feet above ground. These houses should be taken down and cleaned at the end of the nesting season and then put back in early February before the scouts arrive.

Predation And Competition

In recent years, starlings and house sparrows have developed reputations for competing with cavity nesters for nest sites. Native birds that can use cavities with small entrance holes (less than 1 1/4 inches in diameter) are less likely to suffer from competition from house sparrows. Starlings will prey on nestlings of other birds if perches are placed on the nest boxes or if entrance holes are large enough to allow starlings to reach down into nest boxes. When large populations of sparrows or starlings are present, nesting structures should be located at least 1,300 feet from human dwellings, barns, or feed lots.

Landscaping And Water Availability

Besides providing nest boxes for songbirds, many homeowners want to do more to attract birds to their yards. Managing the area around your home for birds is simple, especially if traditional gardening is already being done. Plan for available food plants, feeding stations, adequate plant cover, nesting sites, and a year-round supply of water.



NOTE: Dimensions in parentheses are for a 4"x4" nest box, which is suitable for Eastern Bluebirds, Mountain Bluebirds or larger.

Figure 2. Construction details for a side-opening songbird nest box.

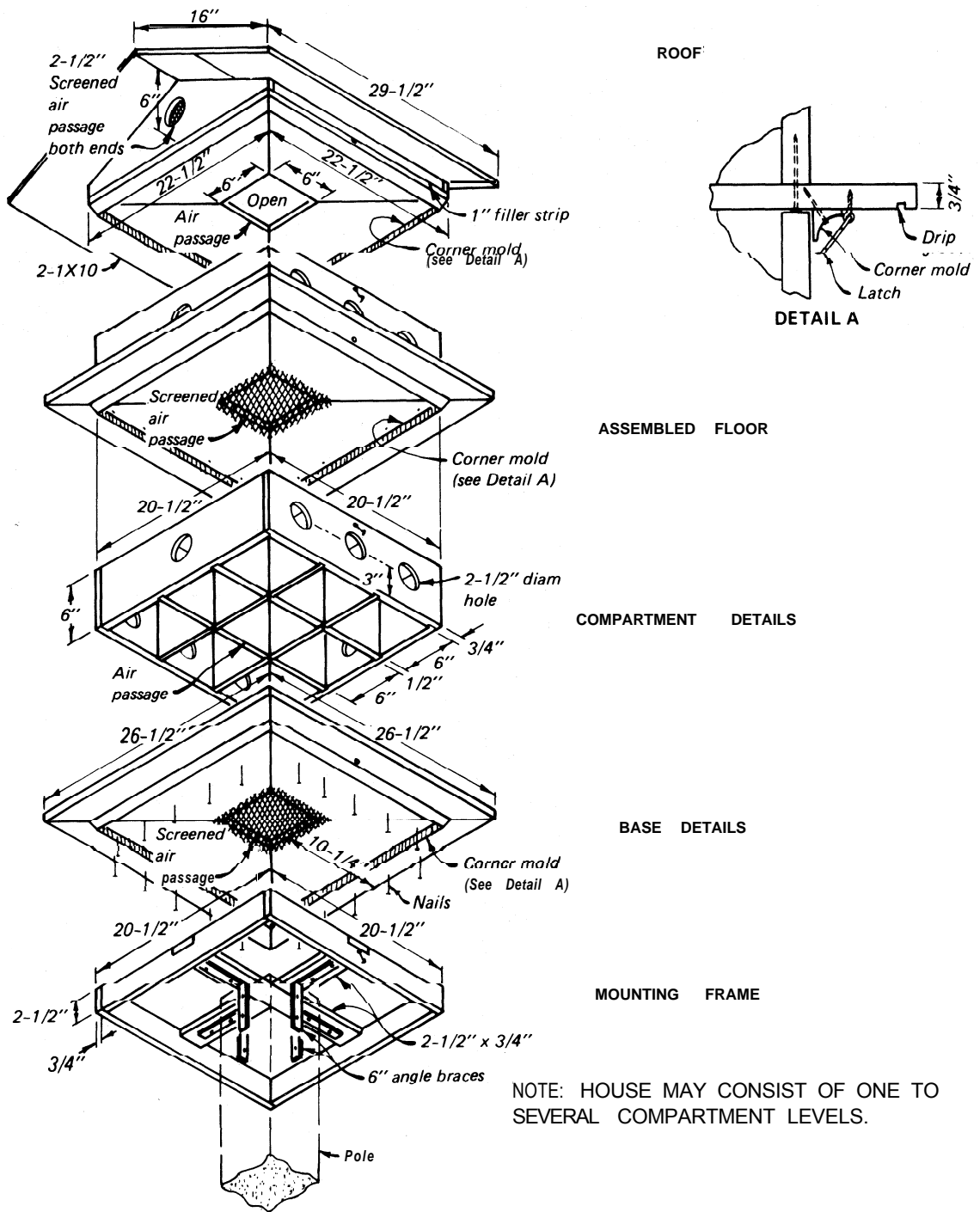


Figure 3. Construction details for a purple martin communal house.

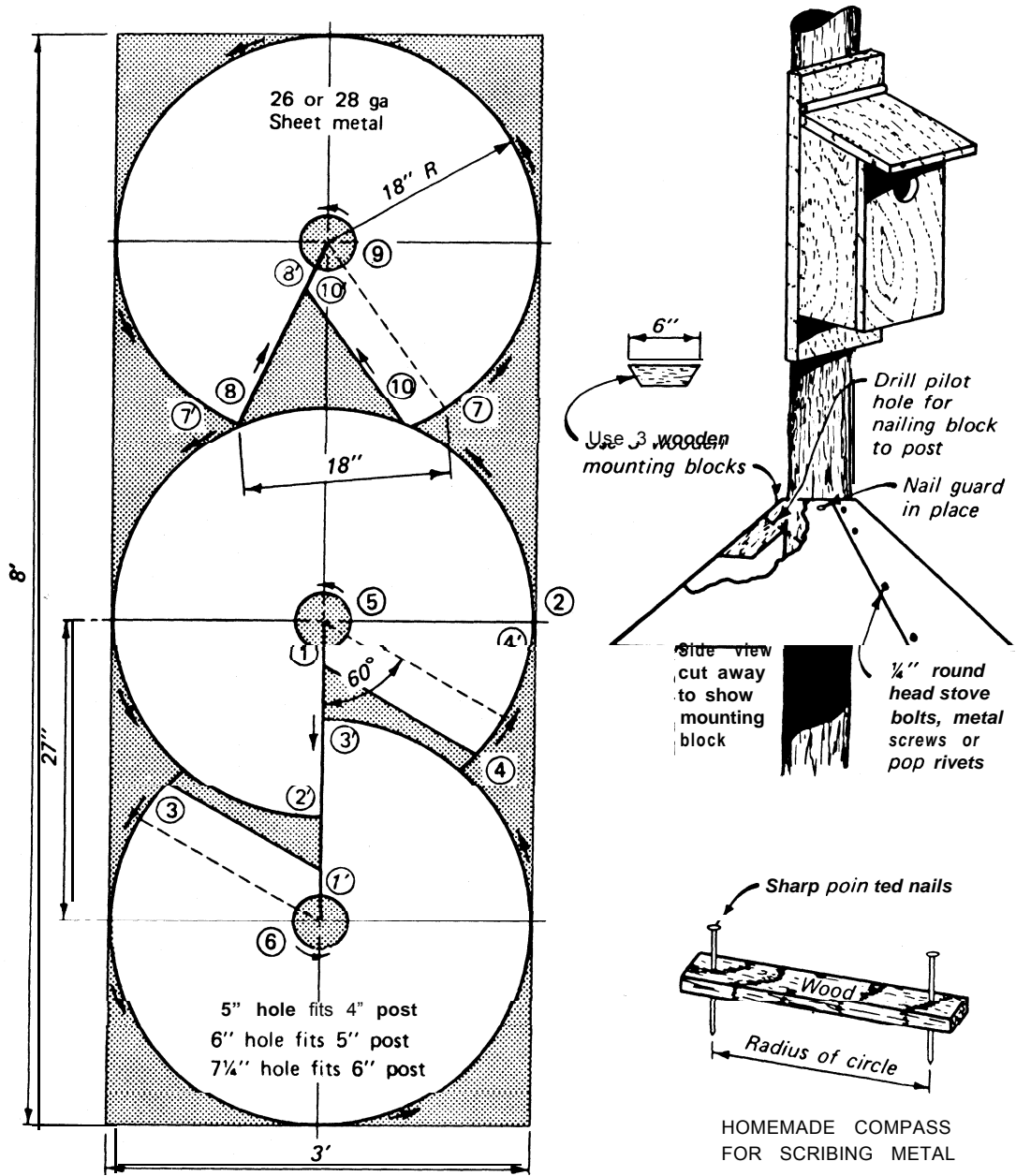
For More Information

For specific information on managing for songbirds, see *Garden Birds: How To Attract Birds To Your Garden*, by Noble Proctor, Rodale Press.

The songbirds mentioned here are only a few of the many yard-nesting species found in Alabama (see Table 1). To find out more about the nesting requirements and

construction of nest boxes for other native birds see the following publications:

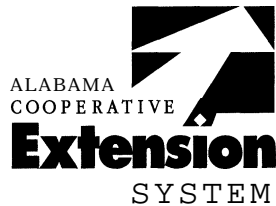
Building Birdhouses And Bird Feeders: A Family Workshop Book, by Ed and Stevie Baldwin, Doubleday & Company, Inc.; *Attracting, Feeding, and Housing Wild Birds-With Project Plans*, by Phyllis Moorman, Tab Books Inc.



INSTRUCTIONS:

Cut on solid lines only. Follow the numbers; complete each cut before starting the next. For example, cut ① to ① then ② to ②. Make circular cuts in counterclockwise direction. For initial cut at ①, make slot with cold chisel. Cut complete circles at ⑤, ⑥, and ⑨. When installing guard, overlap the cut edge to the dashed line. Three guards can be cut from an 8' x 3' piece of sheet metal.

Figure 4. Construction details for a conical sheet metal predator guard.



CIRCULAR ANR-550

Recommended for Extension use by Lee Stribling, *Extension Wildlife* Scientist, Associate Professor, Zoology and Wildlife Science, Auburn University.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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UPS, 10M17, Rep. 10:96 ANR-550

Rabbit

Eastern Cottontail Rabbit

(Silvilagus floridanus)

The Eastern Cottontail rabbit is one of the most popular game animals in the country. It is found in many parts of the United States, and in parts of the Northeast and Midwest, it is the number one game species.

Interest in managing rabbits, which changes with the number of hunters and rabbit-dog trials, has generally been high in the Southeast. Although hunter numbers and rabbit harvests in Mississippi have declined over the last decade, around 60,000 rabbit hunters have harvested about one-half million rabbits annually over the past few years.

Populations

Late winter populations are mainly rabbits born the previous summer. About 20 percent are 2 years old, and about 8 percent are 3 years and older. The chance that wild rabbits will live to be 4 years old is slight.

Predators such as bobcats, foxes, hawks, and owls are probably the rabbit's worst enemies. Other population controls include bad weather and disease. Hunter harvest removes animals that would normally be taken by predators or some other deadly factor.

Many forces work against the rabbit, but populations are strong. Although rabbit populations are often greatly reduced, rabbits can reproduce prolifically. This lets populations build rapidly when you provide the right food and cover.

Nesting

During the February-September reproductive season, rabbits produce an average of four young per nest, though the number in a nest may range from one to more than seven. Female rabbits dig cup-shaped holes in which to bear young.

Nests have been found in diverse locations from open ground under tall pines to corners of lawns, with the only hiding thing being soft grass and fur from the mother's breast. Generally, however, rabbits prefer to nest along the edges of fields, ditch banks, and other areas of low cover where the nest is hidden, while the mother feeds and rests nearby. She returns to the nest only to nurse her young, usually in early morning and late afternoon.

Young rabbits begin to make short trips from the nest when they are about 10 days old. When they are about 2 weeks old, they leave the nest for good.

Range

Cottontails seldom range more than one-half mile and usually spend their lives on 10 acres or less.

Food Habits

Rabbits eat most plants and eat nearly anything that grows above ground. In the growing season, they eat lots of grasses, sedges, sprouts, and leaves. They also eat fruits, branch tips, buds, and bark, along with waste grain around farmed areas.

Management

The cottontail rabbit is mainly a farm animal and does best on fairly small cropland areas. Usually, grown-up fence rows, ditch banks, and turnrows on farms provide adequate cover. For the past several decades, farm sizes have increased and "clean farming" has increased, as a result of better equipment. Also, much farmland that was once suitable for cottontails has been changed to improved pasture or loblolly-pine plantations. These enterprises are important, but they do not produce

as many rabbits as when rows were being plowed with mules.

Generally, varying habitats for cottontail rabbits is important, such as mixing cover areas with feeding areas. Good cover is probably the greatest one factor affecting rabbit populations. Cover provides areas for rabbits to escape from predators, nest, feed, and avoid bad weather. You can usually develop and maintain cover, depending on the type of landscape involved. Where natural cover is lacking, such as in large, clean agricultural fields, you can increase cover by letting natural vegetation along fencerows and ditchbanks grow up into thickets. You can also plant 15-foot-wide strips of Kobe or Korean Lespedeza.

Rabbits are helpless at birth, so it is important that you avoid bush-hogging, disking, and burning during the nesting season, particularly in areas of suitable nesting habitat. But strip disking, bush-hogging, and burning fields on a 4- to 5-year rotation can increase food production and woody winter cover. You can break up thick broom sedge fields of several acres by planting evergreens, and around field edges and in the forest, fell trees to the ground carefully, leaving trees attached at the stumps and still alive.

With forestland areas, it is important to keep stands open, so you can keep early successional stages at ground level. Young pine plantations provide excellent cover, and later on, burning these stands can produce excellent quality forage.

Keeping different ages of various timber stands, mixed with open fields, areas of thick cover, and succulent green forage helps produce more woodland rabbits.

In winter, rabbits eat oats, winter wheat, clovers, and other green foods planted next to ground cover. These plantings reduce the distances rabbits have to move to find food and reduce predation.

General Tips for Improving Rabbit Habitat

- Create small stands (10 to 20 acres) close to fields, swamps, and streams.
- Thin pine stands frequently (3 to 5 years) to stimulate understory growth.
- Use prescribed burning in pine types in winter.
- Control predators where trapping and game laws allow.
- Keep pets (cats and dogs) confined, especially during nesting.

Squirrel

Tree Squirrels in Mississippi

The eastern gray squirrel and fox squirrel are rodents belonging to the family *Sciuridae*. We think the gray squirrel, *Sciurus carolinensis*, and the fox squirrel, *Sciurus niger*, came to North America from the Old World by way of the ancient land bridge across the Bering Straits (which now separates Alaska from Siberia). Today we find squirrels in Europe, Asia, Africa, North America, and South America.

The gray squirrel is often called "the cat squirrel" because of its "cat-like" call. The fox squirrel is sometimes called "red squirrel." But that is confusing, because there is the "red squirrel," *Tamiasciurus sp.*, of the western states. The fox squirrel probably got its name because its color is similar to that of a fox.

The gray squirrel has a head and body 8 to 10 inches long, with a hairy tail of 7 to 10 inches. Some gray squirrels have weighed up to 1½ pounds, although they average just slightly over 1 pound. Mostly they are grayish, but some are black or albino. Although color phases may vary, Mississippi has only one subspecies of the gray squirrel, *S. carolinensis*. In Mississippi most black squirrels are fox squirrels, although you may find some black "gray squirrels." These are common in some northern states.

The fox squirrel is larger than the gray squirrel, weighing about ½ to 2½ pounds. It reaches a body and head length of 10 to 15 inches and has a tail length of 9 to 14 inches. It has a black-brown-orange color combination, which makes up a common grizzled rusty color. We see two subspecies of the fox squirrel in Mississippi. One, *S.n. bachmani*, has the black mask and white nose, ears, and paws of fox squirrels common to uplands across Mississippi.

The other, *S.n. subauratus*, lives at the western border of Mississippi along the Mississippi River. The subspecies *S.n. subauratus* has two color phases. One is a glossy black phase, and the other color is a grizzled rusty phase, often lacking the black mask and white appendage coloration characteristic of the upland fox squirrel, *S.n. bachmani*.

Fox squirrels in Mississippi have two distinct color variations. One is the white nose and ears common on fox squirrels of the pinelands, and the other is the glossy black fox squirrels common to the Mississippi River Delta. The black squirrel is a color phase of our Delta fox squirrel.

At times, the question arises as to whether a squirrel is a gray or fox. The gray squirrel normally has white tips on the long tail hairs, while the fox squirrel's tail is tipped with rusty orange or dark hairs. A gray squirrel's head is more rounded than a fox squirrel's, and its ears are long and more pointed. Color of the paw sole also varies between gray and fox squirrels. Gray squirrel's paw sole color is pinkish, while paw sole color of the fox squirrel is black.

Some of the most distinguishing characteristics between gray and fox squirrels are in the skeletal features. The gray squirrel has a smaller skeleton and tiny teeth in front of the premolars of the upper jaw. After cooking, the bones of gray squirrels are white, while fox squirrel bones are pinkish-orange.

Family Life

Research indicates two major breeding and rearing seasons, although some young are raised throughout the year in Mississippi. The first litter of young is normally born

from January through March, and the second litter follows from June through August.

Studies also found spring-born females are likely to bear a spring litter the following year and skip the summer breeding period. A summer-born female normally does not breed in the spring but has a litter the following summer. Most adult females raise two litters per year. The summer rearing season is usually more successful.

Mating habits indicate gray squirrels are promiscuous, while fox squirrels prove to be monogamous (having one mate). The gestation period is 45 days for fox squirrels and 44 days for the gray squirrel. A normal litter contains about three young. Male squirrels usually do not participate in family affairs after mating.

Spring breeding depends heavily on the quantity and quality of food available in autumn and winter. Often a good mast crop is followed by a good squirrel crop. This is one reason there are ups and downs in squirrel numbers.

The blind, deaf, and hairless litter is born in trees, either in hollowed den trees or in nests built of leaves and twigs. Gray squirrels weigh about ½ ounce at birth, are half an inch long with no teeth, and have closed ears and eyes. Fox squirrels when born are pinkish-purple, and their "vibrissae," or whiskers, stand out.

Late in the fifth week, the baby squirrel has a full coat of new body hair. At about 6 weeks of age, it wanders about the den, eating young leaves and buds. The mother starts weaning the young in the seventh week and continues until the squirrels are about 10 to 12 weeks old. The average lifespan for squirrels in the wild is about 18 months.

Parasites and Diseases

Squirrels are usually hardy little animals, and parasites and diseases worry hunters probably more than the squirrels. Botfly larvae (or "wolves") may be the most common pest in the South but seldom occur in the North. Mange, or "scabies," is a skin condition that causes bald spots on squirrels. It normally occurs more in late winter and early spring and is not as severe in healthy animals with a good food supply. Squirrels also commonly have ticks, fleas, chiggers, and warty growths (fibroma), but these usually aren't serious.

Occasionally we find rabbit fever, tapeworms, roundworms, internal protozoa, and other rodent pests. Of the predators, owls, hawks, snakes, foxes, and bobcats are the most pronounced, but they have never proven destructive to a squirrel population and should be kept to prevent overpopulations and diseases. Man, through habitat destruction, has been a more serious enemy than any disease, parasite, or natural predator.

Habitat and Food

The gray squirrel's habitat needs often differ from the fox squirrel's by requiring denser and larger acreages, away from forest openings. In Mississippi, the fox squirrel is more commonly found on the ridges and in predominantly pine woodlands. The gray squirrel occurs more frequently in the stream or branch bottoms in Mississippi.

Both squirrel species have similar feeding habits. The more desired food (hardwood mast) is important to successful squirrel production. Oaks, beech, and hickories are extremely important food sources for squirrels and offer a high carbohydrate content. Preferred spring and summer foods include ash, elm, gum, holly, hackberry, ironwood, magnolia, maple, mulberry, and pine. Squirrels eat some leaves, and they love buds in early spring. They also eat insects, eggs, seeds, and forbs (weeds).

Common trees and their relative food values to squirrels

<i>Tree</i>	<i>Value of Fruit</i>	<i>Value of Buds</i>
Ash		Medium
Beech	High	
Black cherry	High	
Dogwood	Medium	
Elm	Low	Medium
Gums:		
black,	High	
Tupelo	High	
Gum: red	Low	Medium
Hackberry	Medium	
Hickory	High	
Locust	High	
Magnolia	Medium	
Maple	Medium	Medium
Oaks:		
white,	High	Medium
red,	High	Medium
water	High	Medium
Pine	Medium	
Red mulberry	High	
Sweetbay	Medium	
Sweet pecan	High	
Sycamore	Low	
Willow		Medium
Yellow poplar	Low	Medium

Squirrels fare best in large acreages of mixed hardwoods that are nearing or at maturity. You cannot keep these conditions indefinitely because of different tree environments and changing forest conditions. Recommended timber management practices include the following:

1. Leave as many large mast-producing trees as possible when cutting.
2. Keep fire out of hardwood bottoms.
3. Control cattle and hogs on forest land.
4. Encourage plants such as cherries, huckleberries, dogwood, persimmon, haws, poison ivy, rattan, muscadine, and grapes.
5. Leave several den trees per acre.
6. Build artificial nest boxes for squirrels. (See MSU-ES Publication 884, "Building Homes for Squirrels.")



Revised by **Dr. Ben West**, Assistant Extension Professor, Wildlife and Fisheries

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Information Sheet 635

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture.
Published in furtherance of Acts of Congress, May 8 and June 30, 1914. **JOE H. MCGILBERRY**,
Director (POD-02-05)

Turkey



Eastern Wild Turkey

(*Meleagris gallopavo silvestris*)

by Mary C. Kennamer

NWTF WILDLIFE BULLETIN No.1



NATIONAL WILD TURKEY FEDERATION



PHOTO BY MATT LINDLER



PHOTO BY JOHN HEIDECCKER

ABOVE: The eastern wild turkey inhabits the eastern half of the United States.

RIGHT: The gobbler exhibits the characteristic red, white and blue head, the black-tipped breast feathers and copper/bronze iridescence.

The eastern wild turkey is the most widely distributed, abundant, and hunted turkey subspecies of the 5 distinct subspecies found in the United States. It inhabits roughly the eastern half of the country. The eastern wild turkey is found in the hardwood and mixed forests from New England and southern Canada to northern Florida and west to Texas, Missouri, Iowa, and Minnesota. It has also been successfully transplanted in California, Oregon, and Washington, states outside its suspected original range.

L.J.P. Vieillot first described and named the eastern subspecies in 1817 using the word *silvestris*, meaning "forest" turkey.

Since the eastern wild turkey ranges the farthest north, individuals can also grow to be among the largest of any of the subspecies. The adult male, called a gobbler or tom, may measure up to 4 feet tall at maturity and weigh more than 20 pounds. Its upper tail coverts, which cover the base of the long tail feathers, are tipped with chestnut brown and tail tips with dark buff or chocolate brown. In contrast, the breast feathers are tipped in black. Other body feathers are characterized by rich, metallic, copper\bronze iridescence.

The primary wing feathers have white and black bars that extend from the outer edge of each all the way to the shaft. Secondary wing feathers have prominent white bars and are edged in white, producing a whitish triangular area on each side of the back when the wings are



Eastern gobbler wings folded on the back show a whitish triangular patch.

Eastern wild turkeys are found in 38 states and two Canadian provinces. It is the most abundant of the five subspecies found in the U.S. and Canada.

folded on the back.

A mature female, called a hen, may be nearly as tall but is usually lighter, weighing between 8 and 12 pounds. Females are similar in color to the males but more brown, and the metallic reflections are less brilliant. Feathers of the hen's breast, flanks, and sides are tipped with brown rather than the black tips of the male. The head of the female is considered feather covered with smaller, dark feathers extending up from the back of the neck. Females lack the caruncles or fleshy protuberances of skin at the base of the front of the neck that are bright red on the male. Beards and spurs are generally considered secondary sex characteristics in males. Beards may be present on about 10 percent of the hens, however, they are thinner and shorter than those of adult males. Spurs on hens are uncommon but, when present, are usually rounded and poorly developed.

The reproductive cycle for the eastern wild turkey usually begins in late February or early March in its southernmost habitats but not until April in northern states such as Vermont and other areas across the northern edge of turkey range. Likewise, the cycle is complete with the hatching of poults by June

or as late as mid-summer further north. Birds that reneest may bring off broods as late as August.

Breeding behavior is triggered primarily by the increasing day length in spring, but unusually warm or cold spells may accelerate or slow breeding activity. This behavior begins while birds may still be in large winter flocks prior to separating as individuals or into small groups.

The basic social organization of these flocks is determined by a pecking order with the most dominate bird at the top and the least on the bottom. Males and females have separate hierarchies, and there can be pecking orders within and between flocks of the same sex; while stable pecking orders within flocks of the same sex seem to be common to all wild turkey subspecies. Turkeys have home ranges, not territories where individuals defend space within a given habitat from other members of the same sex. Instead they fight for dominance recognizing individuals within the pecking order while sharing overlapping home ranges.

Courtship behavior patterns include gobbling and strutting by the males. Gobbling attracts hens to males who court the hens by strutting. If the hen selects the gobbler for mating she crouches, which signals the male to copulate. The first peak of gobbling activity is associated with the beginning of the breeding period when gobblers are searching for hens. The second peak occurs a few weeks later, when most hens begin incubation.

Hens become secretive while searching for a site to nest prior to laying eggs. Laying hens may continue to feed with other hens and mate with gobblers, but this social activity will be away from the nest site.

Nests are shallow depressions formed mostly by scratching, squatting, and laying eggs rather than by purposeful construction. The arrangement of twigs and leaves is minimal in sites chosen for their moderately dense understory which still allows the hen a view

but gives protection from avian predators.

Laying a clutch of 10 - 12 eggs takes about 2 weeks and unincubated eggs are usually covered with leaves. Continuous incubation begins about the time the last egg is laid at which time the hen no longer tries to conceal her eggs when she leaves for short periods to feed.

The hen will incubate for 26 - 28 days sitting quietly and moving about once an hour to turn the eggs. Actual hatching begins with pipping—the poult rotating within the shell, chipping a complete break around the large end of the egg. Hens respond to the pipping sounds by making soft clucks at random, a form of communication which begins to imprint the poults to the hen as she inspects the eggs and turns them. Damp poults clumsily free themselves from the egg but are fully dry and coordinated so they can follow the hen away from the nest within 12 to 24 hours after hatching. This vocal communication between hen and poults still in the eggs is an important part of the hatching process and is critical to survival of the young.

Imprinting is a special form of learning which facilitates the rapid social development of the poults into adults. It's a strong social bond between the hen and her offspring which occurs up to 24 hours after hatching. Imprinting describes the rapid process by which the young poults learn to recognize their species, essential for their survival. It happens only at this time and cannot be reversed.

Day-old poults learn to respond to the hen's putt or alarm call before leaving the nest and respond by freezing or running to hide beneath her. The hen, clucking almost continually, slowly leads her poults away from the nest until within a few hours her pace is

more normal. By now the poults have formed into a brood group that is constantly feeding by pecking at food items, a behavior learned from their mother.

By the second day out of the nest, wild turkey poults are performing most of the characteristic feeding, movement, and grooming behavior patterns. By the end of the first week they are regularly dusting with the hen. By their second week they are able to fly short distances and at the third week they are able to roost in low trees with the hen. The ability to roost in trees is an important event in the brood's development as it removes them from the danger of ground predators. Roosting occurs at the beginning of another phase of rapid development, the acquisition of juvenile plumage and a change in diet from predominantly insects to a higher percentage of plant matter. This phase of behavioral and physical development is



PHOTO BY LARRY PRICE

An eastern hen, darker and duller than the gobbler, with 3 poults about 2 weeks old.



PHOTO BY BILL KINNEY

accompanied by a sharp decline in poult mortality. Poults that survive the first six weeks have a much better chance of surviving to adulthood.

At age 14 weeks, male and female poults are distinguishable by body size and plumage. They have formed separate pecking orders although still dominated by the hen until all males have finally

Courtship behavior patterns include gobbling and strutting by males which, because of the wide distribution of the eastern subspecies, can occur when there is still snow cover.



left the brood group to form their own social units.

By fall, the pecking order of the sibling groups has been established and the young flocks are ready to enter the social organization of the surrounding population. The body growth of juveniles ends by the beginning of winter when the flocks, separated by age and sex class, settle into winter range.

For additional information on this subject refer to **The Wild Turkey Biology and Management**, edited by Jim Dickson. The book is available for \$59.95 from the

National Wild Turkey Federation, by clicking [here](#) or calling 1-800-THE-NWTF.

The **Get in the Game CD-ROM** is also available through the NWTF's online Turkey Shoppe. This CD includes a planting guide and valuable information to help you attract wild turkeys to your land. Ordering information can be found [here](#). And to check out more about the NWTF's **Wild Turkey Woodlands** program to help landowners and hunt clubmembers manage their land for wildlife, click [here](#).

Silvopasture and Eastern Wild Turkey

Introduction

Trees and livestock account for much of the income production on lands throughout the southern United States. Today many landowners are combining these two operations into one system called silvopasture, where both timber and livestock are produced on the same field.

While economic gain is most often the primary goal of a silvopasture system, wildlife habitat enhancement is commonly seen as an added benefit. This *Agroforestry Note* discusses the habitat requirements of Eastern wild turkey with respect to management considerations for the production of timber and livestock forage within silvopasture systems.

Silvopasture systems typically are laid out by either planting widely spaced rows of trees (usually pines) onto an open pasture or by heavy thinning of a forest to allow sufficient light to reach the ground so that a livestock forage system can be established. See *Agroforestry Notes* 18 and 22. Minor modification can be made to greatly improve the value of a silvopasture system for wild turkey, while still retaining most of the timber and forage production potential.



Silvopastures provide a mix of tree and grass vegetation that is preferred by wild turkeys. Photo courtesy National Wild Turkey Federation.

Habitat Requirements

The effective range of a flock of Eastern wild turkeys can span several thousand acres, depending upon the available food and habitat conditions, and occasionally may exceed 12,000 acres. Because of this large range and the relatively small scale of most silvopasture operations it is unlikely a silvopasture or, for that matter, most farms in the Southeast will fulfill the year-round habitat requirements for Eastern wild turkeys. Silvopastures, however, can be managed to provide significant requirements and help improve the conditions for the turkeys.

Food Species for Eastern Wild Turkey

Trees	Shrubs	Grasses / Forbs	Vines
pine	crabapple	chufa / sedges	honeysuckle
oaks	dogwood	native grasses	Virginia creeper
persimmon	hawthorn	Bahiagrass	poison ivy
pecan	American beautyberry	legumes / clovers	grapes
hackberry	blueberries / briars	orchardgrass	

Turkeys require a mixture of open agricultural and forest land. While turkeys prefer oak forests, they will utilize most types of timber found in the east and prefer mature open grown timber. Sawtimber stands with a basal area of 40 to 60 square feet can allow enough light penetration to provide good foraging in the understory.

Each year, turkeys go through three distinct periods or seasons each requiring somewhat different habitat conditions. These conditions are:

- Spring (nesting)
- Summer / fall
- Winter

Spring (Nesting) Habitat

An ideal nesting site is an area where the ground cover has a woody component of shrubs, small trees, and briars usually less than four feet in height with a strong herbaceous component. The vegetation is often adjacent, or in close proximity, to water such as a pond, spring stream, or livestock tank. Riparian areas, small clearcuts, open grown forests, old fields, or pastures and hayfields where grazing is deferred during March through June, are often used as nesting sites.



Allowing shrub clusters to persist creates turkey nesting cover.

Management considerations for silvopasture to enhance spring (nesting) habitat:

- Manage trees for an open-grown canopy of between 25 to 45 percent cover or grow trees in two or three row sets with 30 to 40 foot alley ways.
- Establish understory vegetation to native warm season grass and defer utilization until July, or if grazed, manage for a grazing height of 8 to 10 inches.
- And/or manage understory to increase shrub and briar component to improve nesting condition. This will usually require shifting 20 to 30 percent of the forage production to shrubs.

Summer / Fall Habitat

Vegetation at this time of the year is more varied and diverse. Once young turkeys hatch, they move to grassy areas and for the first month feed almost exclusively on insects. High quality pastures and recent forest clearcuts are excellent areas for the young turkey to grow. Within approximately one month their diet begins to mimic the adults and include soft and hard mast, and forages, such as grasses and legumes. These conditions are found near forests and in open grown forests containing at least 50 percent light penetration to the forest floor for understory production and an overstory containing oaks and soft mast producing trees. Thinned pine forest also provides ideal turkey habitat.



Rotational grazing creates a variety of forage stand conditions. Silvopastures with shorter forage are excellent brood rearing and feeding areas for young poults. Taller vegetation is good if there is enough open area to allow poults to access the site.



Existing or established motts (clusters) of oak trees scattered within the pine stand produce acorns which benefit turkeys.

Management considerations for silvopasture to enhance summer / fall habitat:

- Establish motts (clusters) of oaks or soft mast producing trees in linear silvopasture planting (see photo above).
- Protect mast producing tree and shrub species, and manage them to comprise 10 to 30 percent of the stand.
- Establish shrubs within, or adjacent to, linear tree sets in silvopastures (see photo above).
- Maintain legumes as a forage component for grazing and wildlife.

Winter Habitat

During this critical time of the year, winter habitat must provide adequate and reliable food, plus cover from inclement weather. Mature hardwood trees preferably oaks are ideal. Oaks provide roosting sites and acorns for food. Riparian areas near or in silvopastures, left in oaks, as well as managed hardwood sites, provide excellent winter habitat. If a significant area of oak trees is not available for winter food, crop residue or food plots adjacent to wooded areas can be established to assure a good food supply.

Management considerations for silvopasture to enhance winter habitat:

- Maintain 10 to 30 percent oak species in block-type silvopasture plantings.
- Establish motts of oak species in linear silvopasture plantings.
- Plant desirable cool season perennial grasses for winter foraging where adaptable.
- Over seed warm season grasses such as bahiagrass and Bermuda grass to wheat or annual rye grass for winter grazing by livestock and foraging by turkeys.
- Over seed adapted cool season legumes for winter and early spring foraging.

Silvopasture forage can be enhanced to provide additional high quality winter feed for turkeys. Adding cool season grasses or legumes in silvopastures near streams and oak motts create a food source close to other habitat components.

As silvopastures mature, they provide a variety of habitat requirements that turkeys will utilize at different times of the year depending on the habitat requirements that are being satisfied. Photo courtesy National Wild Turkey Federation.





An inventory of turkey habitat conditions near the silvopasture area will indicate which management alternatives will best enhance the area for wild turkeys. Photo courtesy National Wild Turkey Federation.

Additional Considerations

Before deciding what management changes are needed, a landowner should:

- Consult a professional wildlife biologist trained in wild turkey and silvopasture management.
- Inventory the habitat condition of the silvopasture, the farm, and adjoining farms that make up the range of the turkeys in the area.
- Keep in mind that turkey diets are varied. Any one food source is not a limiting factor for quality turkey habitat. Furthermore, turkeys respond to vegetation structure as much as, or more than, availability of specific food items.
- Determine grazing, timber, wildlife and other conservation and production objectives for the pasture, forest and silvopasture on the farm.
- Develop a management plan to meet landowner objectives.

Additional Information

Wildlife Management: Eastern Wild Turkey; 2003; by Bob Tjaden; College of Agriculture & Natural Resources, University of Maryland. FS-606. pgs 10.

Wildlife Food Planting Guide for the Southeast, Dean Stewart, Mississippi State University Extension Service Publication 2111.

Turkey Management in Pine Plantations, 2004. by John S Powers, Area Biologist, Division of Wildlife and Freshwater Fisheries. http://www.conservation.alabama.gov/administrative/Turkey_Management.htm

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Wild Turkey Management In Alabama

The wild turkey thrives as a classic example of wildlife management success. During the Depression years, wild turkeys numbered fewer than 10,000 in Alabama and were restricted to scattered pockets of isolated habitat. In the short time since then, restocking of suitable habitat, protection, and management have allowed turkeys to respond dramatically to favorable land-use changes. Wild turkeys now occupy portions of all 67 counties in Alabama and may exceed 300,000 in number.

Life History

During fall and throughout most of winter, wild turkeys gather in flocks. Flocks are usually distinct units comprised of adult and young hens, adult gobblers, or, by mid-winter, young gobblers. Large flocks, often referred to as droves, are more common in western races of the wild turkey than in the eastern subspecies found in Alabama.

Stimulated by warming temperatures and increasing daylight, flocks begin to break up during late winter and early spring. Young gobbler groups, however, may remain together throughout their first spring.

In preparation for nesting and rearing their young, hens typically disperse to areas containing openings or fields. Adult gobblers establish loose, poorly defined ranges near such areas and call or gobble to attract hens for mating.

Breeding is promiscuous. Gobblers may mate with several hens and hens may mate with more than one gobbler. Some young gobblers reach sexual maturity during their first spring, but very few mate until the following year.

Although some egg laying occurs during March, most hens begin nesting during April. A clutch of about 10 eggs is laid in a shallow, leaf-lined depression on the ground. Twenty-eight days of incubation are required for the eggs to hatch.

Hens assume all incubation and brood-rearing responsibilities. On the average, fewer than 50 percent of all nests are successful. If initial nests are

destroyed or abandoned, hens often attempt to nest again.

The young, known as poults, are covered with natal down at hatching. Although immediately able to run about and feed themselves, they require brooding by the hen to keep warm.

Poults feed heavily on insects and other high-protein matter during their first few weeks of life (Figure 1). Poults mortality averages nearly 70 percent with the majority of that loss occurring by two weeks of age.

The growth of poults is rapid. By three to four months of age, the young are almost indistinguishable from adults. By this time, young gobblers usually outweigh and stand taller than adult hens. By fall, hens and their broods join other such groups—as well as unsuccessful hens—to form new flocks.

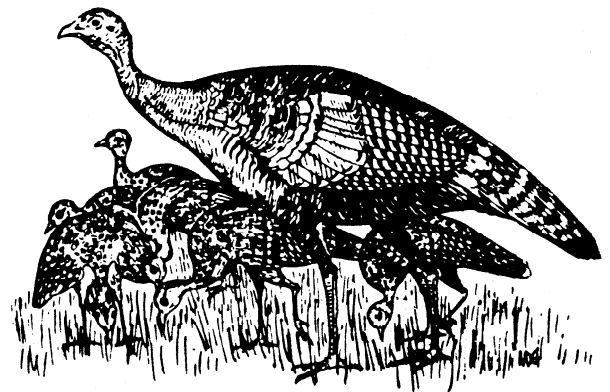


Figure 1. Wild turkeys feeding in low-growing vegetation.

Habitat Needs

Annual home ranges of wild turkeys often exceed 1,000 acres. Range size in Alabama is related to the amount, availability, and condition of critical habitat components. Turkeys in poor habitat may range over several thousand acres annually.

Extensive tracts of land are needed to retain large populations of turkeys year-round, but

turkeys can be attracted to small holdings for the hunting season.

Ideal habitat is difficult to define. Given good protection, turkeys can adapt to several habitat types and conditions. A good range consists of predominantly mature, mixed pine-hardwood stands, interspersed with field and grassy openings.

Habitat for turkeys must offer sufficient sources of seeds, nuts, and other energy-rich food sources during fall and winter. Mast of hardwoods, particularly oaks, is used extensively during this time (Figure 2).

Dietary preferences shift to leafy vegetation, animal matter, grass seeds, and soft fruits during spring and summer. Much of these needs are satisfied by feeding in fields, forest openings, and around the edges of such habitat types.

Hens prefer to nest in brushy areas that offer good cover. Nesting covers and protective covers for adult turkeys are usually plentiful in Alabama. However, protective cover for poults can be critically limited. The survival of turkey broods is influenced by the quality of habitat used.

Broods less than two weeks old need access to areas that give good overhead cover and protection from predators. Broods in good habitat experience fewer losses than those in poor habitat. Excellent habitat for young poults would be fallow fields and woodlands with an open canopy that allows plants to grow at ground level.

Turkeys require water almost daily, but they satisfy much of that need by eating succulent vegetation and fruits. Access to water does not limit turkey distribution or abundance in Alabama.

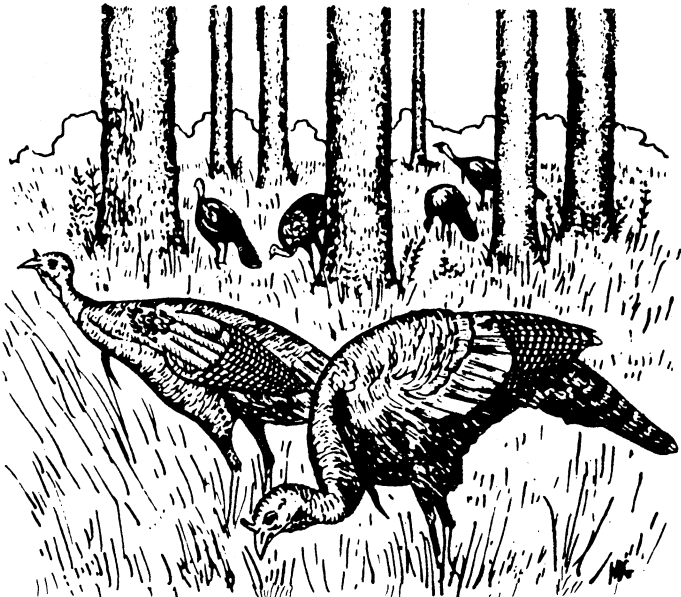


Figure 2. Adult turkeys in mature hardwoods.

Habitat Management

To increase the number of turkeys on a tract of land, you must first evaluate the present abundance and quality of habitat types on the property. Because turkeys are mobile, also consider the land types and usages of adjacent properties. For example, if adjoining lands are dominated by unbroken stands of mature hardwoods, few turkeys could be attracted by managing your land similarly. Instead, you would benefit most by providing openings and other habitat types.

No precise rules govern the minimum amount or proportions of particular habitat types that must be available to turkeys. For example, turkeys may thrive on some areas with a low hardwood component if other areas, such as pine stands or food plots, are managed to meet or supplement fall and winter food needs (Figure 3).

The following are general guidelines to consider when managing land for turkeys.

HARDWOOD MANAGEMENT. Retain a variety of mature, mast-producing hardwoods. Stands of such types should be well distributed over the area. Cutting rotations for hardwoods should extend at least 70 years on most sites. If thinning, select against hickories, sweetgums, and poplars, while retaining beeches and oak groups. If mature hardwoods cover less than 25 percent of an area, do not cut hardwood stands unless equal or greater portions than that scheduled for cutting are entering mast-producing stages.

PINE MANAGEMENT. Short rotation (pulpwood management over extensive areas leaves little prospect for wild turkeys. However, high densities of turkeys may exist on large tracts managed primarily for pine saw timber. Restrict pine management to sites best suited to pine production. Leave hardwood-dominated drains and stream bottoms uncut when harvesting or establishing pine stands.

Thin pine stands liberally as needed. Prescribe burn as soon as the tree height in young stands allows safe burning. Continue using fire on a three- to five-year cycle on pine sites. In relatively large stands, divide each stand into burn compartments so that one-third to one-fifth of the stand can be burned annually. Further benefits may be achieved by burning some stands annually and by permanently excluding fire from others.

Burn woodlands during winter but avoid burning later than March 15 to prevent nest destruction. Ideally, fire should be used early enough to allow ample germination or green-up by the time flocks disperse.

The Alabama Forestry Commission provides technical assistance on fire use and can help with

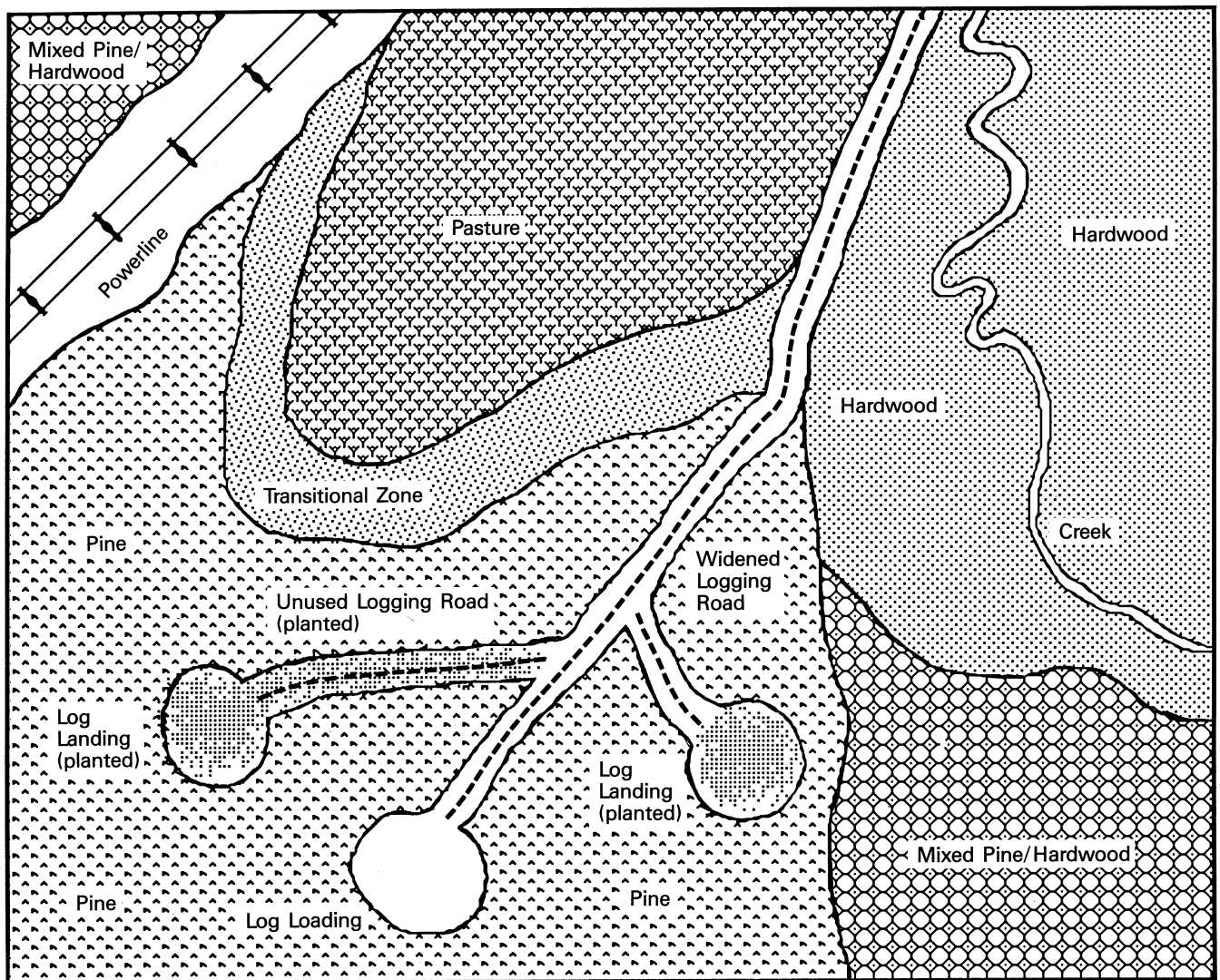


Figure 3. Habitat types for wild turkeys.

the construction of fire containment lanes.

MANAGING OPENINGS. High densities of turkeys rarely occur where fields or forest openings are absent or scarce. Turkeys may thrive where openings comprise as little as 5 percent of the total area and as much as 50 percent. To retain turkeys throughout the year on heavily forested land or to attract them during spring, provide openings of 5 to 20 acres. Long, narrow openings are provided by utility right-of-ways or by widening logging roads.

Improved pastures provide excellent feeding areas for hens and older poults. Mow ungrazed or lightly grazed openings during mid-summer to stimulate new growth and to prevent such areas from becoming too thick or rank for turkey use.

Field edges should provide a subtle transition from woodland to opening, allowing poults to have access to cover when feeding in fields (Figure 4). This can be done by thinning trees along field

edges or allowing edges to revert to brushy cover. If fields or pastures are heavily grazed, build fences several yards out from the woodlands to prevent cows from cleanly grazing field edges.

SUPPLEMENTAL PLANTING. Plant food plots to supplement native foods and to attract or retain turkeys during specific seasons of the year. Plots should be well distributed and located in or near woodlands. Where turkeys and deer are abundant, plots of at least 1 acre are needed. Corn, chufa, soybeans, and grain sorghums are planted exten-

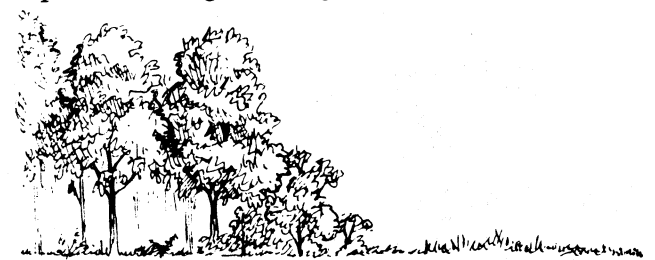


Figure 4. Good transition from field to forest.

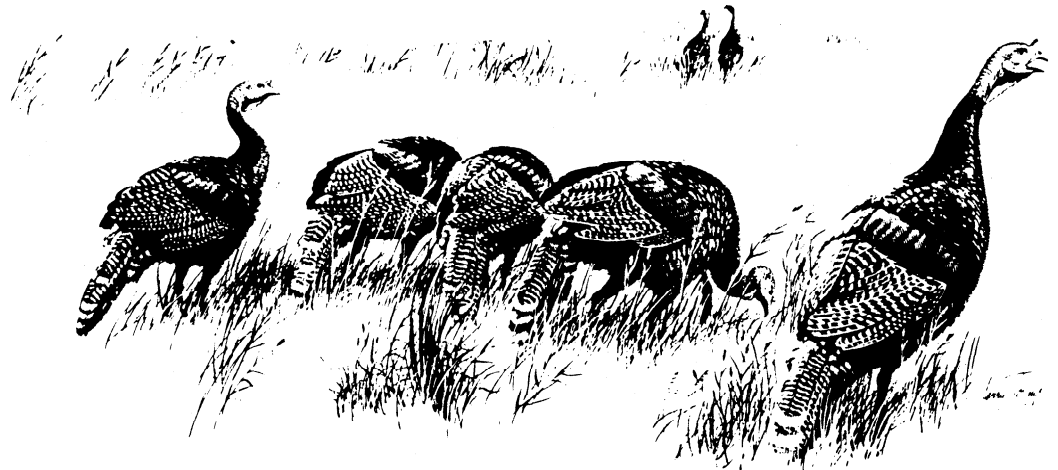
sively to supplement fall and winter foods of turkeys. Vetch, rye, wheat, clover, and oats provide winter grazing for turkeys.

Seeds of bahiagrass and browntop millet are used heavily during summer (see table below). Refer to Extension Circular ANR-485, "Wildlife Plantings And Practices," or ask your county agent for information regarding suitable varieties, planting dates, and planting methods.

Food Plants Beneficial To Turkeys In Alabama.		
Plant	Period Used	Planting Dates
Corn	Fall-Winter	March 15 - May 1
Chufa	Fall-Winter	May 1 - June 30
Soybeans	Fall-Winter	May 15 - July 15
Grain sorghums	Fall-Winter	June 1 - July 1
Vetch	Winter	Sept. 1 - Nov. 1
Rye	Winter	Sept. 1 - Nov. 15
Wheat	Winter	Sept. 1 - Nov. 15
Clover	Winter	Sept. 1 - Oct. 30
Oats	Winter	Aug. 25 - Oct. 30
Bahiagrass	Summer	Mar. 1 - July 1
Browntop millet	Summer	April 1 - Aug. 15

PROTECTION. Turkeys can adapt to widely varying conditions. Given adequate protection, large turkey populations may exist in marginal habitat. Poaching, however, may limit population growth in very good habitat. Restrict access to lands managed for turkeys and erect gates at the entrances of all access roads to discourage unnecessary traffic.

Minimize disturbances to hens during nesting and brood rearing. Pen or remove free-ranging dogs. Where possible, delay cutting timber and mowing fields until July once nesting begins. If fallow fields are scheduled for cultivation, plow them before nesting activity begins.



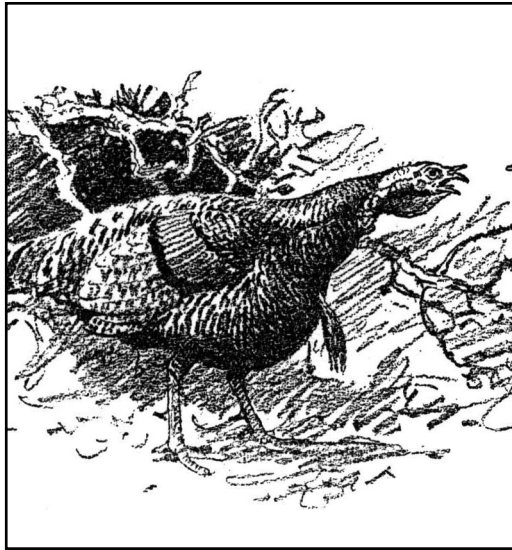
Lee Stribling, *Extension Wildlife Scientist*, Associate Professor, Zoology and Wildlife Science, Auburn University

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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Forest Management for Wild Turkeys



Wild turkeys require a variety of habitat types, including forests, open lands, and old fields. Adequate forestland is critical to maintaining viable populations of wild turkeys, particularly when forest management provides a mix of different forest types and ages and openings that can provide various food sources, brood rearing habitat, edges for nesting, and room for courtship. Turkeys do well in forested landscapes with 15 to 65 percent openings, whether in fields, cropland, pastures, or early successional stages of forestland.

Seasonal Habitat Needs

Nesting (Spring)

Turkey hens nest in a variety of habitat types, including pine forests and young cutovers/regeneration areas, old fields, hay fields, and rights-of-way. Nest sites generally have dense, small plant cover and some

shrub cover at the ground level, with some kind of woody form around the nest. Most nests are within 10 yards of a forest edge, such as a logging road or firebreak. Research indicates that hens nest in pine stands, including unthinned, mature loblolly stands and young (2- to 4-year-old) loblolly pine plantations. They usually don't use plantations younger than 2 years nor older than 4 years.

In large blocks of carefully managed pine plantations, hens nest in 15- to 20-year-old stands that are thinned and burned. Nesting success was much greater in mature pine forests (60 percent) than in the preferred young plantations (less than 20 percent). You can maintain the vegetative conditions necessary for nesting by late-winter burning at intervals of 3 years. You can also mow or bush-hog, but you should not burn, mow, or bush-hog during the spring-early summer nesting season (March-July).

Broods (Summer)

Young turkeys eat mostly insects the first couple of weeks after hatching and then quickly begin to pick up fruits and seeds. For poult protection, vegetation dense enough to afford some cover from predators is necessary. Forest edges next to fields and openings can provide this cover and are excellent brood habitat during this vulnerable time. You can plan forest harvesting to provide a good mix of mature to young forest.

In central Mississippi, broods prefer mature bottomland hardwood forests, where there are sparse shrubs and understory and moderate ground cover of grass-

es, sedges, forbs, and vines. Broods used burned pine plantations older than 10 years but avoided plantations burned less frequently than every 2 years. Plantations 15 to 20 years old that have been thinned and burned often provide good brood habitat. Overall, you can use many different types of forested habitats for hens with broods, as long as adequately dense herbaceous vegetation (for insect production) with some brushy cover nearby is available. Ideally, brood habitat should be mixed with nesting habitat so broods won't have to move far. Thinning and burning pine plantations improve brood habitat conditions. Patchy burns, with burned areas next to unburned areas, provide the best habitat.

Range Shifts

In the fall, turkeys begin to shift their ranges as food sources change to items such as dogwood fruits and oak acorns. Many times forests will provide better winter range for turkeys than other vegetative types, as mast foods, such as acorns, become available. Turkeys may move from pine plantations into mixed pine-hardwood or hardwood stands now, but well-managed (thinned and burned) pine stands may still see heavy use in winter (pine seed is good turkey food). In years when hard mast crops are light, turkeys may heavily use these and other forest types and fields.

In the spring, as winter flocks break up, the birds use a variety of forested habitats, but turkeys tend to move toward areas with more openings (such as pastures). They use openings a lot in the spring breeding season to display and mate. The openings also provide greens and insects for food.

Other Habitat Needs

Roosts

Turkeys roost in a variety of forested habitats but often prefer to roost in conifers next to water. On upland

forested sites, turkeys frequently roost on slopes near ridgetops or knolls. Many times these roost sites offer protection from bad weather. Turkeys roost in pine plantations, mixed pine-hardwood stands, and bottomland hardwoods. They often use flooded riverfront hardwood forests and bald cypress trees as roost sites in the Delta.

Roads

Roads can be helpful or harmful to turkeys, depending on management and protection. In large spreads of pine plantation forest, turkey use is related to spur roads. Roads that are daylighted (opened up) will provide more natural green vegetation for insect and seed production, or they can be planted in cover crops to prevent erosion and provide the same benefits of natural vegetation for turkeys. Roads that are closed with locked gates are important for protecting wild turkeys.

Water

The relationship between turkey populations and being able to get water is not certain, but turkeys can move long distances to get free water or can get water from vegetation, fruits, and insects they eat. Free water may be important during drought.

Forest Management

Forest Service projections show a slow decline in forest acreage across the Southeast over the next several decades. The area currently in pine plantations is projected to double in this period. Natural pine forests are projected to decline by about half, and mixed stands are projected to decline by about 22 percent. Some agricultural land is being reforested under programs such as the Conservation Reserve Program.

Tips for Improving Wild Turkey Habitat

General

- Create forest stands up to 100 acres in size.
- Distribute stand ages.
- Maintain SMZ's of hardwoods.
- Establish long rotations in hardwoods (60 to 90+ years).
- Thin timber frequently during rotation.

Prescribed Burning

- Burn frequently (3 to 5 years) to encourage herbaceous growth.
- Limit burns to winter months.

Regeneration

- Keep mixed stands when possible.
- Regenerate pine types by clearcut or seed tree methods.
- Encourage up to 50 percent of hardwood types as hard mast species.
- Do not change bottomland hardwoods to conifers.
- Keep roost trees and cypress ponds.

Direct Habitat Improvements

- Provide openings planted with clover.
- Eliminate fall tillage of crops and leave some grain unharvested.
- Avoid nesting and brooding areas from March through June.

Pine Plantations

As pine plantation acreage increases in Mississippi, more intensive management will be required to maintain diverse turkey habitats. Rotation length should be 40 to 60 years, if it's economical. Harvest cut areas should be kept as small as possible (10 to 100 acres), with age class dispersion of unharvested, adjacent stands of at least 5 to 7 years. Shapes of clearcuts should provide edges for turkeys to nest along - but not so they will encourage predators to build their nests.

Stream-side management zones (SMZs) should be marked before harvest and treated as separate, unburned, manageable stands from harvested pine plantations. If possible, keep at least 15 percent of the pine plantation area in SMZs. They can be particularly important to turkeys for travel areas, roosting sites, and for mast and other food source production not normally found in plantations. Protecting islands of mast-producing trees in clearcut areas can provide more food sources. You should do prescribed burning in stands as early as possible and, preferably, do patchy winter burns on a 3- to 5-year rotation after plantations are 10 years old. Burning improves taste and nutrition of understory plants, stimulates some types of fruit production, and maintains open understories. You should do commercial thinning at least twice during the rotation of a stand, and, if affordable, protect volunteer hardwoods that provide food within plantations.

Mixed Upland Pine-Hardwood Forests

You should keep mixed stands as natural stands where feasible. In harvesting operations, maintain a good mix of hardwoods and pines of mast/fruit-producing age. You can do thinning, seed tree or shelterwood regeneration cuts, and burning to promote mast production and maintain needed herbs and shrubs in the understory. Protect mid-story species such as flowering dogwood and other fruit producers.

Bottomland Hardwood Forests

Bottomland stands can produce lots of hard mast in one year. Maintain bottomland hardwoods in a vigorous state to take advantage of the potential during these good mast-production years. Rotation lengths of 60 to 90+ years should provide adequate age distribution of healthy mast-producing trees. Frequent, selective improvement harvests, thinnings, and group select cuts provide needed timber harvest while maintaining turkey habitats. Keep fire out of bottomland stands. Keep roost trees that are next to water sources as well as SMZs along bayous, sloughs, and minor and major creeks and rivers.

In general, all timber management operations should include erosion control and site restoration work, where you replant disturbed areas with species such as clover, bahia grass, wheat, or others that may provide feeding, nesting, or brood-rearing cover.

Wild Turkey Foods by Habitat Type

Habitat	Foods		
Openings	Grass/Seeds Paspalums Panicums Legumes	Forage Clovers Grasses Sedges	Insects Grasshoppers Millipedes Insect Larvae
Moist Bottomland	Snails	Insects	Worms
Pine Plantations	Grasses, legumes, seeds	Herbaceous green forage	Insects, soft mast, pine seed
Mixed Pine/Hardwood Stands	Soft Mast Dogwood Blackberries Huckleberries Blackgum Spice Bush	Grapes Dewberries Blackhaw Cherries	Seeds Longleaf Pine Sweetgum Magnolia
Mature Hardwood	Acorns	Hard Mast Beechnuts	Pecans

Revised by **Dr. Ben West**, Assistant Extension Professor, Department of Wildlife and Fisheries.

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Waterfowl

WOOD DUCKS IN MISSISSIPPI

Wood ducks are one of three migratory waterfowl that nest regularly in Mississippi. Unlike most other ducks, they build nests in hollow trees. They often perch in trees, and they are one of the most beautiful and colorful birds in North America. Along with the mallard, wood ducks are some of the most abundant ducks in Mississippi, and they make up a large percentage of waterfowl bagged in Mississippi each year. They also are excellent table fare.

Description and Identification

The male “woodie” is easily recognized by his white throat and chin strap and his bright green and purple feathers. The female, like most female ducks, is brownish; she has a white throat patch and a prominent, white eye-ring. Male and female wood ducks have well-defined head crests and long, dark, square tails that are marks of identification in flight. Woodies increase from 1 ounce to 1 pound in 6 weeks and generally weigh about 1½ pounds when mature.

They are known as “the bird of the shadows” because of the heavy cover they require. Their large eyes allow them to see better than most other birds.

Habitat

Wood ducks require several types of habitat including nesting, rearing, and feeding. They normally nest in natural cavities, usually within one-half mile of a suitable water area. The closer the nest is to water the better, but the nest may be as far as 4 to 5 miles from where the female normally feeds and rests.

Suitable nest cavities, at a minimum, must provide room for the hen to incubate her eggs easily. The cavity entrance can vary from 5 to 70 feet above the ground.

Good brood-rearing habitat may consist of water, heavy vegetation, and low-hanging bushes. This combination produces an abundance of insects and vegetable matter to feed the ducklings. It also provides protective cover for young ducklings.

Feeding areas vary from flooded bottomland hardwoods with acorns and other hard-mast production to marshy areas that provide native aquatic and semi-aquatic vegetation and seed production.

Life History

Although wood ducks prefer nesting in cavities near an isolated lake or stream in wooded areas, they will readily nest in man-made boxes. These artificial nesting boxes and protection from over-harvest are main factors contributing to population increases.

The female wood duck does not build a nest but nests atop decayed wood in the bottom of the cavity. She lays one egg each day, usually in the early morning. When she leaves her nest, she covers the eggs with the loose material in the bottom of the nest. Later in the egg-laying cycle, she adds down plucked from her breast to the nest each day until she has finished laying.

Generally, she lays 5 to 19 small, round, dull-white eggs. The average number is 15; however, as many as 70 eggs, several layers deep, have been found in the nests of wood ducks. The large number of eggs occurs when more than one female lays in the same nest. This is called a “dump”

nest and is the result of having more breeding birds than nesting cavities. The eggs hatch in 27 to 30 days; some 24 hours after hatching, the female calls to her young from the ground. The downy young ducks use their sharp claws and hooked nail at the tip of the bill to climb out of the nest, and then they jump to the ground or water. The nestlings are so light they literally float to the surface without being injured. The female gathers her brood together and leads them to the nearest water. They remain with her until they can fly, which is about 8 weeks later.

In Mississippi nesting starts in February and continues until it peaks in April or May. Much of the late nesting is caused by re-nesting females whose nests are destroyed by predators.

Molt

The male wood duck leaves the female before the eggs hatch and joins other males in secluded areas. Wood ducks lose their flight feathers (cannot fly) and are quiet and inactive during the molt so as not to attract predators.

Food

The main diet of young ducks is insects. Adult wood ducks are primarily vegetarians, although they eat some insects. Foods for adult woodies include dogwood, acorns, button bush, coontail, duckweed, lotus, pondweed, swamp privet, water lily, and wild rice. Animal foods include a diversity of aquatic invertebrates.

Predators

Raccoons, snakes, and opossums eat wood duck eggs. Starling and woodpeckers puncture the eggs, and squirrels crack them. Raccoons and bobcats are probably the worst enemies because they often trap and kill the female wood duck on the nest. If the female is not killed, she will nest in another location. If a nest is not molested, the same bird will come back and use the cavity year after year. Snakes, mink, raccoons, turtles, owls, hawks, herons, and fish (for example, bass, gar) prey on young ducks. Inclement weather also takes its toll.

Management

When duck food is scarce, plant brown-top and Japanese millet on exposed mud flats, beaver ponds, sloughs, or farm ponds and fields. Flood the area to attract wood ducks and other waterfowl species.

One of the best ways to boost the number of wood ducks is to provide adequate nesting sites protected from predators. Build nesting boxes properly shielded against predators, as described in the drawings. It is critical to the protection of the nest box that you construct predator shields as shown; install nest boxes properly in selected locations. Place boxes in or near water at a level at least 5 feet above the water line; avoid locations where flooding could cover boxes. Ongoing research may ultimately reveal the most suitable sites for nest box placement.

Revised and distributed in Mississippi by Dean Stewart, Extension Wildlife Specialist
Information Sheet 643

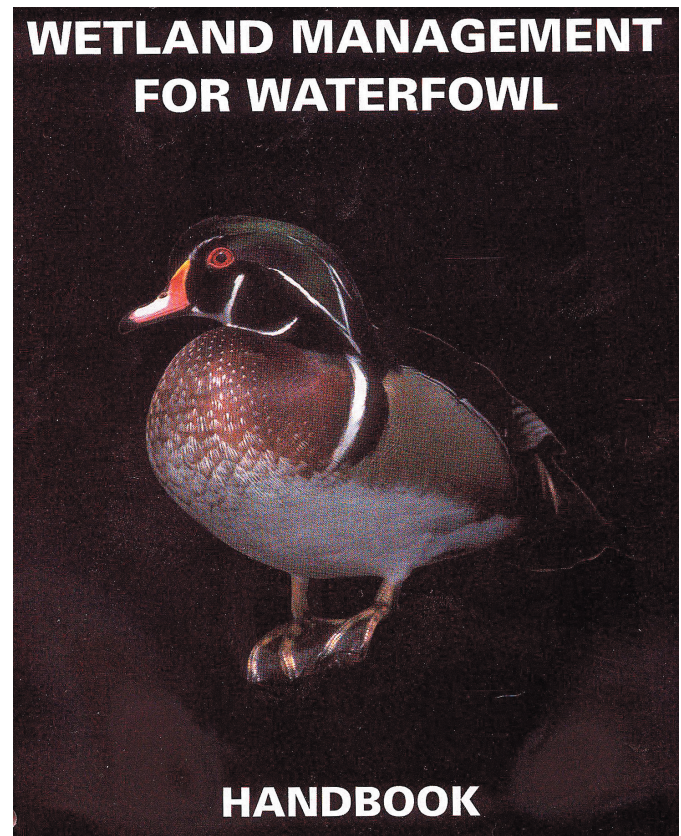
Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture.
Published in furtherance of Acts of Congress, May 8 and June 30, 1914. Ronald A. Brown, Director

Wetland Management for Waterfowl Handbook

This handbook, produced by the Natural Resources Conservation Service, Mississippi Fish and Wildlife Foundation, U.S. Fish and Wildlife Service, Ducks Unlimited, and Delta Wildlife, contains detailed information on wetland management. Topics include: wetland types common to the Lower Mississippi Alluvial Valley, Waterbird migration season overview, Wetland management strategies for food and habitat, other waterfowl foods, life history and wetland management for wood ducks, wetland plan identification guide, and a moist-soil data sheet.

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13.4.6. Strategies for Water Level Manipulations in Moist-soil Systems



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Water level manipulations are one of the most effective tools in wetland management, provided fluctuations are well-timed and controlled. Manipulations are most effective on sites with (1) a dependable water supply, (2) an elevation gradient that permits complete water coverage at desired depths over a majority of the site, and (3) the proper type of water control structures that enable water to be supplied, distributed, and discharged effectively at desired rates. The size and location of structures are important, but timing, speed, and duration of drawdowns and flooding also have important effects on plant composition, plant production, and avian use. When optimum conditions are not present, effective moist-soil management is still possible, but limitations must be recognized. Such situations present special problems and require particularly astute and timely water level manipulations. For example, sometimes complete drainage is not possible, yet water is usually available for fall flooding. In such situations, management can capitalize on evapotranspiration during most growing seasons to promote the germination of valuable moist-soil plants.

Timing of Drawdowns

Drawdowns often are described in general terms such as early, midseason, or late. Obviously, calendar dates for a drawdown classed as early differ with both latitude and altitude. Thus the terms early, midseason, and late should be considered within the context of the length of the local growing season. Information on frost-free days or the average length of the growing season usually is available from agricultural extension specialists. Horticulturists often use maps depicting different zones of growing conditions (Fig. 1). Although not specifically developed for wetland management, these maps provide general guidelines for estimating an average growing season at a particular site.

In portions of the United States that have a growing season longer than 160 days, drawdowns normally are described as early, midseason, or late. In contrast, when the growing season is shorter than 140 days, drawdown dates are better described as either early or late. Early drawdowns are those that occur during the first 45 days of the growing season, whereas late drawdowns occur in the latter 90 days of the growing season. For example, the growing season extends from mid-April to late October (200 days) in southeastern Missouri. In this area, early drawdowns occur until 15 May, midseason drawdowns occur between 15 May and 1 July, and late drawdowns occur after 1 July (Table 1). The

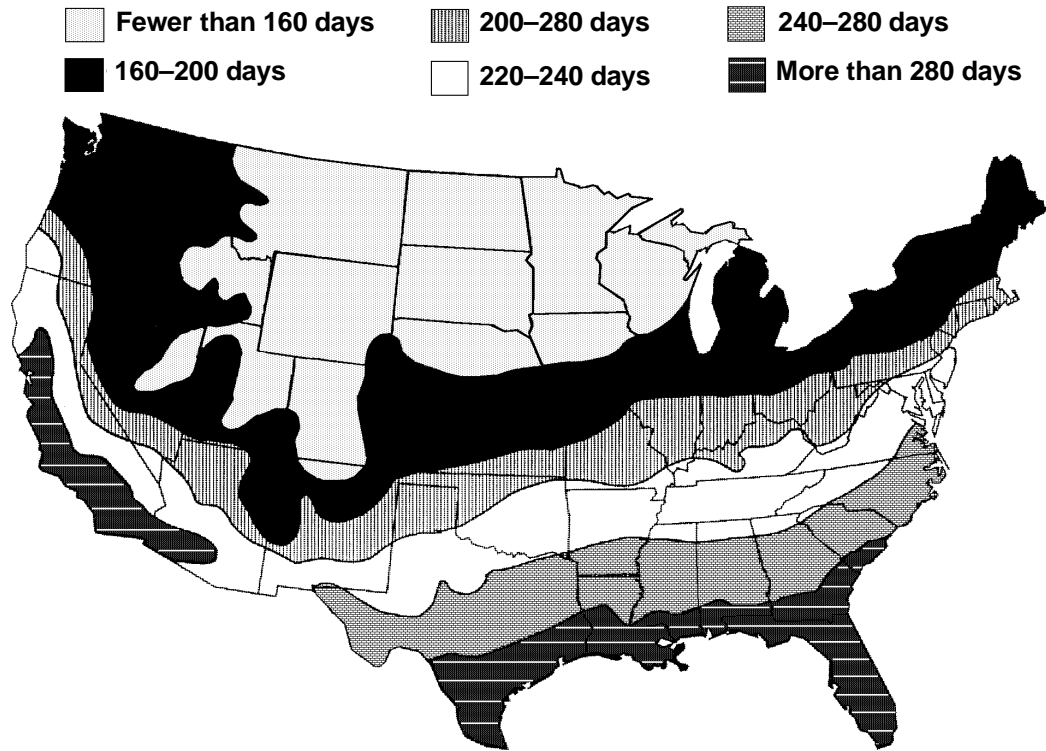


Fig. 1. Zones depicting general differences in the length of the growing season.

correct terminology for drawdown date can be determined for each area using these rules of thumb.

Moist-soil Vegetation

The timing of a drawdown has an important influence on the composition and production of moist-soil plants. Although the importance of specific factors resulting in these differences has not been well studied for moist-soil vegetation, factors such as seed banks, soil types, soil temperatures, soil moisture levels, soil-water salinities, day length, and residual herbicides undoubtedly influence the composition of developing vegetation.

Water manipulations will be effective and economical only if the site has been properly designed and developed (Table 2). Levees, type and dependability of water source (e.g., ground water,

river, reservoir), type and placement of water control structures, water supply and drainage systems, and landform are among the most important elements that must be considered. Independent control and timing of water supply, distribution, depth, and discharge within and among units are essential (Table 2).

An independent water supply for each unit is required to optimize food production, maintain the potential to control problem vegetation, and make food resources available for wildlife (Table 2). Optimum management also requires that each unit have the capability of independent discharge. Stoplog water control structures that permit water level manipulations as small as 2 inches provide a level of fine tuning that facilitates control of problem vegetation or enhancement of desirable vegetation.

Table 1. *Environmental conditions associated with time of drawdown in southeastern Missouri.*

	Date	Temperature	Rainfall	Evapotranspiration
Early	1 April-15 May	Moderate	High	Low
Mid	15 May-1 July	Moderate-High	Moderate	Moderate
Late	1 July or later	High	Low	High

Table 2. *Important considerations in evaluating wetland management potential.*

Factors	Optimum condition
Water supply	Independent supply into each unit Water supply enters at highest elevation
Water discharge	Independent discharge from each unit Discharge at lowest elevation for complete drainage Floor of control structure set at correct elevation for complete drainage
Water control	Stoplog structure allowing 2-inch changes in water levels Adequate capacity to handle storm events
Optimum unit size	5 to 100 acres
Optimum number of units	At least 5 within a 10-mile radius of units

Wetland systems with high salinities can easily accumulate soil salts that affect plant vigor and species composition. Wetland unit configurations that allow flushing of salts by flowing sheet water across the gradient of a unit are essential in such areas. A fully functional discharge system is a necessity in arid environments to move water with high levels of dissolved salts away from intensively managed basins. Thus, successful management in arid environments requires units with an independent water supply and independent discharge as well as precise water-level control.

Scheduling Drawdowns

During most years, early and midseason drawdowns result in the greatest quantity of seeds produced (Table 3). However, there are exceptions, and in some cases, late drawdowns are very successful in stimulating seed production.

Table 3. *Response of common moist-soil plants to drawdown date.*

Family	Common name	Species Scientific name	Drawdown date		
			Early ^a	Midseason ^b	Late ^c
Grass	Swamp timothy	<i>Heleochoa schoenoides</i>	+ ^d	+++	+
	Rice cutgrass	<i>Leersia oryzoides</i>	+++	+	
	Sprangletop	<i>Leptochloa</i> sp.		+	+++
	Crabgrass	<i>Digitaria</i> sp.		+++	+++
	Panic grass	<i>Panicum</i> sp.		+++	++
	Wild millet	<i>Echinochloa crusgalli</i> var. <i>frumentacea</i>	+++	+	+
	Wild millet	<i>Echinochloa walteri</i>	+	+++	++
	Wild millet	<i>Echinochloa muricata</i>	+	+++	+
Sedge	Red-rooted sedge	<i>Cyperus erythrorhizos</i>		++	
	Chufa	<i>Cyperus esculentus</i>	+++	+	
	Spikerush	<i>Eleocharis</i> spp.	+++	+	+
Buckwheat	Pennsylvania smartweed	<i>Polygonum pennsylvanicum</i>	+++		
	Curlytop ladysthumb	<i>Polygonum lapathifolium</i>	+++		
	Dock	<i>Rumex</i> spp.		+++	+
Pea	Sweetclover	<i>Melilotus</i> sp.	+++		
	Sesbania	<i>Sesbania exalta</i>	+	++	
Composite	Cocklebur	<i>Xanthium strumarium</i>	++	+++	++
	Beggarticks	<i>Bidens</i> spp.	+	+++	+++
	Aster	<i>Aster</i> spp.	+++	++	+
Loosestrife	Purple loosestrife	<i>Lythrum salicaria</i>	++	++	+
	Toothcup	<i>Ammania coccinea</i>	+	++	++
Morning glory	Morning glory	<i>Ipomoea</i> spp.	++	++	
Goosefoot	Fat hen	<i>Atriplex</i> spp.	+++	++	

^a Drawdown completed within the first 45 days of the growing season.

^b Drawdown after first 45 days of growing season and before 1 July.

^c Drawdown after 1 July.

^d + = fair response; ++ = moderate response; +++ = excellent response.

In areas characterized by summer droughts, early drawdowns often result in good germination and newly established plants have time to establish adequate root systems before dry summer weather predominates. As a result, early drawdowns minimize plant mortality during the dry period. Growth is often slowed or halted during summer, but when typical late growing-season rains occur, plants often respond with renewed growth and good seed production. In contrast, midseason drawdowns conducted under similar environmental conditions often result in good germination, but poor root establishment. The ultimate result is high plant mortality or permanent stunting. If the capability for irrigation exists, the potential for good seed production following midseason or late drawdowns is enhanced.

Germination of each species or group of species is dependent on certain environmental conditions including soil temperature and moisture. These conditions change constantly and determine the timing and density of germination (Table 3). Smartweeds tend to respond best to early drawdowns, whereas sprangletop response is best following late drawdowns. Some species are capable of germination under a rather wide range of environmental conditions; thus, control of their establishment can be difficult. Classification of an entire genera into a certain germination response category often is misleading and inappropriate. For

example, variation exists among members of the millet group (*Echinochloa* spp.). *Echinochloa frumentacea* germinates early, whereas *E. muricata* germinates late because of differences in soil temperature requirements. Such variation among members of the same genus indicates the need to identify plants to the species level.

Natural systems have flooding regimes that differ among seasons and years. Repetitive manipulations scheduled for specific calendar dates year after year often are associated with declining productivity. Management assuring good production over many years requires variability in drawdown and flooding dates among years. See *Fish and Wildlife Leaflet 13.2.1* for an example of how drawdown dates might be varied among years.

Wildlife Use

Drawdowns serve as an important tool to attract a diversity of foraging birds to sites with abundant food resources. Drawdowns increase food availability by concentrating foods in smaller areas and at water depths within the foraging range of target wildlife. A general pattern commonly associated with drawdowns is an initial use by species adapted to exploiting resources in deeper water. As dewatering continues, these "deep water" species are gradually replaced by those that are adapted to exploit foods in

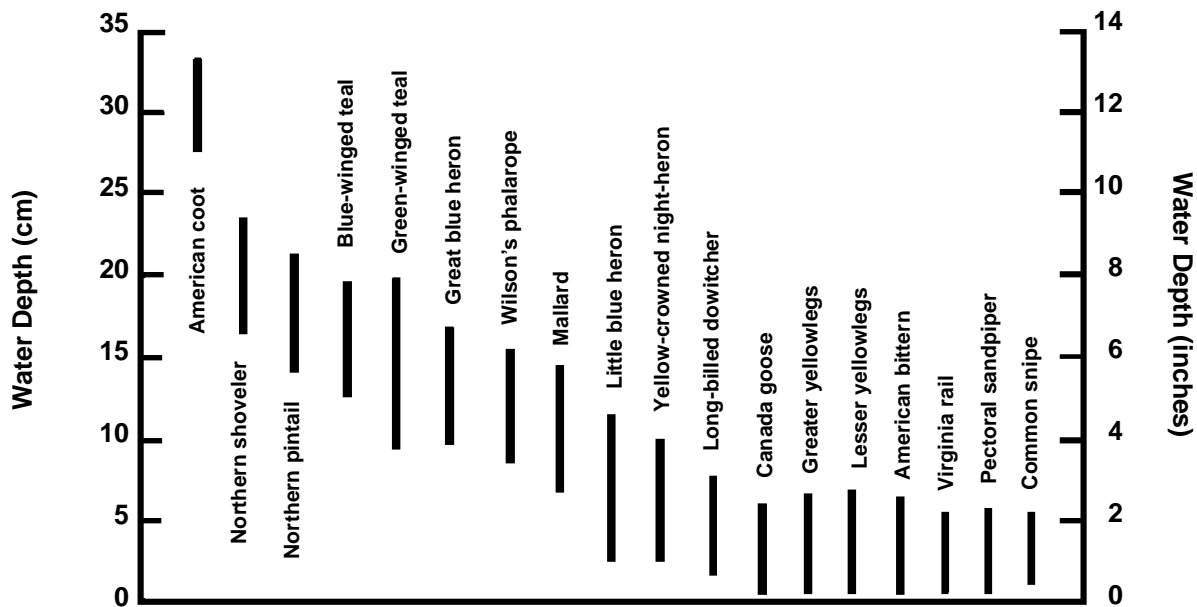


Fig. 2. Preferred water depths for wetland birds commonly associated with moist-soil habitats.

shallower water (Fig. 2). The most effective use of invertebrate foods by wetland birds occurs when drawdowns to promote plant growth are scheduled to match key periods of migratory movement in spring. By varying drawdown dates among units, the productivity of each unit can be maintained and resources can be provided for longer periods. Slow drawdowns also prolong use by a greater number and diversity of wetland wildlife.

Effects of Drawdown Rate

Moist-soil Plant Production

Fast Drawdowns

Sometimes fast drawdowns (1–3 days) are warranted, especially in systems with brackish or saline waters where the slow removal of water may increase the level of soil salts. However, in most locations fast drawdowns should only be scheduled early in the season or when flood irrigation is possible. Rapid drawdowns that coincide with conditions of high temperature and little rainfall during the growing season create soil moisture conditions that often result in poor moist-soil responses (Table 4). Some germination may occur, but generally development of root systems is inadequate to assure that these newly established plants survive during summer drought. Thus, at latitudes south of St. Louis, fast drawdowns are never recommended after 15 June if irrigation is not possible.

Slow Drawdowns

Slow drawdowns (2–3 weeks) usually are more desirable for plant establishment and wildlife use. The prolonged period of soil saturation associated with slow drawdowns creates conditions favorable for moist-soil plant germination and establishment (Table 4). For example, slow drawdowns late in the growing season can result in seed yields of 700 pounds per acre. Rapid drawdowns on adjacent units subject to identical weather conditions have resulted in 50 pounds per acre. Furthermore, slow drawdowns provide shallow water over a longer period, ensuring optimum foraging conditions for wildlife. If salinities tend to be high, slow drawdowns should only be scheduled during winter or early in the season when ambient temperatures and evapotranspiration are low.

Table 4. Comparison of plant, invertebrate, bird, and abiotic responses to rate and date of drawdown among wet and dry years.

	Drawdown rate	
	Fast ^a	Slow ^b
Plants		
Germination		
Period of ideal conditions	short	long
Root development		
Wet year	good	excellent
Dry year	poor	excellent
Seed production		
Early season	good	excellent
Mid-late season	not recommended	excellent
Wet year	good	good
Drought year	poor	good
Cocklebur production	great potential	reduced potential
Invertebrates		
Availability		
Early season	good	excellent
Mid-late season	poor	good
Period of availability	short	long
Bird use		
Early season	good	excellent
Mid-late season	poor	good
Nutrient export	high	low
Reducing soil salinities	good	poor

^a Less than 4 days.

^b Greater than 2 weeks.

Invertebrate Availability in Relation to Drawdowns

When water is discharged slowly from a unit, invertebrates are trapped and become readily available to foraging birds along the soil–water interface or in shallow water zones (Table 4). These invertebrates provide the critical protein-rich food resources required by pre-breeding and breeding female ducks, newly hatched waterfowl, molting ducks, and shorebirds. Shallow water for foraging is required by the vast majority of species; e.g., only 5 of 54 species that commonly use moist-soil impoundments in Missouri can forage effectively in water greater than 10 inches. Slow drawdowns lengthen the period for optimum foraging and put a large portion of the invertebrates within the foraging ranges of many species. See *Fish and Wildlife Leaflet 13.3.3* for a description of common invertebrates in wetlands.

Spring Habitat Use by Birds

Slow drawdowns are always recommended to enhance the duration and diversity of bird use (Table 4). Creating a situation in which the optimum foraging depths are available for the longest period provides for the efficient use of food resources, particularly invertebrate resources supplying proteinaceous foods. Partial drawdowns well in advance of the growing season (late winter) tend to benefit early migrating waterfowl, especially mallards and pintails. Early-spring to mid-spring drawdowns provide resources for late

migrants such as shovelers, teals, rails, and bitterns. Mid- and late-season drawdowns provide food for breeding waders and waterfowl broods. These later drawdowns should be timed to coincide with the peak hatch of water birds and should continue during the early growth of nestlings or early brood development.

Fall Flooding Strategies

Scheduling fall flooding should coincide with the arrival times and population size of fall migrants (Table 5). Sites with a severe disease history should not be flooded until temperatures

Table 5. *Water level scenario for target species on three moist-soil impoundments and associated waterbird response.*

Period	Unit A		Unit B		Unit C	
	Scenario	Water level Response	Scenario	Water level Response	Scenario	Water level Response
Early fall	Dry	None	Dry	None	Gradual flooding starting 15 days before the peak of early fall migrants; water depth never over 4 inches	Good use immediately; high use by teal, pintails, and rails within 2 weeks
Mid fall	Dry	None	Flood in weekly 1–2-inch increments over a 4-week period	Excellent use by pintails, gadwalls, and wigeons	Continued flooding through September	Excellent use by rails and waterfowl
Late fall	Flood in weekly 2–4-inch increments over a 4–6-week period	Excellent use immediately by mallards and Canada geese	Continued flooding, but not to full functional capacity	Excellent use by mallards and Canada geese	Continued flooding to full functional capacity	Good use by mallards and Canada geese
Winter	Maintain flooding below full functional capacity	Good use by mallards and Canada geese when water is ice free	Maintain flooding below full functional capacity	Good use by mallards and Canada geese when water is ice free	Continued flooding to full pool	Good use by mallards and Canada geese when water is ice free
Late winter	Schedule slow drawdown to match northward movement of migrant waterfowl	Excellent use by mallards, pintails, wigeons, and Canada geese	Schedule slow drawdown to match northward movement of early migrating waterfowl	Excellent use by mallards, pintails, wigeons, and Canada geese	Schedule slow drawdown to match northward movement of waterfowl	Good use by mallards and Canada geese when water is ice free
Early spring	Continued slow drawdown to be completed by 1 May	Excellent use by teals, shovelers, shorebirds, and herons	Drawdown completed by 15 April	Excellent shorebird use	Drawdown completed by 15 April	Excellent shorebird use

moderate. When flooding is possible from sources other than rainfall, fall flooding should commence with shallow inundation on impoundments suited for blue-winged teals and pintails. Impoundments with mature but smaller seeds, such as panic grass and crabgrasses, that can be flooded inexpensively are ideal for these early migrating species. Flooding always should be gradual and

should maximize the area with water depths no greater than 4 inches (Fig. 3). As fall progresses, additional units should be flooded to accommodate increasing waterfowl populations or other bird groups such as rails. A reasonable rule of thumb is to have 85% of the surface area of a management complex flooded to an optimum foraging depth at the peak of fall waterfowl migration.

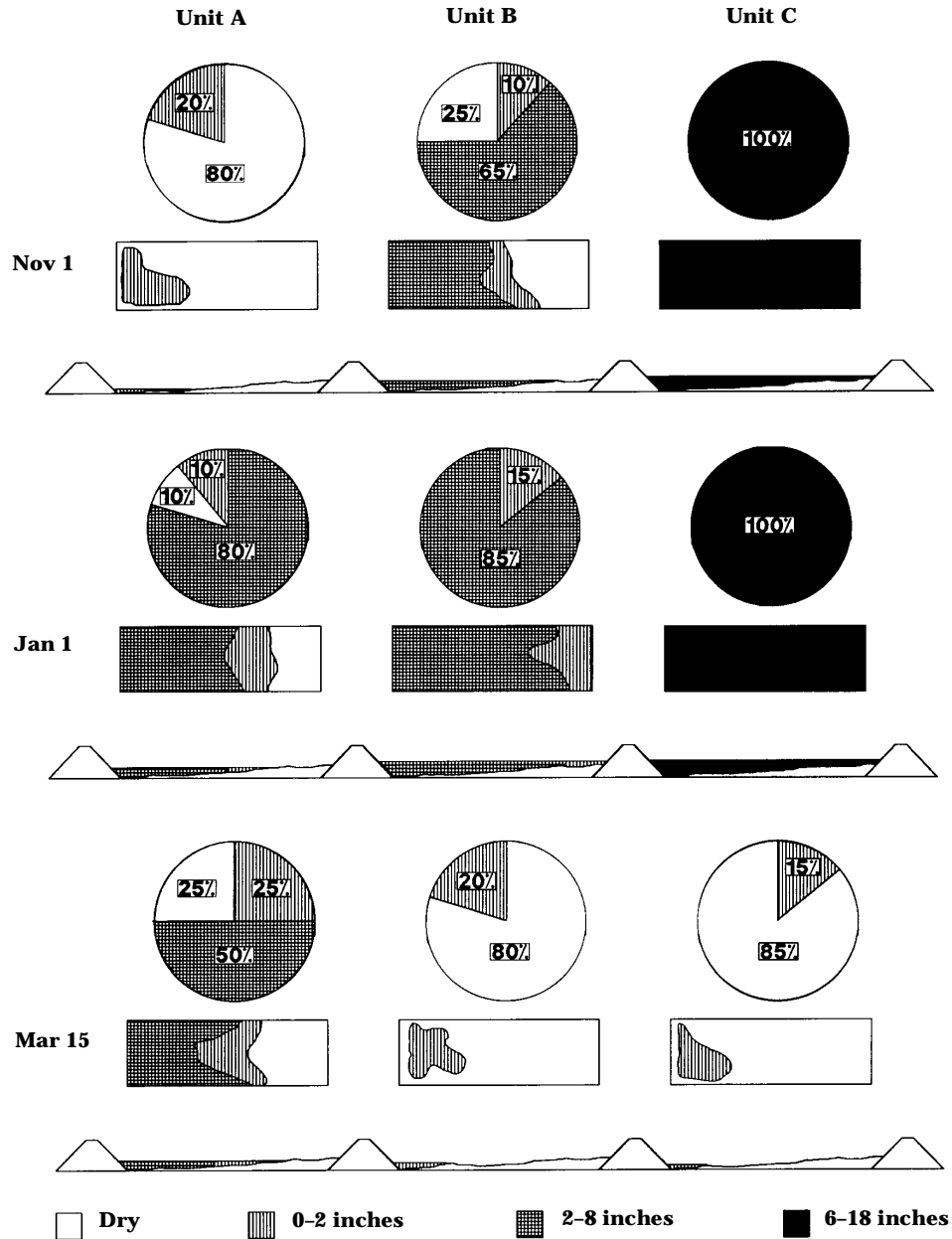


Fig. 3. Planned flooding strategies for three moist-soil units during one winter season. The initiation, depth, and duration of flooding are different for each unit. Note that two of the three units were never intentionally flooded to capacity. This does not mean that natural events would not flood the unit to capacity. Flooding strategies should be varied among years to enhance productivity.

Suggested Reading

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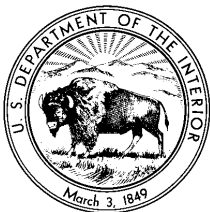
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Appendix. Common and Scientific Names of Birds Named in Text.

Pied-billed grebe	<i>Podilymbus podiceps</i>
American bittern	<i>Botaurus lentiginosus</i>
Great blue heron	<i>Ardea herodias</i>
Little blue heron	<i>Egretta caerulea</i>
Yellow-crowned night-heron	<i>Nycticorax violaceus</i>
Tundra swan	<i>Cygnus columbianus</i>
Snow goose	<i>Chen caerulescens</i>
Canada goose	<i>Branta canadensis</i>
Mallard	<i>Anas platyrhynchos</i>
Northern pintail	<i>Anas acuta</i>
Northern shoveler	<i>Anas clypeata</i>
Blue-winged teal	<i>Anas discors</i>
Canvasback	<i>Aythya valisineria</i>
Virginia rail	<i>Rallus limicola</i>
American coot	<i>Fulica americana</i>
Greater yellowlegs	<i>Tringa melanoleuca</i>
Lesser yellowlegs	<i>Tringa flavipes</i>
Pectoral sandpiper	<i>Calidris melanotos</i>
Long-billed dowitcher	<i>Limnodromus scolopaceus</i>
Wilson's phalarope	<i>Phalaropus tricolor</i>
Common snipe	<i>Capella gallinago</i>



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 FISH AND WILDLIFE SERVICE
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Build a duck nest box

Wood ducks, Barrow's goldeneyes, common goldeneyes, hooded mergansers, common mergansers and buffleheads are all cavity nesting ducks. They build nests in abandoned woodpecker holes or natural tree cavities caused by disease, fire or lightning. These ducks will also use a constructed nesting box. Here are plans for a nest box that you can build, install and maintain. The design, which is used by the Ducks Unlimited Greenwing program, may even attract other cavity nesting birds such as kestrels, tree swallows, great crested flycatchers or screech owls.

Cedar is ideal*

Cedar lumber is recommended because it is naturally resistant to weather and insects. You can also use any materials you have available such as pine or plywood. The box pictured uses 10.5 linear feet of 1" X 10" (3/4" thick by 9 1/4" wide) lumber that is rough on one side (for the inside of the box). *Ducks Unlimited staff in the interior of British Columbia indicate that plywood boxes better withstand the region's temperature extremes.

Finishing touches

Ducks Unlimited does not recommend applying a finish to cedar boxes. A finish might help to extend the life of a plywood box.

If you decide to apply a finish to your nest box, use a nontoxic wood preserver or a light shade of an earth tone paint. The ducks will find your box by seeing the contrast in color caused by the entry hole. Do not apply finish inside the box.

Cavity nesting ducks do not carry nesting materials. It's important to help them out by placing four to six inches of wood shavings in the bottom of the box. You can find wood shavings at your local pet or farm supply store. **Do not use sawdust.** It can suffocate ducklings.

Every year, in the fall after the nesting season has completed or in the winter, clean out old nesting material from the box and replace it with a fresh layer of wood shavings. **This annual cleaning needs to be a part of your long-term maintenance commitment once you place your nest box.**



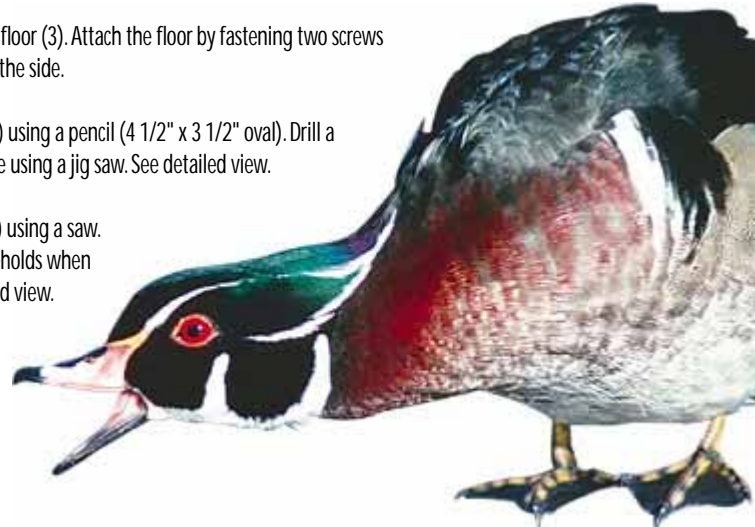
Constructing and placing a nest box is a fun project that brings years of enjoyment. Above: this pole mounted nest box features a conical metal predator guard. Below: wood duck drake.

PROCEDURE

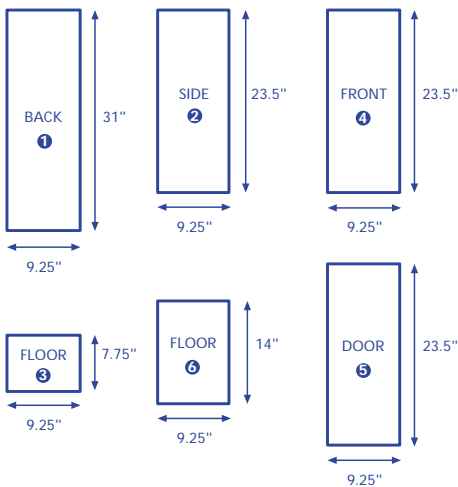
Tools needed: handsaw or table saw, drill and 1/2" bit, jigsaw, screwdriver, sandpaper, pencil, measuring tape, straight-edge

- 1) Measure and cut your wood to produce the six pieces. Number the pieces as shown. See material measurements.
- 2) Attach the back (1) to the side (2) using four screws fastened from the back of the box. See exploded view (next page).
- 3) Drill five 1/2" drainage holes in the floor (3). Attach the floor by fastening two screws through the back and two through the side.
- 4) Draw the entry hole on the front (4) using a pencil (4 1/2" x 3 1/2" oval). Drill a pilot hole and cut out the entry hole using a jig saw. See detailed view.
- 5) Score the inside face of the front (4) using a saw. The horizontal slots will provide toeholds when the ducklings climb out. See detailed view.

continued...



MATERIAL MEASUREMENTS - not to scale



Finding the right place

Now that you've completed construction of your nest box, you need to consider where to install it. Be sure to place the box in a location that will be convenient for monitoring and annual maintenance.

Where to find tenants

To increase the chances of your nest box being used by waterfowl, it should be located in an area attractive to cavity nesting ducks. You'll see these birds using wooded wetlands that contain water year round or, at least, throughout the summer. You'll also see them using trees along riverbanks and lake shorelines.

Positioning your nest box

Nest boxes can be mounted on tree trunks or on steel poles beside the water or above the water.

Good placement a dead tree at the water's edge

Better placement a solid dead tree in the water

Best placement boxes on poles near standing, flooded, dead trees

Live trees can be used for mounting boxes, but keep a close eye on your box. Growing trees may loosen mounts and make boxes less attractive to the birds.

Tree Trunks

Live and dead trees are suitable. If beavers are about, don't place nest boxes on poplar or white birch trees. Beavers eat these trees.

Steel Poles

Make sure the poles are fixed solidly in the soil, or marsh bottom, to ensure that the nest boxes are stable. Drill two holes in this pole to accommodate a predator guard (see below).

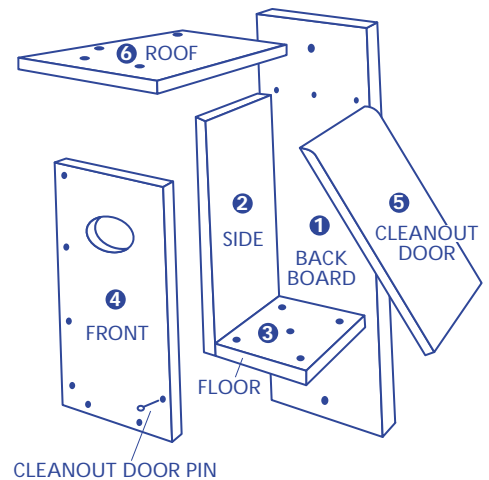
- Boxes should be placed above typical high water levels and at a height that will allow you to access the box for monitoring and maintenance (about 4 to 6 feet above land or water). In terms of distance inland, try to keep your box close to the water.
- Clear an unobstructed flight path to your nest box by removing branches that might be in the way.
- The entrance hole to the box should face the water.
- You can tip the box forward a little bit to help the ducklings reach the entrance.



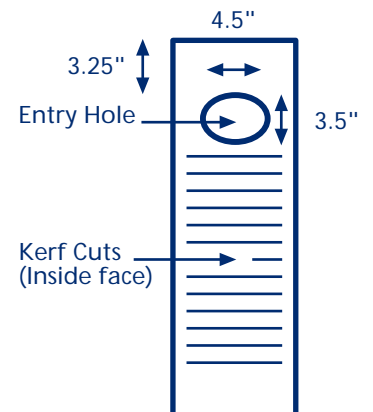
PROCEDURE (continued)

- 6) Attach the front (4) using six screws.
- 7) Round the top, outside edge of the door (5). See exploded view. Fasten the door at the top with one screw from the front and one from the back. The two screws form the hinge and allow the door to open. Pin the door shut with a nail from the front.
- 8) Attach the roof (6) using four screws from the top and three screws from the back (be careful not to screw into the door). The box is now ready to install. Don't forget to put a 4-6 inch layer of wood shavings in the box for nesting material.

EXPLODED VIEW - not to scale



DETAILED FRONT VIEW not to scale



Predator Guards

A predator guard will help to improve the chance of a successful hatch by preventing egg-eating raccoons from entering your nest box.

1) Steel Sheet Sandwich

36" X 49" sheet of 28 gauge steel

- Fold the sheet in half along the 49" length, creating a front and a back, each 24" wide
- Along one 36" side, make a 1" fold towards the inside centre
- Drill two holes, 34" apart (see diagram)
- Place your guard so it surrounds the pole or tree trunk. Slip the unfolded side under the 1" fold. Using vice-grips, bend the corners in to lock these pieces and prevent the guard from opening.
 - *Pole mount:* bolt the guard into place about 2" below the nest box.
 - *Tree mount:* nail the guard in place — if the tree is alive, check the guard often to ensure tree growth hasn't popped the guard off.

2) Plastic Pipe Guard

Metal or plastic pipe (stove pipe, sewer pipe) drilled at the top and bottom and bolted to the tree or pole makes an effective predator guard. To prevent small rodents from crawling through, place a crumpled piece of chicken wire between the pole and the guard.

3) Plastic "Crazy Carpet" Guard

A new use for children's inexpensive plastic snow riders located in any toy store. Wrap the carpet around the tree and tack it in place. Be sure to provide room to grow if you place this guard on a living tree.

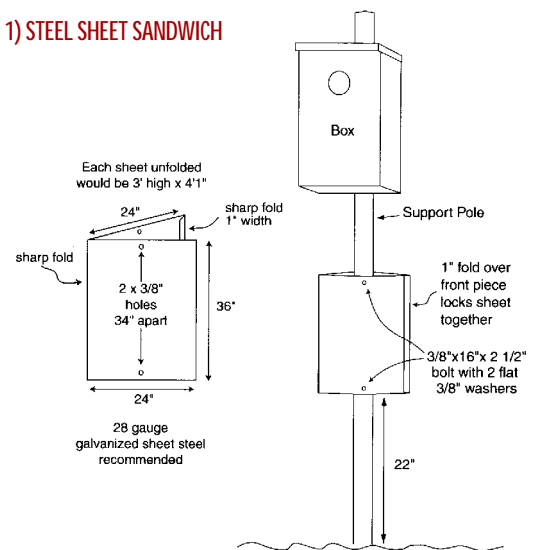
Nest box maintenance — a long-term commitment

Once a cavity nesting bird starts using your box, you'll likely see many broods raised over the years. Nesting sites for these birds are limited in number. When they find a good nesting site, there is a very good chance they'll return in following years. When you put up a nest box you are committing yourself to maintaining that box. Fall and winter are the best times to remove old nesting material, tighten any loose screws and mounts, and add new wood shavings.

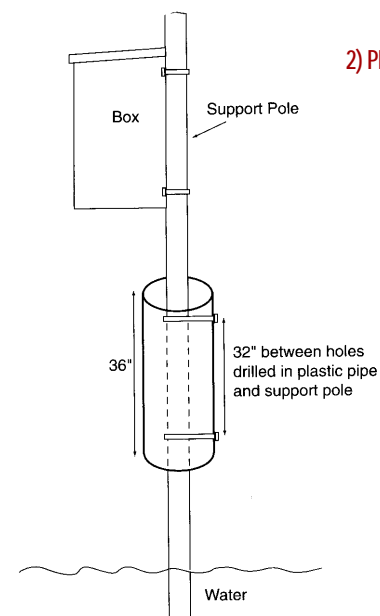
If you don't have any ducks using your box over the summer, don't worry. Waterfowl biologists have seen waterfowl migrating in the fall scope out potential nesting sites for next spring. This too is a good reason to keep your boxes in top condition. You never know when somebody might be popping in!

This information has been compiled from the *Nest Box Guide for Waterfowl* by Ducks Unlimited and the Canadian Wildlife Service, Environment Canada; and a *Conservator* article (Vol. 19, No. 3) by Mearl Rooney.

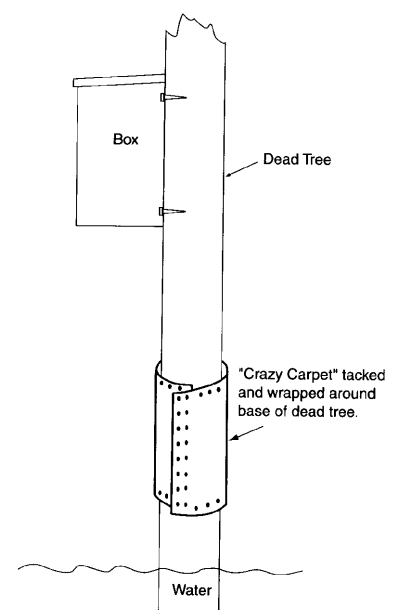
1) STEEL SHEET SANDWICH



2) PLASTIC PIPE GUARD



3) CRAZY CARPET GUARD



Wetlands

Understanding Wetlands And Endangered Species: Definitions And Relationships

Imagine you are walking through the woods. Up ahead, you see a small opening surrounded by trees, shrubs, wildflowers, and grasses. The opening has standing water with small clumps of leafy vegetation scattered throughout and isolated trees standing in the water. Around this opening the ground is soggy and dark. You see a snake move silently by while a salamander watches you before darting away.

You find a stump and sit to rest. As you settle back, you begin to notice many birds flying from one tree to the next, their calls ringing in the air. You hear tree frogs and the buzz of mosquitoes at your ear. You notice crawfish mounds near the water and droppings from a raccoon and a fox. You see the footprints of several deer, and you can see minnows in the shallow water. Water lilies float on the water surface. Butterflies visit the swamp lilies and dragonflies dart through the air.

What is this place and why are there so many different plants and animals here? This place is a wetland. Wetlands provide food, cover, and nesting sites (habitat) for many different animals—many of which are becoming increasingly rare.

We all know that the whys and hows of wetlands and endangered species protection are among the more controversial and actively debated natural resource issues of our day. Many people, even those who have a great love for wildlife, have been taught that wetlands are “wastelands” which serve no purpose unless they are drained and “put to use.” My purpose here is to explain, in general terms, what wetlands and endangered species are and to discuss the relationships which often exist between the two. This explanation will emphasize the role wetlands play in providing habitat for many plants and animals and the consequences loss of wetland habitat has had on many species.



What Are Wetlands?

While the warm, fuzzy description given at the beginning of this publication helps develop a mental picture of a wetland, it leaves out the mosquito bites and humidity for which these areas are famous. In fact, wetlands have had a bad reputation, especially with early settlers who thought that “swamp vapors” caused fevers. This bad reputation and the realization that wetlands, when drained, often converted to very productive and valuable farm land were the root causes of wetland acreage losses which began in earnest in the mid-1800s.

Wetlands share some of the characteristics of both uplands and open water. Because wetlands are often located in an intermediate position between uplands and open water, many people call them transitional areas. Despite the early belief that wetlands were more valuable if converted to another use, time has proven that wetlands serve many functions which make them valuable in their natural state. Some of the valuable functions performed by wetlands are: protection of water quality, flood prevention, water storage, and wildlife habitat.

A few common types of wetlands include: fringe wetlands located along the shoreline of lakes; salt and freshwater marshes located in coastal areas; deepwater swamps and bottomland hardwood forests along rivers; and prairie potholes located in Canada and the upper midwestern states.

Three Components Of A Wetland

To be considered a jurisdictional or legal wetland, all three of the following components must be present: wetland hydrology; hydric soils; and hydrophytic vegetation.

The hydrology (the presence, abundance, and source of water) determines and maintains the structure and function of a wetland. The hydrology of a wetland also drives the formation of hydric soils.

Hydric soils are soils that are “saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part.” Anaerobic conditions develop when water displaces oxygen present within the pore spaces of a soil. Hydric soils are often gray in color and may smell like rotten

eggs. Orange-colored deposits often occur around roots growing within hydric soils. Such things as how often and how long the soils are saturated or flooded; the depth of flooding; the time of year during which the soils are saturated or flooded, and whether the water is fresh or saline determine the type of vegetation found in a wetland.

Hydrophytic vegetation literally means “water-loving” vegetation. Plants that are able to grow and reproduce in wetlands do so because of special adaptations which allow them to survive in a waterlogged environment. Many wetland plants have very spongy roots. These roots have air spaces, which are believed to allow the movement of oxygen from the leaves to the roots, thereby allowing the plant to thrive despite the anaerobic conditions present in the soil. Wetland plants may have adventitious roots (roots growing out of the trunk above the soil surface), surface roots (roots growing at or just above the soil surface), or lenticels (openings on roots and stems for oxygen exchange). The type and abundance of vegetation is an important factor in determining what types of animal species use the wetland.

Wetland Productivity

Many wetlands have very high primary productivity rates. This means that the plants growing in the wetland are very efficient at converting sunlight, water, and soil nutrients into plant tissue. Typically, the most productive wetlands are coastal wetlands and wetlands located adjacent to rivers or streams. The reason that many of these areas are so productive is related to the hydrology or movement of water which occurs within many wetlands.

Coastal wetlands flood regularly due to tidal water movement. Tidal flooding flushes the soils of coastal wetlands, removing toxins and wastes which may make the soils inhospitable to plants or burrowing animals. In addition, the regular movement of water into and out of coastal wetlands helps to re-aerate soils. This re-aeration results in more vigorous growth of wetland plants.

Wetlands adjacent to rivers flood on a fairly regular basis. This movement of water delivers nutrients, sediment, and organic matter from upland areas, creating the rich soils for which these systems are so valued.

Which Animals Inhabit Wetlands?

Not surprisingly, the fact that many wetlands are highly productive means that they are also rich in animal species. Animals are attracted to wetlands because they provide food, water, cover, and nesting sites. In short, wetlands provide many animals with homes. Many species live their entire lives in wetlands and are completely dependent on them for survival. Other species are dependent on wetlands only during a portion of their life cycle. For these species wetlands serve either as a summer home, a winter home, or an occasional feeding or resting spot.

Wetlands provide critical habitat for wildlife, and, in fact, wetlands exceed all other land types in wildlife productivity. It has been estimated that in the United States roughly 150 species of birds and more than 200 species of fish depend on wetlands for their survival.

Many birds such as the great blue heron, great egret, bald eagle, osprey, red-shouldered hawk, owls, wild turkey, belted kingfisher, red-bellied woodpecker, pileated woodpecker, and several species of swallows, sparrows, and warblers use wetlands. Ducks occupy wetlands in great numbers. Duck species include the wood duck, mallards, black ducks, blue-winged teal, gadwall, widgeon, and the northern pintail.

Mammals such as the muskrat, beaver, raccoon, and white-tailed deer also use wetlands. In addition, a wide variety of reptiles, turtles, and freshwater fish depend on wetlands for survival.

One group of animals often overlooked when the inhabitants of wetlands are considered is the invertebrate species. These small animals, which include flatworms, aquatic earthworms, leeches, crawfish, and fairy shrimp, are vital links between plants and the animal food chains. Many invertebrates graze on living plants while others consume dead organic material. The invertebrates are in turn eaten by fish, birds, frogs, toads, and turtles. So, in fact, invertebrates make energy available to animals which may consume little or no plant material.

While much remains to be learned about the many different species of invertebrates that inhabit wetlands of various types, research has shown that these species have very specific habitat requirements. What happens to these vital links when wetlands are altered or destroyed? What happens to the animals that depend on these species for some or all of their nutritional requirements? Obviously, if the flow of energy, in the form of food, from one species to another is interrupted, there will be a negative impact on both species diversity and on population size.

What Are Endangered And Threatened Species?

The Earth is rich in both animal and plant species. However, a number of species are experiencing trouble meeting their needs. Some of these species are considered “endangered” while others are considered “threatened.” Endangered species are species that, if not protected, are in imminent danger of permanently disappearing from Earth. Threatened species are species that, if not protected, are likely to become endangered in the foreseeable future. In 1973, Congress passed the Endangered Species Act with the express purpose of protecting species that were in danger of extinction.

There are many reasons why a species may face extinction, including such natural events as long-term changes in climate and worldwide sea level fluctuations. Some species are found only in small numbers in few locations which means that any change (whether natural or induced) could negatively impact them. Today, people have the ability to alter land, water, air, and climate to a degree never before seen. As a consequence, the majority of species facing extinction today do so as a result of habitat degradation or destruction caused by people. Worldwide, roughly 1,100 species have been designated as either threatened or endangered. In addition, another 3,600 have been identified as candidates for threatened or endangered status although official action has not been taken.

Why Is Wetland Habitat Threatened?

Wetland habitat degradation can result from either increased or decreased flow of water into or out of an area; decreased water quality, resulting from excess nutrients and toxic chemicals originating from faulty septic tanks; overflowing sewers; or runoff from agricultural lands or urban areas. Wetland habitat destruction results from the transformation from natural areas to agricultural fields, urban development, or plant monocultures.

Another danger facing wetland-dependent species is the fragmenting of wetlands into smaller and smaller unconnected areas. When this happens, species requiring large areas of land to survive will begin to disappear. This has been observed with the black bear in Louisiana and the Florida panther in Florida. Other animals, which might not need large ranges, may still face the problem of inbreeding or isolation from suitable reproductive partners simply because they can no longer move from one nearby wetland site to another.

Wetlands have been particularly hard-hit with both habitat degradation and destruction. In fact, roughly half of all wetlands that existed within the lower 48 states at the time of European settlement have disappeared. Some states, such as California have lost as much as 90 percent of the wetlands present 200 years ago. Alabama has lost approximately 50 percent of its original wetlands, Mississippi and Tennessee have lost roughly 59 percent, and North Carolina has lost 44 percent. Kentucky has lost 80 percent of the wetlands that were present 200 years ago. Historically, most of this loss was to agriculture. Present-day wetland loss is often associated with urban expansion, particularly in coastal areas. Conversion of bottomland hardwood forests to pine does still occur in parts of the Southeast.

How Does Wetland Loss Affect Wetland-Dependent Species?

Not surprisingly, coupled with the dramatic destruction of wetlands and degradation of remaining wetlands, there has been a marked decrease in the populations of many animal and plant species that depend on these systems for survival. At least 95 plant, 5 mammal, 22 bird, 4 reptile, 3 amphibian, and 22 fish species listed as endangered or threatened depend on wetland habitats for survival. In 1986, there were 188 species of animals listed as threatened or endangered by the federal government. Of these, roughly 50 percent were wetland related. The animal groups with the largest numbers listed as threatened or endangered are the fish, mussels, and

Federally Listed Endangered And Threatened Species Associated With Wetlands.*

	Number Of Endangered Species Associated With Wetlands	Number Of Threatened Species Associated With Wetlands	Percent Of Total Species Listed In United States
Plants	17	12	28
Animals			
Mammals	7	—	20
Birds	16	1	68
Fishes	26	6	48
Reptiles	6	1	63
Amphibians	5	1	75
Insects	1	4	38
Mussels	20	—	66
Total	98	25	

Source: Niering 1988.

*Only species listed within the United States are included here.

birds. In 1986, 103 plants were listed as threatened or endangered, and 28 percent were considered wetland dependent.

As of 1991, the U.S. Fish and Wildlife Service had listed 595 plant and animal species as threatened or endangered. Of this number, 256 (43 percent) are wetland dependent. In fact, wetlands provide fully 60 percent of all threatened species and 40 percent of all endangered species listed in 1991 with essential habitat. The table illustrates the breakdown of threatened and endangered species by taxonomic groups.

Information on many wetland-dependent plant and animal species is limited. However, data on waterfowl, which migrate from northern to southern wetlands every year, have been collected for many years. Although these species are not threatened or endangered, they have experienced significant decline in numbers. It was estimated that there were 145 million ducks migrating from Alaska, Canada, and the northern prairie states in the period just after World War II. By 1992, that number had dropped to 64 million—a 56 percent reduction. This decrease was attributed primarily to loss of habitat. Many people feel that the decrease observed in duck populations is an indication that many other wetland species are also experiencing declines.

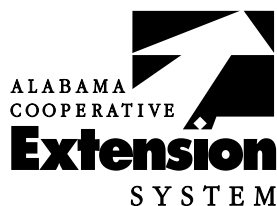
Migratory species, such as waterfowl, may require different types of wetlands at different times during the year. In 1982 it was estimated that 80 percent of the American breeding bird population and more than 50 percent of the 800 species of protected migratory birds relied on wetlands. This means that impacts on wetlands in one part of the United States, Canada, Mexico, or South America may adversely impact the numbers and species composition of migratory birds. This fact complicates attempts to protect wetland-dependent species because decisions affecting migratory birds must be made not only across state boundaries, but across countries and in some cases continents.

Conclusion

As you can see, wetlands are valuable real estate to many plants and animals. The next time you discuss the issues of wetlands and endangered species I hope the information provided here will help you have a better understanding of how these two issues are related. Hopefully I've helped you to a better understanding of the value of wetlands and how many animal and plant species depend on them for survival. Unless we all begin to understand this relationship, you can expect to hear more and more about endangered species at the same time that you hear about wetland loss.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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White-tailed Deer

White-Tailed Deer Management

White-tailed deer are found in all 67 Alabama counties. In fact, huntable populations of deer thrive close to all major metropolitan areas of the state. Deer hunting pumps millions of dollars into Alabama's economy each year, and recreational demand for deer hunting is growing rapidly.

Increasing numbers of landowners in Alabama are realizing the potential income from leasing their land to deer hunters. Others have capitalized on this demand by opening commercial hunting operations.

Considering their present abundance and the accounts of early explorers to Alabama, it's hard to imagine that deer were once nearly eliminated from the state. Fewer than 10,000 deer, restricted largely to isolated river bottoms of southwestern counties, existed in Alabama during the early 1900s.

Protection, favorable land-use changes, and restocking deer in suitable habitat allowed populations to respond dramatically. Alabama's herd now numbers in excess of 1 million deer.

Physical Characteristics

The long necks of white-tailed deer and the antlers of mature males give the appearance of an animal of considerable size, but deer seldom stand taller than 40 inches at the shoulder. In fact, most measure less than 36 inches tall.

Size and weight vary according to sex, age, nutrition, and genetic composition. Adult bucks may weigh from 65 to more than 200 pounds. Does generally weigh about two-thirds as much as bucks.

Deer have a keen sense of smell. They rely upon smell to detect danger, identify other animals, and locate food. Deer have large, cupped ears that can rotate, giving them an acute sense of hearing. Their eyesight, though not as well developed as other senses, readily detects movement over a wide field of vision.

Deer, like cows, have compound, four-chambered stomachs that allow digestion of plant materials. Initially, food enters the first chamber or *rumen*. From there, it may be regurgitated and chewed further as

cud. The other three chambers are the *reticulum*, the *omasum*, and the *abomasum*, respectively.

Muscles and skeletal structure of deer are well adapted to running. Deer are capable of exceeding 30 miles per hour for short intervals. Weight is carried on the toes, and some bones of the feet are fused to extend their gait. Bones of the shoulders and front feet are encased entirely in muscle, adding greater flexibility to limb movement.

Life History

Alabama white-tailed deer fawns are usually born during July, August, and September. However, in some scattered populations, fawns are dropped during May and June. At birth, white-tailed deer weigh only 4 to 6 pounds.

Fawns are born with a reddish-brown coat covered with white spots that allow them to blend naturally with patterns of sunlight and shade. This coat is gradually replaced by brownish-gray winter hair. Weaning usually occurs by 4 months of age, but fawns may remain with their mothers for more than a year.



In Alabama, bucks and does breed during winter, usually from late December through February. Bucks and does normally breed for the first time in their second winter. Much of the breeding by males is performed by older, socially dominant bucks. Consequently younger males, though sexually mature, play a minor role in breeding.

Occasionally, on very good range, does conceive during their first winter and give birth when 1 year old. Does bearing young for the first time usually give birth to only one fawn. Thereafter, does typically have two fawns each year if the food is adequate.

Young bucks start growing antlers during their first spring when they are about 9 to 12 months old. The paired antlers are bony outgrowths from the skull. Growing antlers are supplied with blood vessels and are covered by hairy skin called velvet.

Antler growth is usually complete by late September. The velvet then dries and is sloughed or rubbed off. These hard, polished antlers are kept throughout the breeding season and shed during late winter. Growth of new antlers begins almost immediately.

Habitat Needs

The white-tailed deer is one of the more adaptable large mammal species in the world. Given adequate protection, deer thrive over a wide array of land-use types and, often, close to humans.

Deer habitats are composed of different quantities and qualities of food, cover, and water. The number of deer that can be supported in good physical condition on any given land area is called the carrying capacity of that habitat.

Food. Deer require an abundance and variety of nutritious foods for growth, reproduction, and maintenance. The amount and nutritional content of available food will affect deer productivity, health, size, and antler growth. On the average, a deer eats 4 to 6 or more pounds of food daily for each 100 pounds of body weight. During a year, one deer may eat more than a ton of food.

Deer have been known to feed on thousands of different food items. Generally, food is selected according to its availability, nutritional value, and taste. The preferred food of deer may vary from area to area and may change seasonally. Table 1 lists some of the foods deer eat. Besides foods listed in this table, legumes are also extremely good deer foods.

During spring through early fall, deer eat succulent grasses, legumes, weeds, fleshy fruits, assorted agricultural crops, and the tender growth of shrubs, trees, and vines. During fall and winter, their diet shifts to acorns, evergreen leaves, succulent green growth of small grains, and stems of many woody plants.

Table 1. Deer-Browse Plants In Alabama.

Common Name	Scientific Name	Rating
Common Persimmon	Diospyros virginiana	H
Strawberry Bush	Euonymus americanus	H
Ashes	Fraxinus spp.	H
Japanese Honeysuckle	Lonicera japonica	H
Southern Crabapple	Malus angustifolia	H
oaks	Quercus spp.	H
Blackberry, Raspberry,		
Dewberry	Rubus spp.	H
Greenbrier	smilax spp.	H
Sweet Pepperbush	Clethra alnifolia	H-M
Hollies	Ilex spp.	H-M
Wild Grapes	Vitis spp.	H-M
Red Maple	Acer rubrum	M
Rattan Vine	Berchemia scandens	M
Trumpet Creeper	Campsis radicans	M
Flowering Dogwood	Comus florida	M
Swamp Cyrilla	Cyrilla racemiflora	M
Yellow Jessamine	Gelsemium sempervirens	M
Virginia Sweetspire	Itea virginia	M
Yellow Poplar	Liriodendron tulipifera	M
Waxmyrtle	Myrica cerifera	M
Blackgum	Nyssa sylvatica	M
Blackcherry	Prunus serotina	M
Sweetleaf	Symplocos tinctoria	M
American Beautyberry	Callicarpa americana	M-L
Eastern Redcedar	Juniperus virginiana	M-L
Sweetgum	Liquidambar styraciflua	M-L
Sweetbay	Magnolia virginiana	M-
Redbay	Persea borbonia	M-L
Elderberry	Sambucus canadensis	M-L
Sassafras	Sassafras albidum	M-L
Blueberry, Huckleberry	Vaccinium spp.	M-L
Boxelder	Acer negundo	L
Buttonbush	Cephalanthus occidentalis	L
Sourwood	Oxydendrum arboreum	L
Rhododendron	Rhododendron maximum	L

H=High

M = Moderate

L=Low

Food items must be from ground level to 4 1/2 feet high to be available to deer. Tender, palatable stems of vines and trees are useless, regardless of their abundance, if they are out of reach for deer.

Cover. Deer can inhabit a variety of sites, but the areas providing the best cover include an even mixture of mature hardwoods, croplands, brushlands, and pasturelands.

An uneven aged woodland with scattered openings is best since it produces an abundance of succulent vegetation within easy reach of browsing deer. Such an area also provides plenty of resting and bedding room.

Water. Although deer get some water by eating succulent foods, they require free water for drinking almost daily. Streams, ponds, and other wet areas

are used regularly for drinking. Access to water does not limit deer abundance in Alabama. But, during periods of drought, water may influence the habitat they use.

Herd Management

Deer herds are managed primarily by selective removal through hunting. Unlike other game animals in Alabama, deer have few natural predators to keep populations in check. Sport hunting takes the place of natural predators.

If un hunted or lightly hunted, deer increase rapidly until their numbers exceed available food supplies. As this occurs, preferred foods are eliminated, herd productivity is reduced, and the health and size of the animals begin to decline.

Continued population increases often cause long-term habitat destruction. The incidence of disease and parasites increases. Ultimately, natural mortality rises and, occasionally, widespread die-offs occur.

Once a deer population reaches the carrying capacity of the habitat, the growth must be stabilized. About 35 percent of a deer population must be removed annually to stabilize the population. Intensive buck-only hunting rarely removes more than 10 to 15 percent of a population. Removing significant numbers of antlerless deer (does) is necessary to keep a deer herd from becoming overpopulated.

Buck Management

Many sport hunters are interested in increasing their opportunities for taking a trophy buck. Such objectives demand that deer populations be reduced enough to ensure that adequate nutrition is available for good body and antler growth. Hunters must also be willing to conserve younger age classes of bucks and allow them to reach potential trophy age (4 to 7 years).

It is normal for Alabama bucks to have spikes when they are yearlings. Given time and good food, almost all will develop nice racks as they get older. Do not eliminate all spikes because of the mistaken belief that spikes are a sign of genetic inferiority. Removing spikes is not recommended as a way to increase antler size.

Alabama Department of Conservation biologists can help landowners and hunting clubs define management objectives and outline harvest strategies through the Deer Management Assistance Program. If you or your club is interested in this program, write to the Alabama Department of Conservation and Natural Resources, Division of Game and Fish, 64 N. Union, Montgomery, AL 36130.

Habitat Management

The capability of land to support deer is influenced largely by vegetation types and condition, soil pro-

ductivity, and weather patterns. Land may be manipulated to increase the number of deer it can sustain and to improve nutritional plants for existing populations. Ideally, a mixture of habitat types, over relatively small areas, should be provided for deer.

Several land/forest management techniques are very valuable for managing deer habitat. They include prescribed burning, timber thinning, food plantings, and fertilization programs.

Prescribed Burning

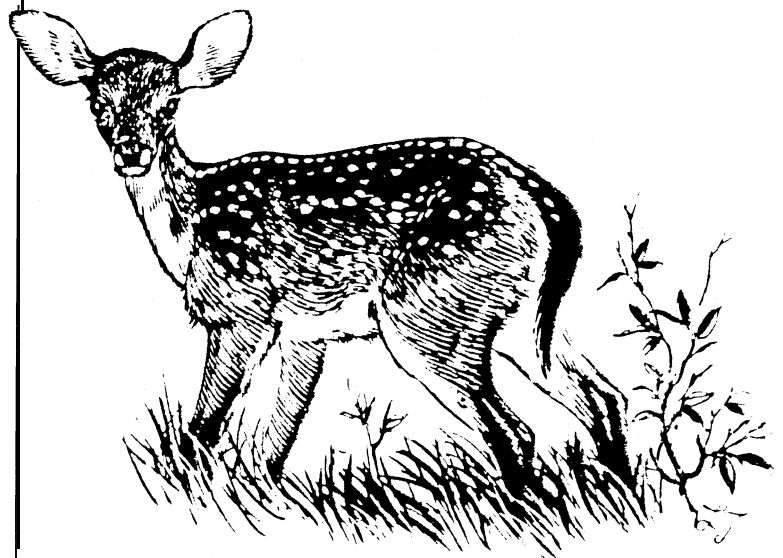
Prescribed burning is an effective method of increasing the abundance and improving the quality of deer forage in old fields and pine-dominated woodlands. Additionally, prescribed fire is an excellent timber management tool.

On most sites, deer forage is increased by burning small blocks of woodlands on a 3- to 5-year cycle. This is attained by burning about one-fifth to one-third of all suitable areas each year. Preferably areas no larger than about 200 acres should be burned in any one block. For deer, restrict fire use to February and March.

The Alabama Forestry Commission and private forestry/wildlife consultants can provide technical assistance to landowners who are inexperienced in prescribed burning. The commission also will plow fire containment lanes at a small fee for landowners.

Thinning/Cutting

Extensive stands of mature timber allow very little sunlight to reach the forest floor. As a result, little plant growth is found in the 0- to 4 1/2-foot range where deer feed. Thinning or clearcutting small blocks of timber (1/2 to 10 acres in size) opens the forest canopy and allows more sunlight to reach the forest floor. Consequently, deer food abundance and availability are increased.



Logging roads and food plot margins are often good sites for cutting or thinning. The edges of these areas may be maintained in deer forage production by periodic burning or mowing (every 3 years). When thinning or cutting, try to avoid cutting down trees that are producing good deer food. Good, natural deer foods are listed in Table 1.

Manage forest stands to maximize different types of food for deer. Manage large stands of timber on an uneven-age basis so that trees of all sizes and ages occur throughout the stand. Small, even-aged stands provide good habitat if they are mixed in among other stands of different ages.

Food Plantings

Food plots are frequently planted to supplement native foods and to attract deer for hunting. Small grains and clovers are planted as a winter grazing source for deer. Seeds of corn, grain sorghum, beans, and peas are energy-rich foods that are suitable for food plots and are planted during the spring and summer.

Food plots should be from 1 to 5 acres in size to help ensure adequate food production and availability. Larger plots may be needed for summer plantings of beans or peas in areas where deer populations are high.

Soil test; then lime and fertilize according to recommendations. The correct lime and fertilizer is absolutely necessary for optimum production, nutrient quality, and use of food plantings by deer. Table 2 gives recommendations for several fall green

field plantings. County agents can help with suitable plant varieties, planting dates, and methods.

Fertilizing

Fertilizing woodlands and patches of native vegetation is an effective but underused method of attracting deer. Nutritional content and production of Japanese honeysuckle may be increased by light, periodic applications of complete fertilizer during spring and summer. Deer are attracted to these natural food plots by the improved nutrition and taste of fertilized plants.

Acorn yields of oaks may be increased by applying regular fertilizer from spring through summer. Apply a complete fertilizer under the drip-line of selected trees, beginning at flowering (usually during early April) and every 6 weeks thereafter through September.

Table 2. "Green Field" Crop Planting Recommendations.

Crop	Seeding Rate Per Acre
Clover, Crimson	20-30 pounds broadcast
Clover, White	2-4 pounds broadcast
Wheat	90-120 pounds drilled or broadcast
Ryegrass, Winter Mixture:	40 pounds broadcast
Clover, Crimson	15 pounds broadcast
Clover, White	2 pounds broadcast
Ryegrass	10-15 pounds broadcast
Wheat	60-90 pounds broadcast



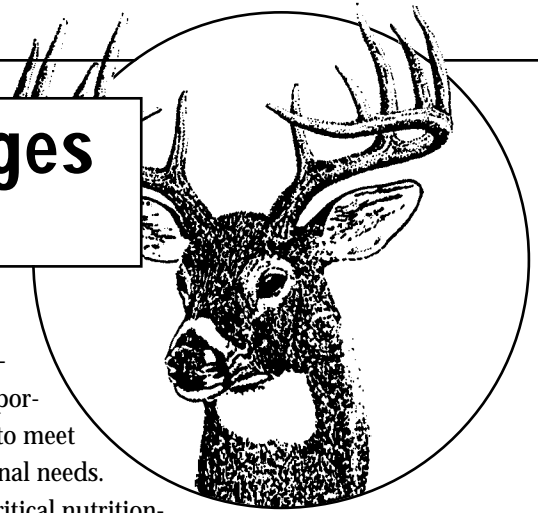
ANR-521

Lee Stribling, *Extension Wildlife Scientist*, Associate Professor, Zoology and Wildlife Science, Auburn University

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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Planting Warm-Season Forages for White-Tailed Deer



The white-tailed deer is the most popular big game animal in the country. It is also one of the most plentiful, with more than 30 million in the U.S. Annual harvests in North America increased from 2 million deer in 1978 to more than 5.3 million in 1994. Certain regions (including the Southeast) are facing overpopulation problems.

Overpopulation damages forest regeneration and agricultural crops and increases deer-vehicle collisions and disease. Annual U. S. damage may be as high as \$1 billion or more.

Overpopulation creates unhealthy deer herds because of inadequate food supplies and can reduce health and abundance of native plant communities. Plant communities, which provide staple deer browse foods like vines, forbs, woody plant leaves, and twigs, decline over time from overbrowsing.

Deer herd health, including fawn production, body weight, and antler development, depends on good nutrition, age, and genetics. Nutritional requirements, including adequate protein and mineral levels, must be met through adequate habitat management. Habitat management involves proper manipulation of commercial forestland and agricultural crops. Management of native vegetative species, from forbs (weeds) to mature trees, impacts habitat quality more than any food planting or supplemental effort.

As an example, timber clearcuts, if planned, harvested, and reforested properly, can provide diverse habitat edges, excellent escape cover, and large quantities of nutrient-rich forage/foods as they grow back into young forests. Small, irregularly-shaped harvest cuts with streamside management zones (strips of timber left along drains) provide excellent habitat if these areas are part of a mix of habitat types. Depending on initial tree spacing and site quality, areas that are replanted to pine trees may provide good forage production for 3 to 7 years, and even longer for hardwood regeneration areas. Forage production eventually declines as the amount of sunlight reaching the forest floor declines. Later in the forest cycle, with proper fertilization, pruning, thinning, and other timber stand treatments, these areas can again provide excellent habitat.

While native vegetation management has a much greater potential to increase total deer forage production than food

plantings, plantings may be important seasonally to meet specific nutritional needs.

The two most critical nutritional times annually for white-tailed deer are late summer, when deer population levels are high and native food quality is low, and late winter, when forage quality and quantity is low and mast (fruit) from oaks and other trees is scarce.

Research has indicated that if at least 1 percent of an area is planted to year-round cool- and warm-season forages, the plots can positively affect the nutritional plane and quality of whitetails. Cool-season forages can aid hunter harvest and improve deer condition, but the benefits of warm-season forage management are often overlooked. Planting summer forages may be as important as planting cool-season forages, since antler growth, fawn production, and initial rearing take place then. Therefore, both bucks and does face special nutritional demands. Seasonal comparisons indicate deer eat the most food in late summer. We know that deer use of warm-season plantings declines from highest in March to lowest in early June. Use increases in late June, peaks in August, then declines slowly through September.

Warm-season food plot planning requires careful thought and on-the-ground evaluation. Existing openings like pipeline and transmission line rights-of-way, abandoned secondary roads, and firelines can provide economical locations for food plots. Carefully plan and consider equipment needs and access points, soil quality, fertilization or liming requirements, size and distribution of plots, seedbed preparation, and choice of planting materials. Landowners should approve planting locations. Designate enough planting sites $\frac{1}{2}$ to 3 acres in size to plant 1 to 2 percent of the managed area. Make plots long and narrow, but do not exclude sunlight from plots in forested areas. Evenly distribute warm- and cool-season plantings by dividing plots and planting half to each type, or at least distribute both food types evenly across the area.

The abundance and condition of wildlife are related directly to soil fertility. Soil fertility may vary widely on a given area, with higher fertility generally being found near

drainages and in low areas. These are locations which, if available for planting, will produce the best warm-season forage plots, since they are both fertile and generally hold moisture better during the summer months. Initially, conduct a soil test for each new food plot location. Your Extension Service office can provide soil test kits and soil analysis. Soil test results will be tailored to give the fertilization and lime requirements for each planting material specified for use. Proper fertilization will dramatically increase forage produce and is critical to deer use. Liming, if recommended, will bring the pH up and dramatically increase the efficiency of fertilizer and forage production. To be effective at the time of seed germination, lime generally requires application 3 months before seed planting. Legume seeds must be treated with the proper inoculant at the time of planting and will produce their own nitrogen.

Plant and manage forage with a farm tractor and 5-foot wide implements including a disk, broadcast seeder/fertilizer distributor, and mower. A harrow, 2-row planter, and a hand and/or electric seeder are also useful. Plots should be limed, disked, and allowed to settle before planting. Broadcast seeding increases seeding rate over similar drilled crops. Most seeds should be lightly covered with a harrow or by dragging a heavy timber, log chain, or piece of chain-link fence over the plot. Frost planting, or overseeding crops such as red or arrowleaf clover, birdsfoot trefoil, or winter hardy forage oats over closely mowed or grazed vegetation in late winter can be effective and inexpensive. Frozen ground allows seeds to contact and germinate in mineral soil.

Choices for warm-season deer plantings are limited compared to the many cool-season favorites. However, several meet criteria of spring-summer production, resistance to overbrowsing, high protein levels, and digestibility to deer. The best choices for the Southeast include Alyceclover, cowpeas, jointvetch, Lab Lab, and soybeans. Alyceclover is a legume that produces forage through the early fall. It produces abundant forage and withstands browsing pressure better than most of the other choices. Plant it with cowpeas, another favorite warm-season annual legume, to help prevent overbrowsing of the peas. Cowpea varieties such as Catjang, Iron-clay, Tory, and Wilcox have a wide soil tolerance and grow well with a pH as low as 5.5.

Large plots tend to withstand deer pressure best. The same is true of soybeans, a favorite annual legume for deer plots. Soybeans may be 40 percent protein, and deer readily use both the green leaves and beans. Unfortunately, small plots and high deer densities may leave a field of "stems" after deer find them, and thus they are useful for only a lit-

tle while. Corn, another favorite, is planted as a general crop for deer, doves, turkeys, and other animals. While not accurate to call it a summer forage, the grain matures in around 90 days, making it available mid-to-late summer. It is more important as a food resource during fall and winter, and while low in protein, it provides a good source of carbohydrates and energy. Thus, it is an important food to develop energy reserves in the fall deer herd.

Plant peas with corn at the final cultivation and fertilization to help control weeds and add much needed nitrogen. Jointvetch is a fern-like appearing plant that is adapted to moist soils. It may reseed if disked the following spring, and since it is a legume, it does not require nitrogen fertilizer. Lab Lab, a relative newcomer to the deer forage scene, is planted in the spring as are the others we have discussed. Lab Lab differs in that it is very drought tolerant and is used widely in arid climates.

Another forage to plant is Forage Brassica (rape). There are several varieties of these leafy plants. They are highly attractive to deer, average 30% or more protein, and may be available commercially in blends with Chicory and Plantain.

It can be important to document deer use of summer plots. To do this, exclosures of 3 inch wire formed into a tube 2 to 3 feet in diameter and 6 feet high can be staked to the ground on selected food plots to estimate deer use. Some forages, such as Alyce clover, hold up better to deer browsing pressure than others. Plant soybeans or peas with these types of forages to ensure adequate stands, particularly if 2 acres or smaller.

Following are recommendations for some of the common warm-season forages. Ladino clover, although it is a cool-season forage and normally planted in the fall, is included because it produces abundant forage through the summer months and, in some years, may provide a near year-round forage resource. In contrast to most cool season forages, summer forages may need herbicides to control competition.

Alyceclover

Description: A warm-season legume that provides forage in the summer and early fall. Especially important to white-tailed deer as one of the few warm season forages that hold up well to browsing.

Soil Adaptation: Most moderate to well-drained soils, including bottomland sites.

Fertilization: Apply according to soil test or apply 200 lbs./acre of 1-14-14 after planting is established.

Lime Requirements: Apply according to soil test or

apply amounts necessary to bring pH to 6.5-7.0.

Planting Dates: May 1 - June 15

Planting Rate: Inoculate seed. Broadcast 15-20 lbs./acre or drill 16 lbs./acre

Soil Preparation: Disk and plant in a firm seedbed.

Companion Plants: Plant with forage cowpeas and/or jointvetch. Reduce seeding rate to 10 lb./acre when planting combinations.

Ladino Clover

Description: A cool-season annual legume. A very popular clover for providing deer forage, and foliage and insects for quail and turkey.

Varieties: Osceola, Tillman, Regal, Louisiana S-1, and California

Soil Adaptation: Fertile, bottomland, moist soils.

Fertilization: Soil tests are recommended or use 300 lbs./acre of 0-20-20.

Lime Requirements: Apply according to soil test or use amounts necessary to maintain a soil pH of 6.5.

Planting Dates: September 1 - November 15.

Planting Rate: Requires white clover inoculant. Drill 3 lbs./acre at 1/4 inch or broadcast 4 lbs./acre and cover 1/2 inch.

Soil Preparation: Plant in a firm seedbed. In wet areas, broadcast and lightly disk in seed and fertilizer.

Companion Plants: Ryegrass, cool-season, annual small grains, and vetch. Reduce planting rate to 2-3 lbs./acre broadcast when planting combinations.

Management: Re-seeding can often be enhanced by fall disking or mowing and fertilizing at the rate of 40 lbs./acre of 0-20-20.

Cowpeas

Description: A warm-season annual legume. Browsed by deer and rarely eaten by doves, but heavily used by turkeys and quail.

Varieties: Varieties are Thorsby Cream, Tory, Wilcox, Iron Clay, and Catjang.

Soil Adaptation: Well-drained soils, from sandy loams to heavy clay soils.

Fertilization: A soil test is recommended, or use amount required to maintain a soil pH of 5.5-7.0

Planting Dates: May 1 - July 1

Planting Rate: Plant 15 lbs./acre in 24-36 inch rows or broadcast 25 lbs./acre and cover 1 inch. Inoculant required.

Soil Preparation: Plant in a firm seedbed.

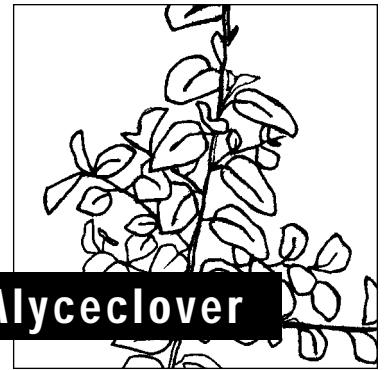
Companion Plants: Other warm season annual peas, Alyce Clover, and Brown Top Millet. Reduce planting rate to 12-15 lbs./acre broadcast when planting combinations.

Soybeans

Description: A warm-season annual legume. Provides food and cover for rabbits, turkeys, quail, doves, and ducks. Browsed heavily by deer in early stages of growth.

Varieties: There are hundreds of varieties; re-seeding varieties such as Bobwhite and Quailhaven have been researched at the Natural Resources Conservation Service Plant Materials Center in Coffeerville, Mississippi. Select "forage" type varieties for best performance.

Soil Adaptation: Well drained, medium-textured soils such as sandy loams and



Alyceclover

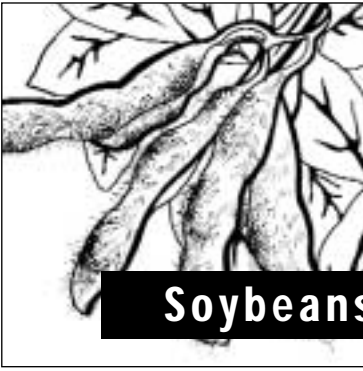


Ladino Clover

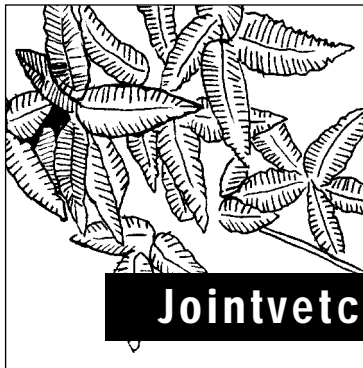


Cowpeas

For more information on wildlife food plantings, check out the Mississippi State University Web Site ext.msstate.edu and look up publications entitled "Wildlife Food Planting Guide to the Southeast" and "A Guide to Sources of Conservation and Wildlife Food-Planting Materials." Order the Food Planting guide and other wildlife-related publications from MSU-Extension Service/Department of Wildlife and Fisheries, Box 9690, Mississippi State, MS 39762.



Soybeans



Jointvetch

clay loams.

Fertilization: A soil test is recommended or use 300 lbs./acre of 0-20-20.

Lime Requirements: Apply according to soil test or use amounts required to maintain a soil pH of 5.8-7.0.

Planting Dates: May 1 - June 1

Planting Rate: Plant 30 lbs./acre in 24-36 inch rows or drill 30 lbs./acre at 10 inch row spacing or broadcast 50 lbs./acre and cover $\frac{1}{2}$ inch; inoculant required.

Soil Preparation: Plant in a well disked, firm seedbed.

Companion Plants: Corn. Reduce planting rate to 30-35 lbs./acre broadcast when planting combinations.

Management: If planted for waterfowl, remember that non-reseeding variety seeds will spoil in 30 days after flooding. Also, waterfowl do not utilize the protein in soybeans very efficiently, even though they readily consume them. Plant large plots in areas with high deer densities, or plots will be overbrowsed quickly.

Jointvetch (Deer Vetch)

Description: A warm-season annual, re-seeding legume. Provides excellent forage for deer and succulent foliage and seeds for dove, quail, and turkeys. Will grow on wet sites and can be flooded 18-24 inches for ducks.

Soil Adaptation: Moist and wet, light-textured soils. Do not plant in sandy soils.

Fertilization: A soil test is recommended or use 300 lbs./acre of 0-10-20.

Lime Requirements: Apply according to soil test or apply amounts necessary to keep a soil pH of 5.5-6.5.

Planting Rate: Broadcast 8-10 lbs./acre and cover $\frac{1}{2}$ inch; inoculation required.

Soil Preparation: Plant in a well disked, firm seedbed.

Companion Plants: Warm-season perennial grasses.

Management: Re-seeding can be enhanced by spring disking; reapply 200 lbs./acre of 0-10-20. Not very competitive – may require preplanting herbicide application.



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Wildlife Foods



Wildlife
FOOD PLANTING
Guide
FOR THE SOUTHEAST

Wildlife

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Diverse habitat, including a mixture of different forest types and openings, is important to meeting needs of wildlife.



Disking strips in openings next to timber sets back natural succession, which helps meet needs for early successional species such as bobwhite quail.



Prescribed burning in pine forests is one of the most important cost-effective and beneficial tools forest and wildlife managers use.

Wildlife

FOOD PLANTING

Guide

FOR THE SOUTHEAST

Wildlife require suitable, healthy living areas to survive and increase population numbers. The living areas must provide the food, cover, space, and water needs of different animals. Together, these components create an animal's habitat. Management of native vegetative species, from forbs (weeds) to mature trees, will impact habitat quality more than any food planting or supplemental efforts. Also, for many wildlife species, especially the ones mentioned in this publication, habitat management must include proper protection and harvest.

This guide has been designed for the Southeast to help landowners, recreation clubs, and hunters better manage populations of white-tailed deer, eastern wild turkey, bobwhite quail, mourning dove, and various species of waterfowl. These same techniques also will benefit many nongame wildlife species.

This guide covers several wildlife habitat and food-planting management techniques. The techniques provide information to increase natural food production, supplement the diets of game species, improve recreation, and to manage populations to meet user objectives. This guide is based on proven wildlife management techniques and ongoing wildlife research and is written to provide information that will help meet recreational and management objectives.

Soil and Vegetation Disturbances

Soil quality determines wildlife habitat and population potential. Soil disturbances, such as timber harvest, disking, mowing, and prescribed burning, can improve wildlife habitat, and, if you do it correctly, can reduce the need for food plantings. However, for the best vegetative habitat diversity and to help in wildlife harvest and viewing, you might want a mixture of both natural vegetation and food plots.

Disking can prepare seedbeds for planting and change the natural composition of plants by removing thicker, undesirable grasses and creating space for more desirable legumes and seed producers. Disking also increases insect production. The best method of disking is "strip disking." This technique works best with fields (pastures or agricultural) and rights-of-way but may also be used in stands of open timber. The key is to disk strips that are 30 to 50 feet wide to leave similarly undisked strips in between them. Do this alternately across the length of the field or area. You should disk strips every 3 years or so for quail.

Strip disking is excellent for providing nesting and broodrearing habitat, insect production, and important seed (food) production for quail and turkeys. As an example, blackberries, an important food to deer, turkeys, and quail, grow on an average 3-year rotation and can be promoted on a 3-year disking schedule. Aquatic plants (such as maidencane and smartweed), which are important duck foods at certain times, can be encouraged by spring and summer disking in drawdown ponds or marshy areas. Legumes (such as partridge pea, beggarweed, vetches), forbs (such as croton, ragweed), and large seeded grasses can be encouraged with winter-to-spring disking of fields and plots. Always disk on the contour to prevent or to minimize soil erosion.

Mowing is used primarily for the bobwhite quail and wild turkey. Late-winter (February) and late-summer (August) mowing attracts insects that are critical in the diets of juvenile birds. Late-summer mowing of grassy plots and fallow fields can increase nutrient availability of plants by providing fresh, green growth. The highest nutrient availability in grasses is in the first 8 inches of growth. Mowing can also help provide browse for deer.

Prescribed burning is the skillful use of fire to natural fuels, under confinement, to get planned benefits for forest or wildlife. Prescribed burning often is the most economical

and beneficial tool in wildlife management. It is also a controversial because of possible landowner liability and smoke management health concerns. Prescribed burning is often used in pine or upland mixed pine hardwood stands to reduce dry fuel hazards, to control hardwood competition, and to prepare sites for replanting of trees. Besides these timber management benefits, wildlife benefits include ground exposure, seed spread, legume spread, hardwood butt sprouts, and growth of nutrient-rich forbs, vines, and browse. **Only responsible, trained, experienced persons should do prescribed burning! Report all unattended fires to state forestry personnel.**

Landowners must have a burning permit to burn in any state. You can get the permit by contacting the state forestry agency. Also, several states, including Mississippi, have prescribed burn laws that might require training, certification as a burn applicator, and written plans before burning. Although a 1- to 2-year burning cycle is ideal for quail, an average 3- to 5-year burning schedule is best for maintaining habitat diversity for many other game species. A 3- to 5-year burning rotation consists of burning 1/3 to 1/5 of the habitat each year. By doing so, you maintain different plant stages in the habitat, ensuring enough food production and good reproductive, escape, and resting cover.

Here are some safe burning conditions that can bring greatest wildlife benefits:

1. Burning in January and February, when temperatures are lower than 40 °F.
2. Burning with wind speeds of 3 to 10 mph.
3. Burning with a relative humidity of 50 to 70 percent.
4. Burning at night when the humidity is higher, for safety reasons. (Note: Smoke is harder to manage at night, though.)
5. Burning with a backfire where possible.

Do not practice any of these during the critical March to August nesting periods for bobwhite quail, turkey, and other ground-nesting species of interest.

The goal is to keep fire between ground level and 18 inches high. Limit burning to fields or stands of pine at least 10 years old. Restrict fire from hardwood stands. Unlike southern yellow pines, the cambium layer of most hardwood species can stand only 120 °F of heat. The best wildlife burn is a patchy or incomplete burn, which will increase habitat diversity.

You can get professional help from state or federal agency wildlife biologists, forestry specialists, and private consultants. Many state forestry agencies will schedule and conduct burns on private lands for a small fee.

Openings

Openings are various-sized areas in the habitat where sunlight reaches the ground. Openings are critical for a variety of species. They provide low growth that attracts insects and provides green forage and other foodstuffs near ground level for deer, quail, turkeys, and other species. Openings can vary in size from a few square feet to many acres. A list of a few different openings might include pastures, agricultural fields, power lines, gas lines, road rights-of-way, and timber harvest areas. For example, turkeys can thrive in forested habitats that have anywhere from 15 to 60 acres of opening per 100 acres of habitat.

These areas naturally provide food and cover for wildlife but can also be controlled or planted to various crops. For example, you can strip plow or mow them and/or plant to foliage, such as bahiagrass or clover that attracts insects. Bobwhite quail and turkeys often nest near these areas, which serve as good sources of food and cover.

Clearcuts (harvest cuts) can be used to create openings and, if planned and harvested properly, can provide diverse habitat edges, excellent cover for nesting, brood rearing, and escape, and lots of nutrient-rich forage/foods. Small, irregularly shaped harvest cuts with streamside management zones (strips of timber left along drains) provide excellent habitat, if these areas are part of a mix of different habitat types. Depending on initial tree spacing and site quality, an area that has been harvest cut might provide good quail habitat for up to 3 to 4 years after replanting. Later in the rotation, if pine is being grown, with proper thinning and burning, these areas can again provide excellent habitat. Best deer browse occurs 2 to 4 years following complete timber harvest, and food and cover benefits can continue for years with proper timber/wildlife management.

Group selection, individual tree selection, thinning, seed tree, and other methods of timber harvest can create small to large openings that can be suitable for planting. These harvests, when paired with other practices, such as burning, can magnify benefits to wildlife species.



Forest openings provide important components for wildlife species and also can be suitable for planting supplemental forages.



Clear-cuts (harvest cuts), as shown in this aerial view, provide good, early successional habitat for some species. Streamside management zones (SMZ's) protect water quality and provide travel and feeding areas.

White-tailed deer are known to feed on more than 700 different species of plants and are characterized as browsers.



Supplemental forages (cool and warm seasons) can help meet late-summer and winter (stress periods) needs of white-tailed deer.



*Blackberry (shown) and dewberry (*Rubus* species) are important native vines. They provide browse and fruit.*

*Honeysuckle (*Lonicera japonica*) is likely the most important vine in the Southeast for white-tailed deer and can be enhanced with fertilizer.*

Fruit-bearing hardwood trees, shrubs, and vines that provide food (including browse) for deer in the Southeast include the following:

Trees

Beech
Black Cherry
Black Haw
Black Locust
Crab Apple
Dogwood
Hackberry
Honey Locust
Mulberry
Oaks
Persimmon
Redbud
Red Maple
Sassafras
Wild Plum

Shrubs

American Beautyberry
Elderberry
Gallberry
Rhododendron
Serviceberry
Sumac
Witch Hazel

Vines

Blackberry
Greenbriar
Honeysuckle
Muscadine
Poison Ivy
Virginia Creeper



White-Tailed Deer

Habitat and Food Requirements

The white-tailed deer (doe) has an average home range of at least 1 square mile (640 acres), while mature bucks may range more than 3,000 acres annually. When basic biological needs for white-tailed deer are met on a suitably sized unit of land, deer might be less likely to leave, unless pressured by people, environmental conditions, or other animals. Mature hardwood forests, mixed pine-hardwood forests, pine forests (including managed plantations and natural forest), and open fields are some habitat types useful in helping meet habitat requirements.

The white-tailed deer browses on grass and other plants. It has four stomachs that help digest various foods, making it versatile in its feeding habits. It eats a variety of leaves, twigs, bark, buds of trees and shrubs, plus hard and soft fruits, vines, forbs, lichens, mushrooms, cultivated crops, and some grasses.

As far as nutrition, the two most critical times for white-tailed deer are late summer, when deer population levels are high and food quality is poor, and late winter, when food quality and quantity are low and mast (fruit) from oaks and other trees is scarce. These are times food plots can be good for deer. If at least one percent of an area is planted in food plots, the plots can positively benefit white-tails.

During the spring and early summer, deer browse is high in protein and complex carbohydrates. At this time, weights are increased for winter. Body fat stores are increased during the fall and early winter months with a variety of mast crops, including red and white oak acorns, which are good sources of carbohydrates.



Wild turkeys pick up seed heads, green forage, and insects in grassy openings. Hens prefer to nest near openings.

Eastern Wild Turkey

Habitat and Food Requirements

The eastern wild turkey has an average home range of about 1,500 to 3,000 plus acres, with hens having smaller home ranges on average than mature gobblers. It is hard to manage wild turkey populations on small tracts of land, but it can be done. Protection with gates and other ways to control access is critical to managing wild turkey populations.

The ideal habitat for turkey production includes a mixture of intensively managed (thinned and burned) pine plantations, natural pine forest, mixed pine-hardwood forest, mature hardwood forest (upland, bottomland, or creek bottom) for travel and mast production, and properly maintained roadsides and openings for reproductive, broodrearing, and feeding areas.

Openings are an important part of wild turkey habitat, and you will need several small and large permanent openings. A range of 25 to 50 percent of the total area to be managed for wild turkeys should be in small to large, permanent, grassy openings. You can easily manage turkeys, even if timber is your main objective. You can leave a streamside management zone (SMZ) when you harvest timber. SMZ's can include hardwoods and/or pines left along creeks and drains to protect water quality and to provide travel paths and mast production for wildlife.

Turkeys often use intensively managed plantations that are thinned and burned as production areas (nesting, brood rearing, feeding). You can burn in pine stands as young as 10 years old. You can do commercial thinning early (13 to 17 years) in the rotation. Salvaged pine beetle (bug) spot areas, log loading decks, skid trails, and roadsides provide openings you can maintain in food plantings.

The eastern wild turkey is a strong scratcher and needs a diet of animal and plant matter. During their first 2 weeks of life, turkey poults feed almost entirely on protein-rich insects. After 4 weeks old, they need a diet like those of adults, which feed mainly on a wide variety of plant matter (seeds, leaves, fruits, tubers, forbs, grasses) and insects. In addition to grassy "bugging" areas, summer and winter food plantings that provide desirable foliage, fruit, and seed production are beneficial. During fall and early winter months, turkeys use mast crops of oaks, pines, and several other fruit-producing trees and shrubs (such as dogwoods and huckleberry).

Fruiting trees, shrubs, forbs, grasses, and vines in the diets of the wild turkeys include the following:

Trees and Shrubs

American Beautyberry
 Autumn Olive
 Barberry
 Black Cherry
 Black Gum
 Black Locust
 Crab Apple
 Dogwood
 Hawthorn
 Honey Locust
 Mountain Ash
 Oaks
 Persimmon
 Pine
 Redbud
 Russian Olive
 Serviceberry
 Sumac
 Wild Plum
 Yaupon

Forbs and Grasses

Aquatic Sedge
 Bahiagrass
 Beggarweed
 Bluestem
 Johnsongrass
 Lespedeza
 Milk Pea
 Orchard Grass
 Panic Grass
 Partridgeberry
 Partridge Pea
 Pokeweed
 Ragweed
 Vetch

Vines

Blackberry
 Honeysuckle
 Muscadine
 Poison Ivy
 Virginia Creeper



Field edges that have grown up around wood lines provide important cover for the bobwhite quail.

Bobwhite Quail

Habitat and Food Requirements

The bobwhite quail has an average home range of about 40 acres, but quail might stray from these areas if the habitat doesn't meet certain requirements. Bobwhites are an easy game bird to manage on smaller tracts of land. Population numbers have been declining over the last 30 years, and the decline has increased over the last 10 years.

Bobwhites are an "edge" and early successional stage species and need a mixed pattern of open ground and weedy/grassy habitat and/or open (thinned and burned) timber. The best basal area (cross sectional square footage of trees on a per acre basis) for quail is a range of 40 to 60 square feet per acre. It is difficult to produce quail long term in short rotation pine pulpwood stands.

Harvest cut areas can provide good habitat and hunting for quail for up to 3 to 4 years after harvest, though. With proper management, these areas might provide good numbers of birds for 5 to 6 years. For sawtimber rotations, thinning, prescribed burning, mowing, and disking are beneficial quail management techniques where timber is the key objective.

The bobwhite quail favors patchy farming techniques where you keep 5-acre and smaller patches of different early successional habitats to include an abundance of brushy fence rows, ditch banks, and strips of open timber separating

fields. Loss of suitable habitat because of clean farming techniques, loss of small farming operations, and other changes in land-use patterns have limited bobwhite quail populations.

The most critical factors in quail management include providing the right mix (mosaic) of habitat to meet food, bare ground, and cover needs. Quail will not venture far out into a large, open field to feed because of lack of cover. Neither can they scratch out foods in areas of heavy cover, if the seeds are available. You can ease these situations by mixing habitats and by creating transitional zones in the habitat. A transition is a middle habitat between two types of habitat.

The following are suggestions where transitional zones improve quail habitat:

- Build several long fences (preferably wooden, in a criss-crossed pattern) and let them grow up in vegetation. You can enhance this by fertilizing and planting rows of shrub lespedeza, honeysuckle, or muscadine on both sides of the fence row. Leave a buffer strip of 10 to 30 feet on both sides of the fence. You can plant this area to desirable seed-producing plants or perennial grasses that attract insects and can be mowed in late winter. A good substitute for fences would be to push up windrows where cut slash is available.

- Let field edges grow up next to wood lines.
- Build brush piles in large open fields or harvest cut areas, then let a buffer grow up around the brush pile.
- Plant 6 to 10 rows of pines in open fields, bordered by strips of annual reseeding lespedeza or broom sedge.
- Leave 30-foot buffer zones between cultivated crops and trees alongside ditch banks, roadsides, or fence rows.

Bobwhite quail, as do wild turkeys, eat animal and plant matter. Quail chick diets are mainly insects for the first 2 weeks of life. After about 8 weeks, their diets are more like those of adults. Adult quail diets, although supplemented by insects, are seeds, fruits, acorns, forbs, and grasses/green matter. Food plantings that attract insects and produce green stuff and seeds can be beneficial at all times during the year, especially in late summer, when nesting and brood rearing are complete. In the Southeast, free water is not generally considered critical for bobwhite quail habitat. Although quail will drink available water, they can hold enough water from fruits, dew on foliage, and insects to meet their needs.

Numerous wild plants, trees, and shrubs are good food sources for bobwhites. You can produce many of these native plants by seasonal diskings.



The bicolor lespedeza plot in the center of this thinned pine stand provides cover and an important winter food source (seeds).

Trees, shrubs, forbs, and grasses that provide important food and/or cover for bobwhites include the following:

Trees and Shrubs

American Beautyberry
 Autumn Olive
 Barberry
 Black Cherry
 Black Gum
 Crab Apple
 Dogwood
 Gallberry
 Hawthorn
 Huckleberry
 Magnolia
 Mountain Ash
 Mulberry
 Oaks
 Persimmon
 Pine
 Privet
 Redbud
 Russian Olive
 Serviceberry
 Sumac
 Sweet Bay
 Wax Myrtle
 Wild Plum
 Yaupon

Forbs and Grasses

Beggarweed
 Butterfly Pea
 Bluestem
 Common Ragweed
 Cranesbill
 Croton (Dove Weed)
 Goldenrod
 Johnsongrass
 Lespedeza
 Milk Pea
 Panic Grass
 Partridgeberry
 Partridge Pea
 Poison Oak
 Pokeweed
 Vetch



This grain sorghum field was established by disking, broadcasting seeds and fertilizer, and then covering the seeds with a disk drag.

Mourning Dove

Habitat and Food Requirements

Mourning doves are migratory game birds that usually migrate through the Southeast from early fall through winter. Even so, many will nest in the Southeast and have habitat requirements that must be met. Doves need “grit” (small bits of gravel and larger grains of sand) in their diets to help grind food in the gizzard. Doves are often seen on sand and graveled roadsides and in gravel pits. Also, a water source (such as a farm pond) is needed within approximately one mile of the food source. Doves are herbivores and are characterized as seed eaters. They feed primarily on the seeds of forbs, grasses, and small grains. Doves prefer to light in areas where the ground is bare and then walk to the food source. A large machine-harvested field attracts doves because of the clean ground and scattered seeds. Doves seek food by sight, prefer clean ground, and will not scratch or dig in the ground for food.

Doves are federally regulated migratory birds, and you should place extreme care and attention on federal and state regulations regarding dove field management. Consultation with wildlife biologists or enforcement officers might help avoid illegal field situations. Normal and acceptable agricultural practices typically have been considered legal dove shooting areas.

It is important to plant summer grain crops no later than June 15, if you want to attract doves to fields for dove shoots in September. Doves are easily attracted to prepared grain fields of at least 10 acres, and larger fields will attract proportionately greater numbers of birds. Planting techniques should use small seed and grain crops such as browntop millet, grain sorghum, corn, and sunflower. Crop production will be maximized if drilled, but broadcasting seeds, followed by light disking and dragging, will produce acceptable results. Harvests of portions of the field beginning 6 to 8 weeks in advance of expected shooting dates and continuing weekly until the shooting date might help hold doves on the field. Waste grain and bare ground are critical to the doves using the field.

Dove fields can easily be overharvested but can be retained by using a harvest schedule. Schedules might include shooting only in afternoon hours, regulating all-day shoots (if legal) to one per week, or stopping shoots at least 1 hour before sunset to allow doves time to feed and water before roosting.



Wood ducks are cavity nesters and readily use man-made boxes. A metal guard will deter predators.

Waterfowl

Habitat and Food Requirements

The mallard and wood duck are two of the most popular species of waterfowl in the Southeast. Both of these ducks are herbivores, are characterized as grazers and seed eaters, and have diverse diets of grasses, forbs, seeds, fruits, acorns, cultivated crops, and aquatic plants. Mallards and wood ducks are further characterized as dabbling ducks or puddle ducks, and feed in shallow water.

Waterfowl are federally regulated, migratory species, and most nest from the northern tier of the United States into Canada. Wood ducks, however, also nest in the Southeast in great numbers, and, unlike most waterfowl (which are ground nesters), use natural tree or man-made cavities. The number of wood ducks can be increased by providing nest boxes around water sources where there are inadequate numbers of natural cavities.

Cover, food, and shallow water are habitat requirements important for waterfowl impoundment management. Farm/beaver ponds and other impoundments of at least 5 acres can be made attractive to waterfowl. Food plantings of corn, Japanese millet, and other small grains planted around the edges and in these impoundments can provide excellent habitat and good hunting. Those trees not producing small acorns and other duck foods can be removed from the pond's edge to allow seed-producing weeds and grasses to flourish. Water levels where beavers are active can be controlled by using the Clemson drain or similar devices.

One of the best techniques used in waterfowl management is the greentree reservoir. This technique involves constructing a levee in a hardwood drain or bottom (with an adequate water source such as a creek, sizeable watershed, or well) that contains oaks and other small, hard mast-producing trees and shrubs. Water levels are controlled via a structure such as a weir or flashboard riser. The timber is flooded in the fall to an average depth of about 18 inches and often attracts good numbers of dabbling ducks, depending on mast crops. Do not continue flooding longer than 4 to 5 months, to prevent timber damage. Landowners and clubs interested in this technique can receive technical and often material assistance regarding location, permits required, and/or cost estimates from the Natural Resource Conservation Service, Cooperative Extension Service, state wildlife agency, Ducks Unlimited, and U.S. Fish and Wildlife Service. Most of these areas are considered wetlands and might require federal and state approvals before development.

Similar techniques can be used with agricultural production areas, pastureland, and with any impoundment that has a water-control structure. These areas can be drained by March 1, and native food production can be promoted by disking and fertilizing the soil, or they can be planted to crops that will tolerate some flooding.

Some wild plants in wet areas or drawdown ponds are beneficial to ducks and might be enhanced by mechanical soil disturbance.

Crops that can tolerate some flooding include the following:

- Browntop Millet
- Buckwheat
- Cattail Millet
- Chufa
- Corn
- Egyptian Wheat
- Grain Sorghum
- Japanese Millet
- Joint Vetch
- Rice
- Soybeans

Wild plants that might be enhanced by mechanical disturbance:

- Aquatic Sedge
- Arrowhead
- Alligator Weed
- Asiatic Dayflower
- Barnyard Grass
- Bladderwort
- Bullrush
- Coontail
- Duckweed
- Maidencane
- Pickeral Weed
- Pondweed
- Saw Grass
- Smartweed
- Tearthumb
- Water Primrose
- Watershield



You can seed Japanese millet seed directly onto mud flats around ponds or in wet fields for waterfowl.

Soil testing, with follow-up treatment, will improve cost effectiveness, production, and use of food plantings. Contact your Extension office or NRCS office for kits and information.



Supplemental Forages

Research indicates clearly that no one particular supplemental forage variety can meet all the needs of any one wildlife species on a year-round basis. However, combining different forages in food plantings, including warm and cool season forages, is an excellent way to maximize benefits of food plantings. Selections of adapted varieties should be based on soil and site characteristics, as well as cost and the wildlife species managed. Experiment with different varieties and planting combinations. Initially, plant small areas to serve as test plots before establishing large acreages.



Soil Quality and Fertilization

Wildlife seek and consume foods that are high in nutrient content. Since plants and animals are by-products of soil quality, determining soil quality and correcting problems in fertility and pH are the first steps in food-plot preparation.

Fertilize food planting based on the soil test recommendations. A small tractor and broadcast spreader will access most remote locations.

To test soil quality, collect soil samples 3 months before planting. Soil testing kits are available from the Extension Service or Natural Resource Conservation Service. One way to sample soils is to collect a handful of topsoil from 3 to 5 locations throughout the plot. Mix the soil in a container and remove a small sample (handful) to go in a small bag. Label the container with name and address and include the plant variety to be planted in the plot (s). Soil test results can give different NPK and lime (pH) rates for particular plant varieties. Contact the agencies listed for information on analysis of samples.



Planting food plots without proper fertilization and liming wastes time and money and, in most cases, is of little value to wildlife. In addition to fertilizing food plantings, fer-

Many of the soils in the Southeast are acidic and need liming periodically to allow maximum forage production, quality, and to encourage annual reseeding.

tilizing native vegetation in fallow fields, along roadsides, fence rows, and wooded areas with scattered openings also has benefits. Honeysuckle, for example, is an excellent wild vine to fertilize for deer forage production. If you cannot get a soil test, for most cereal grains, use a good complete fertilizer with equal amounts of nitrogen, phosphorous, and potassium applied at the rate of 200 to 400 pounds per acre. NPK is expressed as a number on the fertilizer sack, such as 15-15-15. Most legumes, however, require only low nitrogen levels, such as 6-24-24.

Liming involves applying agricultural lime (if needed) to bring up soil pH to the proper level to maximize growth, yield, fertilizer efficiency, and palatability of food plantings. For slightly acidic soils, applying 2 to 4 tons per acre is generally required to adjust pH to the proper level. Many clovers need a pH of 6.5 to 7.0 to promote reseeding.

Food Plot Size, Shape, and Placement

Match food plot size to the animal species you are managing. The size of food plots can vary from a few square feet to 20 or more acres. Deer, for example, will best use a 1- to 3-acre plot every 100 acres, and quail will best use a ¼- to ½-acre plot every 15 to 20 acres. Generally, plans should address a percentage of the total area managed and/or controlled to be planted in food plots. Plant at least one percent of the managed area in food plots for deer.

For greatest plant diversity and cover, plant long, narrow plots between two or more types of timber stands. For example, plant a plot between a stand of hardwoods and a stand of pine, between two separate ages of pine stands, or on the edge of a clear cut near the surrounding timber. Planting fruit- and nut-producing trees and shrubs in plots can add diversity and increase wildlife use of these plantings.

Food-planting locations that might not impact timber production very much include wide fire lanes, rights-of-way of gas and power lines, logging roads, old log-loading decks, and small, salvaged spots of timber. You can also overseed permanent roadsides. Do not plant food plots next to public roads, since these plots are too easy to get to. You should control access to plots by gates and fencing placed at least 100 yards inside property boundaries.

Food plantings located near drains, bottomland, or flat-wood sites usually are more productive because of soil fertility and topsoil depth. Unless you can reduce soil movement to insignificant levels, don't locate food plots on steep slopes that might erode. Unless waterfowl is the target species,

don't plant areas that routinely flood. Available sunlight is a major consideration in food-planting placement. Although some plants and shrubs are shade tolerant, most are not.

Preparing Food Plots

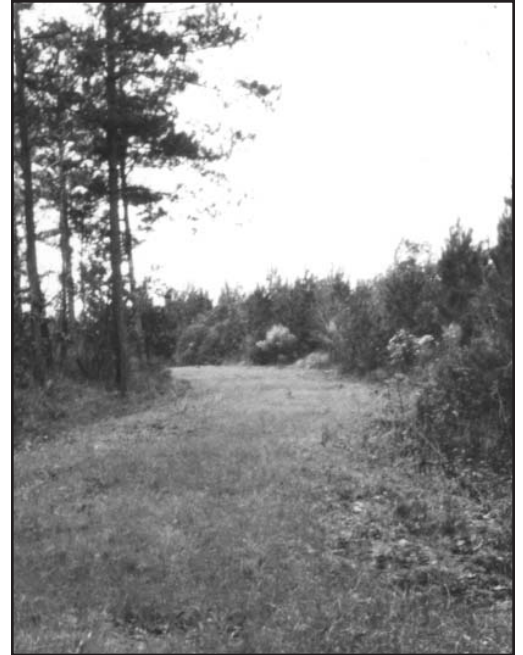
Some farm equipment is needed to plant and maintain wildlife food plantings. A tractor large enough to pull 5-foot implements is sufficient in most cases. Useful implements include a heavy-duty mower, disk, broadcaster (seeder), and a planter or drill with at least two rows. Although a row planter or drill is not essential, for most plantings it can be useful in making productive grain plots, and you can use it to plant areas that are level with little soil preparation (low till).

A hand seeder is also useful for planting small-seeded crops, such as clovers, or for seeding remote, wet, or steep areas. Direct seeding can be feasible for small seeded plants and might not require disking or other soil preparation. You can use direct seeding (no till) on roadsides, fire lanes, or other areas with freshly disturbed soils. Roadside food-planting management will provide edges, openings, and food for wildlife, as well as help control erosion of roads and ditches. Disk roadsides only along flat stretches and away from ditches. Fertilize and plant in a desirable grass, legume, or seed-producing plant. Cover with wheat straw or other type mulch to help prevent erosion and to hold seeds in place.

Soil-preparation techniques useful for food plots include fallowing and preparing firm seedbeds. Fallowing builds and maintains soil before planting legumes and is done by letting fields or plots lay out several months before planting. You can disk plots before planting time. To prepare firm seedbeds, let disked plots settle before planting. Usually this happens with one good rain and several days of sunshine. Lightly cover seeds by dragging a piece of railroad iron or a piece of chain link fence behind the seeder. Five tires chained together in a V will also cover seeds and help level plots.



It is important to locate food plots well away from public roads and place them (plots) where foods are needed (such as this young pine plantation).



This fire lane ryegrass planting can benefit timber and wildlife. It serves as a wide, green firebreak and a long food plot.



Adding sawtooth oak trees to this wheat plot adds diversity in the form of cover and a late-winter hard-mast component.



One percent of an area planted to year-round deer forages will positively impact the nutritional plane and response of white-tailed deer.

Wildlife Food-Planting Mixtures/Strip Planting

Food plots planted with two or more crops or mixtures provide diverse food and cover and often are used by more wildlife species than a one-crop field. These mixed plots can provide year-round use on smaller acreage. When planted, if one crop does not make, a second or third probably will produce. The better technique used for mixing crops is strip planting. Plant several long strips about 30 to 40 feet wide to alternating crops.

The following plant mixtures work well in a single plot. If you plant them together rather than in strips, there will be some competition.

Mixes	Planting Dates
Deer and Turkey	
Forage Cowpeas, Alyce Clover, Joint Vetch	May 1 to June 15
Arrowleaf, Red Clover, Crimson Clover, Ryegrass, Wheat	Sept. 1 to Nov. 1
Regal or Osceola (moist area), Ladino Clover, Ryegrass, Oats	Sept. 1 to Nov. 1
Bobwhite Quail and Mourning Dove	
Sunflower, Grain Sorghum, Browntop Millet	April 15 to May 15
Egyptian Wheat, Quailhaven Soybeans	April 15 to June 1
All Species	
Corn, Soybeans	April 1 to June 1

The following mixtures contain at least one excellent soil holder, several perennials, annual reseeder, and several good wildlife food plants. They are designed for the least site preparation and are small seeded, so you can distribute them with a hand seeder or a broadcaster and tractor. These are excellent for planting on roadsides, disked fire lanes, or log decks. You should cover plantings with wheat straw and fertilize, if direct seeded, for greatest benefit. Application will be around 60 pounds per acre for the total mix, and the cost will be in the \$1 to \$1.50 per pound range. Plant large seeded crops first, cut in, then apply small seeded crops (clovers) on top and cover lightly.

These plant mixtures are for minimal site preparation and are small seeded, so you can distribute them with a hand seeder or a broadcaster and tractor.

Planting Dates	
Late-Winter Mix	February to April
Orchard Grass, Korean Lespedeza, Kobe Lespedeza, Ladino Clover, Red Clover, Ryegrass, Alyce Clover (optional)	
Late-Spring Mix	May to June
Browntop Millet, Buckwheat, Korean Lespedeza, Wildflowers (optional)	
Fall Mix	September to November
Orchard Grass, Ladino Clover, Red Clover, Crimson Clover, Ryegrass, Wheat, Nebraska Rye, Meechee Arrowleaf Clover (optional)	

Note: Consult a wildlife biologist or local seed dealer before buying prepackaged, high-priced seed mixtures. Check bag contents and prices with several vendors. Often a seed dealer can customize seed mixtures at a much lower price while maintaining the same or similar contents as prepackaged mixes.

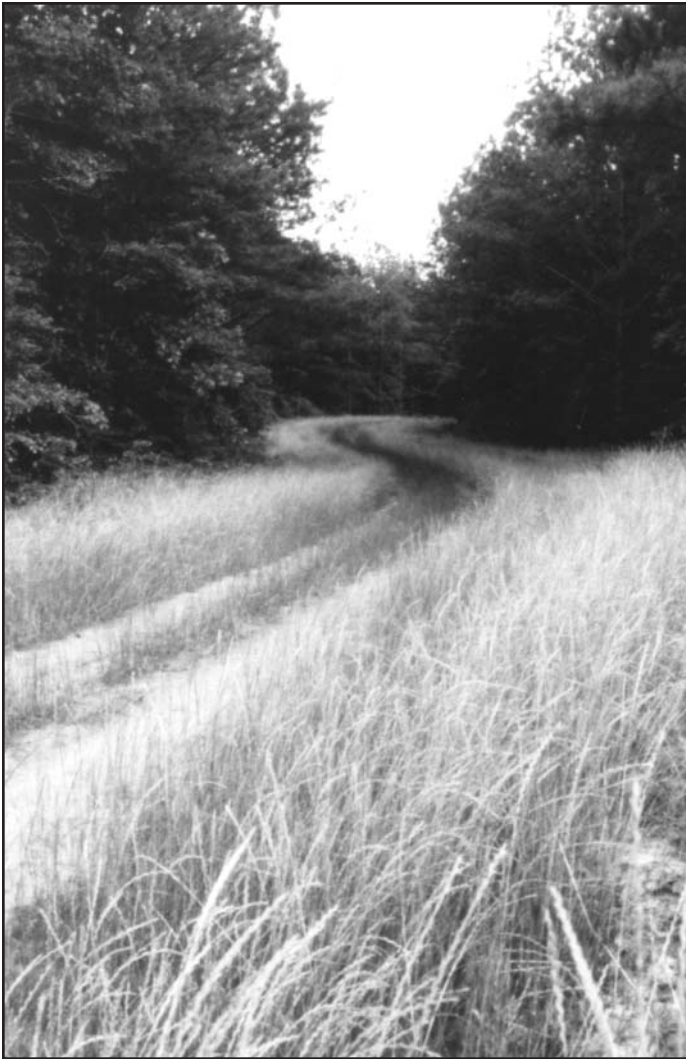
Plant Applications

Cool-season annuals are planted in late summer and early fall to provide forage and seed crops for fall, winter, and spring uses. These often make the best mixtures.

Before planting **legumes**, inoculate the seeds with a plant-specific packet of inoculum-containing bacteria (rhizobium) that fix nitrogen to the nodules of legume roots and allow nitrogen production and intake by plants. Inoculation of legume seeds will increase production of legumes, decrease fertilizer cost, and build soil quality. Mix the packet with a small amount of water or sugar water, then mix thoroughly with the seed just before planting. Avoid fertilizer contact with inoculated seed, if possible.

Perennial plants will continue to sprout each year after establishment. Some fertilizing and liming are required for continual growth. Periodic competition control, such as mowing or disking, is often needed.

Warm-season annuals are planted in early to late spring to provide forage and seed crops for summer and fall uses.



This secondary road is planted to gulf ryegrass for erosion control and wildlife management. Access is controlled with gates.



Alyce clover is one of the better warm-season forages for white-tailed deer.



Cereal grains such as wheat, oats, and rye are often chosen for cool-season plantings.



Quailhaven soybeans and milo are mixed in this planting.



Corn is popular as a planting because a variety of wildlife species use it, and it is highly desirable. It is a good source of carbohydrates but is low in protein.



Egyptian wheat will grow in many locations and in late winter provides good cover and food for bobwhites.



This stand of Japanese millet was planted for waterfowl.



This young 5-year-old stand of sawtooth oaks is starting to produce acorns.

Planting Materials Guide

Alfalfa

Companion plants

None; do not mix with other plants.

Description

A cool-season perennial legume, widely used by deer and turkey in the spring, summer, and fall. Provides nesting habitat, seeds, insects, and foliage for turkeys.

Fertilization

Soil tests are necessary; generally requires 150 pounds of phosphorus and 300 pounds of potassium per acre.

Lime requirements

Apply according to soil test or use amounts necessary to bring soil pH to 7.0.

Management

Mowing is required in early spring and late summer to keep shoots green and tender. Apply 75 pounds of (P) and 150 of (K) per acre annually after the first mowing.

Planting dates

September 1 to October 15.

Planting rates

Alfalfa inoculant required. Drill 15 pounds per acre at 1/4 of an inch, or broadcast 18 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Requires fertile, well-drained soils; not suited to heavy clay or wet soils.

Soil preparation

Disk plot in June and leave plot fallow until planting date; redisk and plant in a firm seedbed.

Varieties

Apollo, Vanguard, and Florida 77.

Austrian Winter Peas

Companion plants

Perennial grasses.

Description

A cool-season annual legume. Provides excellent fall, winter, and early spring foliage for deer and turkeys. Seeds mature from May to June.

Fertilization

A soil test is recommended, or use 250 pounds per acre of 0-14-14.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.0-7.0.

Planting dates

September 1 to November 1.

Planting rates

Vetch inoculant required. Drill 40 pounds per acre at 1/2 of an inch, or broadcast 40 to 60 pounds per acre; cover 1 inch.

Soil adaptation

Better adapted to heavy clay; moderately fertile to fertile soils.

Soil preparation

Plant in a well-disked seedbed.

Bahiagrass

Companion plants

Clovers, winter peas, and annual lespedeza.

Description

A warm-season perennial grass. Used heavily by wild turkeys as a source of insects and choice seeds.

Fertilization

A soil test is recommended, or use 400 pounds per acre of 13-13-13 or 15-15-15.

Lime requirements

Apply according to soil test or to maintain a soil pH of 5.5-6.0.

Management

Mow in early spring and late summer. Apply 150 pounds per acre of 34-0-0 annually after first mowing.

Planting dates

March 1 to June 1; September 1 to November 1.

Planting rates

Drill 15 pounds per acre at 1/4 of an inch, or broadcast 18 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Well adapted to most soils; best stands are obtained in sandy soils.

Soil preparation

Plant in a firm seedbed.

Varieties

Argentine, Paraguay, Pensacola, and Wilmington.

Barley

Companion plants

Ryegrass, clover, and vetch.

Description

A cool-season, annual small grain. Provides choice seeds for game and nongame birds and choice foliage for deer in early stages of growth. Barley is tolerant to cold weather.

Fertilization

Soil tests are recommended, or use 60 pounds of (N), 80 pounds of (P), and 80 pounds of (K)/acre.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 5.5 to 6.5.

Management

(Optimal) Apply 120 to 200 pounds per acre of 34-0-0 in February.

Planting dates

September 1 to November 1.

Planting rates

Drill or broadcast 1.5 bushels or 80 pounds of seeds per acre and cover 1 inch.

Soil adaptation

Adapted to well drained, light textured soils. Does not grow well in poorly drained or heavy clay soils.

Soil preparation

Plant in a well disked seedbed.

Bird's-Foot Trefoil

Companion plants

Ryegrass, clover, and vetch.

Description

A cool-season perennial legume. Mostly planted for quail and turkey. Provides a good source of foliage and insects. Grows to heights of 2 feet.

Fertilization

Soil tests are necessary. Generally, 75 pounds of (P) and 150 pounds of (K) are required.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.5 to 7.0.

Management

Mow in early spring and late summer.

Planting dates

September 1 to October 15.

Planting rates

Inoculation required. Drill or broadcast 12 pounds per acre, and cover seed 1/4 of an inch.

Soil adaptation

Most productive in the mountain and Piedmont regions. Adapted to well-drained soils.

Soil preparation

Disk plot in June and leave fallow until planting date. Redisk and plant seeds in a firm seedbed.

Varieties

Fergus, Empire, and Viking.

Buckwheat

Companion plants

Sunflower, millets, and grain sorghum.

Description

A warm-season annual grain. Used by deer, turkeys, waterfowl, quail, and doves. Hard to establish when deer populations are high.

Fertilization

Soil tests are recommended, or use 200-300 pounds per acre of 13-13-13 or 15-15-15.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.5 to 7.0.

Planting dates

May 1 to June 1.

Planting rates

Drill 30 pounds per acre at 1/4 of an inch, or broadcast 40 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Widely adapted to fertile and infertile soils. Grows best on well-drained sites.

Soil preparation

Plant in a firm seedbed.

Burnett

Companion plants

Clovers.

Description

A warm-season perennial forb planted mainly for quail. This is a small, creeping, seed-producing plant.

Fertilization

A soil test is recommended, or use 150 pounds per acre of 13-13-13 or 15-15-15.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.5 to 7.0.

Planting dates

March 1 to May 1.

Planting rates

Drill 4 pounds per acre at 1/4 of an inch, or broadcast 6 pounds per acre and cover 1/4 of an inch.

Soil adaptation

Requires fertile, well-drained upland soils.

Soil preparation

Plant in a firm seedbed.

Puna Chickory

Companion plants

Oats, Crimson, or Ladino clover

Description

Perennial herb; a member of the lettuce family. Selected for high yields in New Zealand. Planted in the fall, grows slowly until spring, then grows rapidly until it blooms in late summer. May last up to 3 years.

Fertilization

Soil tests are recommended, or use 50 units of nitrogen fertilizer every month.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.5 to 7.0.

Management

When stand declines, reseed in fall and cover lightly.

Planting dates

August 15 to October 31.

Planting rates

Plant 5 to 6 pounds per acre, and cover 1/4 of an inch.

Soil adaptation

Prefers well-drained site with good water-holding capacity.

Soil preparation

Plant in a firm, smooth seedbed prepared by plowing and dragging. Broadcast seed, and cover lightly.

Chufa

Companion plants

Grows best alone.

Description

A warm-season sedge. Chufa produces small, underground, nut-like tubers. These are choice foods for turkey, deer, and ducks, and are even tasty to humans. Chufa is also a delicacy to raccoons and can be severely damaged if plots are small and raccoon populations are high.

Fertilization

Soil tests are recommended, or use 300 pounds per acre of 13-13-13 or 15-15-15.

Lime requirements

Apply according to soil test, or use amounts necessary to bring soil pH to 5.5 to 6.5.

Management

You can often have second-year crops by disking in February to March and reapplying 100 to 150 pounds per acre of 13-13-13 or 15-15-15. Rotate crops to avoid nematode infestations.

Planting dates

April to May.

Planting rates

Plant 30 pounds per acre in 24- to 36-inch rows at 9-inch spacings, or broadcast 50 pounds per acre and cover seeds 1 inch.

Soil adaptation

Grows on well-drained to moderately well-drained soils; can be flooded if duck hunting is desired.

Soil preparation

Plant in a well-disked plot.

Clovers

Note: Clovers are excellent forages that provide high protein levels in winter for deer. Clover can be mixed with other cool-season annuals. The clovers discussed in this publication are best suited for the Southeast. Clover is expensive, ranging from \$1.70 per pound to \$2.50 per pound. Be careful to check clover prices carefully. Mixes packaged and marketed to produce trophy animals carry high price tags and often can be mixed at local seed dealers for half the cost. Clovers are site specific and perform best when you use lime to correct pH problems.

Alyce Clover

Companion plants

Plant with forage cowpeas and/or joint vetch. Reduce seeding rate to 10 pounds per acre when planting combinations.

Description

A warm-season legume that provides forage in the summer and early fall. Especially important to whitetailed deer; one of the few warm-season forages that holds up well to grazing pressure.

Fertilization

Apply according to soil test, or apply 200 pounds per acre of 0-14-14 after planting is established.

Lime requirements

Apply according to soil test, or apply amounts necessary to bring pH to 6.5-7.0.

Planting dates

May 1 to June 15.

Planting rates

Inoculate seeds. Broadcast 15 to 20 pounds per acre, or drill 16 pounds per acre.

Soil adaptation

Suited to most moderate to well-drained soils, including bottomland sites.

Soil preparation

Disk and plant in a firm seedbed.

Arrowleaf Clover

Companion plants

Ryegrass, barley, oats, wheat, and rye; although these will often outcompete clovers.

Description

A cool-season, reseeding annual legume. Grows to heights of 40 to 50 inches under fertile conditions. Seeds germinate in the fall, and plants grow slow in winter, then grow rapidly in spring. Flowers are white and pink. Seeds mature from late June to early August. Arrowleaf provides excellent foliage that attracts insects for turkeys and produces choice forage for deer, although palatability might be lower than some other clovers.

Fertilization

Apply according to soil test, or apply 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or apply amounts necessary to bring soil pH to 6.5 to 7.0 to ensure reseeding.

Management

Reseeding may be enhanced by bushhogging or light disking and fertilizing at the rate of 200 pounds per acre of 0-20-20 in October the following year.

Planting dates

September 1 to November 15.

Planting rates

Arrowleaf inoculant required. Drill 6 pounds per acre at 1/4 of an inch, or broadcast 6 to 8 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Best suited to fertile, well-drained soils. Grows best in sandy loams and light clay soils.

Soil preparation

Disk plot in July and leave fallow until planting date. Redisk and plant seeds in a firm seedbed.

Varieties

Meechee, Yuchi, Amclo, and Chief.

Ball Clover

Companion plants

Grasses.

Description

A rapid growing, cool-season annual legume that grows on sites not suitable to other clovers. Provides foliage and insects for turkeys and forage for deer.

Fertilization

Apply according to soil test, or use 200 pounds per acre of 0-20-20.

Management

Reseeding can be encouraged by mowing or disking and fertilizing at the rate of 300 pounds per acre of 0-20-20 in September.

Lime requirements

Apply according to soil test, or use amounts necessary to bring soil pH to 6.0.

Planting dates

September 1 to November 15.

Planting rates

White clover inoculant required. Drill 3 pounds per acre at 1/4 of an inch, or broadcast 3 to 4 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Adapted to a wide range of soils. Grows in heavy clays, poorly drained soils, and light-textured soils.

Soil preparation

Plant in a well disked plot, or broadcast over a closely mowed grass.

Crimson Clover

Companion plants

Ryegrass, small winter grains, other clovers, and vetch.

Description

A cool-season annual legume. Tolerates acidic soils. Provides insects and foliage for turkeys and forage for deer. Has pink-red blossoms and grows to heights of 3 feet. This is an excellent crop to plant to control erosion and beautify roadsides. Can be used in combination with other clovers, since it initiates growth quicker, but seeds out earlier than most clovers.

Fertilization

A soil test is recommended, or apply 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts necessary to bring soil pH to 6.5 to 7.5.

Management

Reseeding may be enhanced by disking or mowing the following fall. Apply 150 pounds per acre of 0-20-20 after soil disturbance.

Planting dates

September 1 to November 15.

Planting rates

Inoculation required. Drill 15 pounds per acre at 1/4 of an inch, or broadcast 20 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Best adapted to fertile, well-drained soils. Grows in loamy clay and heavy clay soils. Does not grow well in sandy soils.

Soil preparation

Plant in a firm seedbed. Can be planted immediately following summer pea crops with one disking.

Varieties

Autange, Chief, Dixie, and Tibbee.

Red Clover

Companion plants

Red clover grows best alone but can be planted with dallisgrass.

Description

A cool-season legume. Provides insects and foliage for turkeys and forage for deer.

Fertilization

A soil test is recommended. Apply 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.0 to 6.5.

Management

Mow in October and fertilize at the rate of 200 pounds of 0-20-20 per acre.

Planting dates

September 1 to November 15.

Planting rates

Requires a red clover inoculant. Drill 8 pounds per acre at 1/4 of an inch, or broadcast 810 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Grows best on fertile, well-drained soils. Does not grow well on sandy soils. Prefers a sandy, clay loam.

Soil preparation

Disk plot in July and leave fallow until planting date; redisk and plant in a firm seedbed.

Varieties

Kenland and Redland II.

Subterranean Clover

Companion plants

Warm-season perennials, ryegrass, cool-season winter grains, and vetch.

Description

A cool-season annual legume; very tolerant to shade; can be planted on temporary food plots, such as logging roads, and in strips of thinned timber. Makes excellent plots in short-rotation pine and provides foliage and insects for quail and turkeys and forage for deer.

Fertilization

Soil test recommended, or apply 250 pounds of 0-20-20 per acre.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 6.5 to 7.0.

Management

Reseeding can be enhanced by mowing or fall disking and fertilization of 200 pounds per acre of 0-20-20.

Planting dates

September 1 to October 15.

Planting rates

Requires subterranean inoculant. Drill 8 pounds per acre at 1/4 of an inch, or broadcast 15 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Best adapted to well-drained, sand, loam, or clay soils.

Soil preparation

Plant seeds in a well-prepared, firm seedbed.

Varieties

Mount Barker, Woogenellup, Tallarook, Nangech, and Meterora.

Ladino Clover/White Clover

Companion plants

Ryegrass, cool-season annual small grains, and vetch.

Description

A cool-season annual legume. A very popular clover for providing deer forage and foliage and insects for quail and turkey.

Fertilization

Soil tests are recommended, or use 400 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.5 to 7.0.

Management

Reseeding can often be enhanced by fall disking or mowing and fertilizing at the rate of 200 pounds per acre of 0-20-20.

Planting dates

September 1 to November 15.

Planting rates

Requires white clover inoculant. Drill 3 pounds per acre at 1/4 of an inch, or broadcast 4 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Very well adapted to fertile, bottomland, and moist soils.

Soil preparation

Plant in a firm seedbed. In wet areas, seeds and fertilizer can be broadcast and lightly disked in.

Varieties

Osceola, Tillman, Regal, Louisiana S1, and California.

White Dutch Clover

Companion Plants

Bahiagrass, dallisgrass, ryegrass, and cool-season annual small grains.

Description

A cool-season perennial legume. Grows well in shaded areas and can be planted on logging roads, decks, and in strips of thinned timber. Provides foliage and insects for quail and turkey and forage for deer.

Fertilization

A soil test is recommended, or apply 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts required to bring soil pH to 6.0 to 7.0.

Management

Reseeding can be enhanced by fall mowing and fertilization of 200 pounds per acre of 0-20-20.

Planting dates

September 1 to November 15.

Planting rates

Requires a white clover inoculant. Drill 4 pounds per acre at 1.4 inches, or broadcast 4 to 6 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Well adapted to fertile, bottomland, wet soils.

Varieties

New Zealand.

Corn

Companion Plants

Soybeans, cowpeas, and winter legumes.

Description

A warm-season annual; a very favored and sought-after crop for wildlife. Corn is high in carbohydrate energy.

Fertilization

A soil test is recommended, or use 300 pounds per acre of 15-15-15 on poor sites and 200 to 250 pounds per acre of 6-12-12 on fertile sites.

Lime requirements

Apply according to soil test, or use amounts required to bring soil pH to 6.5-7.0.

Management

For ducks, if flooding is desired, do not plant with any winter legumes. You can plant Japanese millet and cereal grains nearby for height/diet diversity. For deer, leave standing in patches near the wood's edge. For turkey and quail, allow seeds to fall naturally or knock down by hand or with a mower. For doves, mow in strips to provide scattered seeds and clean ground.

Planting dates

Ideally, April 1 to May 1.

Planting rates

Plant 12 pounds per acre in 36-inch rows, no till-in with legumes, or broadcast 12 to 15 pounds per acre and cover 1 inch.

Soil adaptation

Well-drained loam or light clay soils are best. You may choose moderately drained soils if you want flooding for ducks.

Soil preparation

Plant in a well-prepared seedbed.

Varieties

There are numerous varieties. Those that produce low-growing "ears" are best for wildlife.

Cowpeas

Companion plants

Other warm-season annual peas and browntop millet.

Description

A warm-season annual legume. Browsed by deer and rarely eaten by doves but highly used by turkey and quail.

Fertilization

A soil test is recommended, or use 100 pounds per acre of 0-20-20.

Lime requirements

A soil test is recommended, or use amount required to maintain a soil pH of 5.5 to 7.0.

Planting dates

May 1 to July 1.

Planting rates

Plant 15 pounds per acre in 24- to 36-inch rows, or broadcast 25 pounds per acre and cover 1 inch. Inoculant required.

Soil Adaptation

Adapted to well-drained soils, from sandy loams to heavy soils.

Soil preparation

Plant in a firm seedbed.

Varieties

Thorsby Cream, Tory, Wilcox, and Cat Jang.

Dallisgrass

Description

A long-lived perennial bunch grass; can be planted in spring and fall with other grasses and clovers. Attracts insects, provides foliage and good nesting habitat for turkeys; also good for erosion control.

Fertilization

A soil test is recommended, or use 400 pounds per acre of 13-13-13.

Management

Early spring and late summer mowing with one annual fertilization of 250 pounds per acre of 13-13-13 after the first mowing.

Lime requirements

Apply according to soil test, or 12 tons per acre in absence of test.

Planting dates

February 15 to May 15 or September 1 to October 15.

Planting rates

Broadcast 10 pounds per acre, and cover 1/2 of an inch.

Soil adaptation

Adapted to fertile, moist, well-drained, light- and heavy-clay-textured soils.

Soil preparation

Plant in a well-prepared seedbed.

Egyptian Wheat

Description

Egyptian wheat is actually an annual sorghum that grows up to 8 feet tall. It grows in thick stands, and heads will easily fall to the ground (lodge) at maturity. Makes cover and choice seeds for quail and turkey.

Fertilization

A soil test is recommended, or use 200 pounds per acre of 13-13-13.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.5 to 6.5.

Planting dates

April 1 to May 15.

Planting rates

Drill 6 pounds per acre at 1/4 of an inch, or broadcast 6 to 10 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Widely adapted to well-drained, light-textured soils.

Soil preparation

Plant in well-disked plots. Best to plant in patches 8 to 12 feet

wide and 30 to 50 feet long. Excellent for providing cover in large fields; you can strip plant it alternately with other warm-season grasses.

Elbon Rye

Companion plants

Other cool-season, annual small grains, ryegrass, vetch, and clover.

Description

An annual, cool-season, small grain (similar to wheat). Choice food of doves, ducks, quail, turkeys; browsed heavily by deer in early stages of growth. Rye grows very fast and loses its protein level early. Rye is a cold-tolerant small grain; provides forage for deer in fall and winter, if kept mowed. Rye provides nesting, bugging areas, and seed for quail and turkey; usually dies back in early summer.

Fertilization

A soil test is recommended, or apply 200 pounds of 13-13-13 per acre.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.5 to 6.5.

Management

Apply 200 pounds of 34-0-0 per acre in February.

Planting dates

September 1 to November 15.

Planting rates

Drill or broadcast 1.5 bushels or 80 pounds of seed per acre and cover 1 inch.

Soil adaptation

Adapted to well-drained, light-textured clay soils. Does not grow well in poorly drained soils.

Soil preparation

Plant in a well-disked seedbed.

Grain Sorghum

Companion plants

Browntop millet, corn, sunflower, and winter legumes.

Description

A very hardy, warm-season annual with tall, medium, and dwarf varieties. Favorite foods of turkeys, quail, doves, and, less often, ducks.

Fertilization

A soil test is recommended, or use 150 to 250 pounds of 13-13-13 per acre.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.6 to 6.5.

Management Management

If you choose larger varieties, knock down with mower at maturity; often you can make second crops after pruning heads with mower.

Planting dates

April 15 to June 15.

Planting rates

Plant 8 pounds per acre in 24- to 36-inch rows, or broadcast 12 to 15 pounds per acre and cover 1 inch.

Soil adaptation

Bottomland, well-drained, heavy clay to clay loam soils are best. However, moderately-drained soils are acceptable when you want flooding.

Soil preparation

Plant in a well-disked seedbed.

Varieties

Choose non-bird resistant, dwarf varieties such as Kafir, Hegair, Milo, and small game food sorghum.

Lab Lab

Companion plants

Other drought-resistant warm-season legumes; millet, corn, and sorghum.

Description

Very drought tolerant, fast growing, erect, warm-season legume that is weakly perennial and does not readily reseed. Used widely in south Texas. Highly preferred by deer.

Fertilization

Soil tests are recommended, or use 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.0 to 7.5.

Management

Seedlings are not competitive. Keep seedbed free of weeds, and avoid grazing or browsing for the first month after establishment. Must be reseeded each year. Inoculate before planting.

Planting dates

April 15 to June 15.

Planting rates

Drill 5 to 10 pounds per acre at 1/4 of an inch, or broadcast 10 to 20 pounds per acre and cover 1/2 to 3/4 of an inch.

Soil adaptation

Grows on well-drained, sandy, upland sites. Very drought tolerant; will not tolerate wet soils.

Soil preparation

Plant in a well prepared, firm seedbed.

Lespedezas

Note: *Lespedeza* is an excellent crop for the bobwhite quail. You can plant annual lespedezas with other summer grasses, legumes, and grains. Seeds will also germinate and sprout without soil disturbances, especially on areas overseeded after prescribed burning. These are good plantings for seeding roadsides. *Sericea lespedeza* is widely planted for soil erosion and hay. However, its seeds are not palatable to quail and turkeys. You get better stands of shrub lespedeza by transplanting prepared seedlings from a nursery.

Annual Lespedeza

Description

Kobe and Korean lespedeza are reseeding annual legumes. Kobe grows about 6 to 10 inches high, and Korean grows about 12 to 18 inches high. Both produce seeds for quail and turkey.

Fertilization

A soil test is recommended, or use 200 to 300 pounds of 0-20-20 per acre.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.0 to 6.5.

Management

Reseeding can be enhanced by disking and fertilizing with 100 pounds of 0-20-20 per acre.

Planting dates

March 1 (Kobe) to May 1 (Korean)

Planting rates

Broadcast 10 pounds per acre, and cover 1/2 of an inch.

Soil adaptation

Adapted to well drained soils, primarily sandy loams to clay loams.

Soil preparation

Plant in a well-disked seedbed, or direct seed along fire lanes and roadsides.

Shrub Lespedeza

Description

Two types of shrub lespedeza are commonly planted in this region. Bicolor is the number-one planted lespedeza and is a sought-after plant of the bobwhite quail. Bicolor produces choice seeds for quail and turkeys and provides suitable nesting cover. Deer will also heavily browse these plants. The other is *Thunbergii*. It also provides choice seeds for quail and turkey but supposedly is more deer resistant than other lespedezas. Both of these species are perennial legumes that grow to heights of 5 to 8 feet.

Fertilization

A soil test is recommended, or apply 400 pounds of 0-20-20 per acre in fields (depleted areas), or 250 pounds per acre in woods.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.0.

Management

Shrub lespedeza should be bushhogged and refertilized with 200 pounds of 0-20-20 per acre just before spring green-up.

Method of establishment

Direct seeding or seedling transplants.

Planting dates

November 15 to March 1.

Planting rates

Broadcast 15 pounds per acre, or plant seedlings in rows 2 to 3 feet apart with 18- to 24-inch spacings between plants. A long and narrow plot 4 to 5 rows wide and at least 200 feet long (1,000 to 2,000 plants) is recommended. Plant along fence rows and at edge of woods for transition zones and through thinned

timber of fields to break up touching, single vegetative layer areas.

Soil adaptation

Well-drained sandy loam to clay loam sites.

Soil preparation

If you will seed lespedeza, plant in a well-prepared, firm seedbed. Although not necessary, disking would help hand-planting tremendously. A tractor with three-point hitch planter is essential when planting considerable numbers/plots of bush lespedeza seedlings.

Varieties

Bicolor Strain 101; Thunbergii Amquail and Attaway.

Browntop Millet

Companion plants

Winter legumes, grain sorghum, and sunflower.

Description

A summer annual grass that grows up to 3 feet high and matures in 60 days. Seeds are choice foods of quail, turkeys, doves, waterfowl, and non-game birds.

Fertilization

A soil test is recommended, or use 300 pounds of 6-12-12 per acre. Additional use of nitrogen may cause less seed production and more grass production, which is not desirable, unless planted for hay.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.5 to 7.0.

Planting dates

For doves, plant 80 days before the season. For ducks, plant in late July to early August and flood several weeks before desired hunting date.

Planting rates

Drill 8 pounds per acre at 1/4 of an inch, or broadcast 10 pounds per acre and cover 1/2 of an inch; can be planted in 2 to 3-foot rows at 8 pounds per acre.

Soil adaptation

Well adapted to all upland soils and well-drained bottomland soils.

Soil preparation

Plant in a well disked seedbed.

Dove Proso Millet

Companion plants

Grows best alone.

Description

A warm-season annual grass that grows up to 6 feet high. Seeds mature in 80 days; choice seeds of doves, quail, and turkeys.

Fertilization

A soil test is recommended, or use 300 pounds of 6-12-12 per acre.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 5.5 to 6.5.

Planting dates

May 15 to June 15.

Planting rates

Drill 15 pounds per acre at 1/4 of an inch, or broadcast 15 to 20 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Adapted to well-drained fertile soils.

Soil preparation

Plant in a well-disked seedbed.

Foxtail Millet

Companion plants

Usually outcompetes other grasses.

Description

A warm-season annual grass that varies in height according to variety. Seeds mature in 90 days; choice seeds of doves, quail, and turkeys.

Fertilization

A soil test is recommended, or apply 300 pounds per acre of 6-12-12.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.5 to 6.5.

Planting dates

May 15 to June 1.

Planting rates

Drill 15 pounds per acre at 1/4 of an inch, or broadcast 15 to 20 pounds per acre and cover 1/2 of an inch.

Soil adaptation

Adapted to well-drained upland soils.

Soil preparation

Plant in a well-disked seedbed.

Varieties

Common, German, and Hungarian.

Japanese Millet

Companion Plants

Grows best alone.

Description

A warm-season, annual reseeding grass that grows up to 2 to 4 feet tall. Seeds mature in 50 to 60 days. Japanese millet is the most popular planting used for ducks. This plant can withstand shallow flooding during growth. It produces choice seeds for ducks, doves, quail, and turkeys and provides forage for deer.

Fertilization

Apply 200 pounds per acre of 13-13-13. Fertilization is not required when direct seeding on mud flats.

Lime requirements

Use amounts required to maintain a soil pH of 6.0.

Management

Flood 2 weeks before duck season. It is prone to lay over and sprout if flooded for extended periods.

Planting dates

As near August 1 as possible for waterfowl.

Planting rates

Broadcast 20 pounds per acre, and cover 1/4 of an inch.

Soil adaptation

Grows best on wet soils.

Soil preparation

Plant in a well-disked seedbed, or direct seed onto mud flats.

Oats

Companion plants

Ryegrass, clover, vetch.

Description

A cool-season annual small grain that is a choice food of doves, ducks, quail, turkeys, and browsed by deer in early stages of growth. Oats are not as cold hardy as are wheat, barley, and rye.

Fertilization

A soil test is recommended, or use 200 pounds per acre of 13-13-13.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.5 to 6.5.

Management

Apply an additional 200 pounds per acre of 34-0-0 in February.

Planting dates

September 1 to November 1.

Planting rates

Broadcast or drill 1.5 bushels or 80 pounds of seed per acre, and cover 1 inch.

Soil adaptation

Adapted to well-drained, light-textured soils.

Soil preparation

Plant in a well-disked seedbed.

Partridge Pea

Description

A reseeding, warm-season annual legume with small fern-like leaves, yellow flowers, and short pods containing black seeds. Grows naturally along roadsides, fence rows, ditch banks, and fallow fields. Seeds are a staple of the bobwhite quail.

Fertilization

Not required on fertile sites; infertile sites require 200 pounds per acre of 0-20-20.

Management

Partridge pea needs to be disked in February every third year to ensure proper reseeding.

Planting dates

February 1 to March 15.

Planting rates

Drill or broadcast 15 pounds of scarified seed per acre.

Soil adaptation

Grows naturally on all soils in this region.

Soil preparation

Can be planted on closely mowed grasses and lightly disked in, or can be planted in a well-disked seedbed.

Rape

Companion plants

Wheat, rye, turnips.

Description

An erect, warm-season perennial that resembles turnips. Highly preferred by deer.

Fertilization

Soil tests are recommended, or use 50 to 75 pounds per acre of 10-10-10.

Lime requirements

Apply according to soil tests, or use amounts necessary to maintain a soil pH of 6.5 to 7.0.

Planting dates

August 1 to September 15.

Planting rates

Plant 8 to 10 pounds per acre and cover 1/4 of an inch.

Soil adaptation

Well suited for damp soils.

Soil preparation

Plant in a firm seedbed. A good plant for no-till seed combinations.

Varieties

Dwarf essex

Ryegrass

Companion plants

All cool-season small grains, clover, and vetch.

Description

A cool-season annual grass heavily browsed by deer; provides forage and insect habitat for turkeys and quail.

Fertilization

A soil test is recommended, or apply 250 pounds per acre of 13-13-13.

Management

In December, apply 150 pounds per acre of 34-0-0.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.0.

Planting dates

September 1 to November 1

Planting rates

Drill or broadcast 20 to 30 pounds of seed per acre and cover 1 inch.

Soil adaptation

Adapted to all textured, well-drained soils, except sandy soils.

Soil preparation

Plant in a well-disked seedbed.

Varieties

Gulf Coast, Marshall (cold tolerant), and Jackson (rust resistant).

Sawtooth Oak

Description

An oak introduced from Asia that can produce mast crops of acorns in 5 to 6 years. It has long, shallow, lobed leaves like Chestnut Oak and produces acorns about 5/8 of an inch to 1 1/4 inches long. Deer, turkeys, and squirrels are attracted to these acorns. Sawtooth oak is in the white oak group.

Fertilization

Not recommended until second year. At that time, apply 4 to 6 ounces of 15-15-15 per tree in a circular fashion around the tree.

Lime requirements

While research is still being conducted on exact rates, a pH of 5.5 to 6.0 is desirable for other white oaks.

Management

After the second year, continue to fertilize with 4 to 6 ounces of 13-13-13 until mast crops appear. Control weed competition by mowing or disking. Thinning is required when limbs start to touch.

Planting date

January.

Planting rates

Obtain 1 year old seedlings. Plant in a 10 by 8 foot spacing, with trees 8 feet apart and rows 10 feet apart.

Soil adaptation

Adapted to fertile, well-drained sites and can withstand flooding in the dormant season. Sawtooth oaks are difficult to establish on many Southeastern sites.

Soil preparation

Plant in an area that can be mowed.

Soybeans

Companion plants

Corn.

Description

A warm-season annual legume. Provides food and cover for rabbits, turkeys, quail, doves, and ducks. Browsed heavily by deer in early stages of growth.

Fertilization

A soil test is recommended, or use 300 pounds per acre of 0-20-20.

Management

If planted for waterfowl, remember that non-reseeding variety seeds will spoil in 30 days after flooding. Also, waterfowl do not use the protein in soybeans efficiently, even though they readily eat them. Plant large plots in areas with high deer densities, or plots will be overgrazed quickly.

Lime requirements

Apply according to soil test, or use amounts required to maintain a soil pH of 5.8 to 7.0.

Planting dates

May 1 to June 1.

Planting rates

Plant 30 pounds per acre in 24- to 36-inch rows, or drill 30 pounds per acre at 10-inch row spacing, or broadcast 50 pounds per acre and cover 1/2 of an inch; inoculant required.

Soil adaptation

Adapted to well-drained, medium-textured soils such as sandy loams and clay loams.

Soil preparation

Plant in a well-disked, firm seedbed.

Varieties

There are hundreds of varieties; reseeding varieties, such as Bobwhite and Quailhaven, are being studied at the SCS Plant Materials Center in Coffeerville. Select "forage-type" varieties for best performance.

Sunflower

Companion plants

Browntop millet, grain sorghum.

Description

A warm-season annual that is a highly favored food source for mourning doves. Seeds are also used by turkeys, quail, and non-game birds. Plant the dwarf varieties where possible.

Fertilization

A soil test is recommended, or use 300 pounds per acre of 13-13-13.

Lime requirements

Apply according to soil test, or apply amounts necessary to maintain a soil pH of 5.5 to 6.5.

Management

Mow several strips randomly through plot to clean the ground, and scatter the seeds; should be done at least 14 days before dove season.

Planting dates

April 15 to June 15. If planted for doves, plant before May 15 to ensure seed maturity for dove shoots in September.

Planting rates

Drill or broadcast 10 to 15 pounds per acre at 1/4 to 1/2 of an inch. For best results, plant 15 pounds of seed per acre in 36-inch rows.

Soil adaptation

Best adapted to fertile, well-drained soils.

Soil preparation

Plant in a well-disked seedbed.

Vetch

Companion plants

Cool-season small grains, ryegrass, clover.

Description

A cool-season annual legume. Grows rapidly in late winter and early spring. Provides choice seeds and foliage for turkey and bobwhite quail; browsed heavily by deer.

Fertilization

A soil test is recommended, or use 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts required to maintain a pH of 5.5 to 6.5.

Management

To enhance reseeding, disk plot every third year in February, and apply 100 pounds per acre of 0-20-20.

Planting dates

September 1 to November 1.

Planting rates

Drill 20 pounds per acre at 1/4 of an inch, or broadcast 25 to 30 pounds per acre and cover 1/2 of an inch; inoculant required.

Soil adaptation

Adapted to well-drained, medium textured soils.

Soil preparation

Plant in a well-disked seedbed.

Varieties

Hairy vetch, the most hardy and widely planted; smooth vetch, same as hairy, without hairs on stem; grandiflora, the best reseeded of the three and can be encouraged naturally by winter diskings.

Joint Vetch (Deer Vetch)

Companion plants

Warm-season perennial grasses.

Description

A warm-season annual, reseeding legume. Provides excellent forage for deer and succulent foliage and seeds for dove, quail, and turkeys. Will grow on wet sites and can be flooded 18 to 24 inches for ducks.

Fertilization

A soil test is recommended, or use 300 pounds per acre of 0-10-20.

Lime requirements

Apply according to soil test, or apply amounts necessary to maintain a soil pH of 5.5 to 6.5.

Management

You can enhance reseeding by spring disking; reapply 300 pounds per acre of 0-10-20.

Planting dates

March 1 to June 1.

Planting rates

Broadcast 8 to 10 pounds per acre and cover 1/2 of an inch; inoculation required.

Soil adaptation

Adapted to moist, and wet, light textured soils. Do not plant in sandy soils.

Soil preparation

Plant in a well-disked, firm seedbed.

Wheat

Companion plants

Ryegrass, clover, vetches.

Description

A cool-season, annual small grain, widely planted; highly favored by ducks, doves, quail, and turkey as a source of seed; also, heavily browsed by deer in early stages of growth.

Fertilization

A soil test is recommended, or use 200 pounds per acre of 13-13-13.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 5.5 to 6.5.

Management

Apply an additional 200 pounds per acre of 34-0-0 in February.

Planting dates

September 1 to November 1.

Planting rates

Broadcast 80 pounds (1.5 bushels) per acre and cover 1 inch.

Soil adaptation

Adapted to well-drained, lightly textured soils; does not grow well in poorly drained soils or heavy clays.

Soil preparation

Plant in a well-disked seedbed.

Wild Winter Peas

Companion plants

Bahiagrass and dallisgrass.

Description

A cool-season, annual reseeding legume. Grows up to 3 feet high and makes rapid growth in spring. Seeds mature in June. These peas are also known as rough winter peas, singletary peas, and caley peas. These peas are choice food of quail and turkeys and heavily used by deer.

Fertilization

A soil test is recommended, or use 300 pounds per acre of 0-20-20.

Lime requirements

Apply according to soil test, or use amounts necessary to maintain a soil pH of 6.0 to 7.0.

Management

You can enhance reseeding by early fall disking and reapplication of fertilizer at the rate of 200 pounds per acre of 0-20-20.

Planting dates

September 1 to November 15.

Planting rate

Broadcast 30 pounds per acre, and cover 1 inch. Must use scarified seed. Vetch inoculant required.

Soil adaptation

Better adapted to heavy clay, fertile to moderately fertile soils.

Soil preparation

Plant in a well-disked seedbed.



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Revised by **Dr. Ben West**, Assistant Extension Professor, Wildlife & Fisheries. Originally adapted by Dean Stewart from *Wildlife Food Planting Guide for PCA Recreation Users* by David McArthur, Wildlife Manager, Tennessee Packaging. Photographs courtesy of Dean Stewart, former Extension Associate; Dr. Richard Kaminiski, Professor of Wildlife; and Dr. Harry A. Jacobson, Professor of Wildlife, Mississippi State University.

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(rev-2500-08-04)



Wildlife Food Plot Planting Guide For the Southeast



Crop	Forage Class ^A	Varieties	Planting Dates	Planting Rate (lbs./acre) ^B			Wildlife
				Drill	Broadcast	Inoculant ^C	
Alyceclover	L/A		May 1 – June 15	15	20	EL	Deer
Aeschynomene (American Jointvetch, Deervetch)	L/A	Lee, Glenn	March 15 – June 15	15	20	EL	Deer-Dove-Quail
Alfalfa	L/P	Alfagraze, Amerigraze 401 & 702, Ameristand, Bulldog 505	Sept. 1 – Oct. 15	15	20	A	Deer-Quail-Turkey-Rabbit
Austrian Winter Peas	L/A	Granger, Fenn, Melrose	Sept. 1 – Nov. 1	30	40	C	Deer-Turkey
Benne or Sesame	F/A	(90- to 120-day maturity)	April 1 – June 30	5	10		Dove-Quail
Birdsfoot Trefoil	L/P	AU Dewey, Fergus (best in a mix with grasses or other legumes)	Sept. 1 – Oct. 15	6	10	K	Deer-Quail-Turkey-Rabbit
Brassicas	F/A	Available varieties of Rape, Kale, Turnip, Canola	Sept. 1 – Oct. 15	5	10		Deer-Rabbit-Turkey
Buckwheat	F/A	Japanese, Silverhull, CommonGray, Mancan, Manor, Royal, Tokyo	May 1 – June 1	40	60		Deer-Dove-Duck-Quail-Turkey
Burnett, Small	F/P	Delar	March 1 – May 1	5	10		Deer-Quail
Chicory	F/P	Choice, Puna, Puna II, Brow Tyne, Six Point, Oasis	Sept. 1 – Oct. 15	2	4		Deer-Rabbit-Turkey
Chufa	G/A	Turkey Gold, Wingmaster	April 1 – June 1	25	40		Deer-Turkey-Duck
Clover, Arrowleaf	L/A	Meeche, Yuchi, Amclo, Apache	Sept. 1 – Oct. 15	10	15	O	Deer-Turkey-Rabbit
Clover, Ball	L/A		Sept. 1 – Oct. 15	2	3	B	Deer-Turkey
Clover, Berseem	L/A	Bigbee, Tibbee	Sept. 1 – Oct. 1	10	20	R	Deer-Turkey
Clover, Crimson	L/A	Chief, Autauga, Dixie, Tibbee, Auburn, Talladega	Sept. 1 – Oct. 15	20	30	R	Deer-Turkey-Rabbit
Clover, Ladino (White) ^D	L/P	Osceola, Regal, Louisiana-S1, Patriot, Durana, Regalgraze	Sept. 1 – Oct. 15	4	5	B	Deer-Quail-Turkey-Rabbit
Clover, Red	L/P	Kenland, Redland Max, Redland Graze, Redland III, Bulldog, Kenstar	Sept. 1 – Oct. 15	8	12	B	Deer-Quail-Turkey-Rabbit
Clover, Subterranean	L/A	Woogenellup, Mt. Barker, Daliak, Clare, Nuba, Nungarin	Aug. 15 – Oct. 15	15	20	WR	Deer-Quail-Turkey-Rabbit
Corn ^E	G/A	Commercial varieties Dwarf Tropical	March 15 – June 1	12	15		Deer-Dove-Duck-Quail-Turkey
Cowpeas	L/A	Iron Clay, Red Ripper, Combine	May 1 – July 1	15	45	EL	Deer-Quail-Turkey
Egyptian Wheat	G/A		April 1 – June 1	5	15		Dove-Quail-Turkey
Grain Sorghum ^E	G/A	Kafir, Hegair, Dwarf Milo, Commercial varieties (90-to 115-day maturity, depending on variety)	April 15 – June 15	10	15		Dove-Duck-Quail-Turkey
Lab Lab	L/A	Rongai, Highworth, Rio Verde	April 1 – June 1	5	10	EL	Deer-Rabbit
Lespedeza, Annual	L/A	Common, Kobe, Korean	March 1 – April 1	20	30	EL	Quail-Turkey
Lespedeza, Shrub ^F	L/P	Amquail Thunbergii, Attaway, Bicolor 101	March 1 – April 1	6	12	EL	Quail
Millet, Browntop	G/A	Commercial varieties (60- to 65-day maturity)	May 1 – August 1	15	25		Dove-Duck-Quail-Turkey
Millet, Proso	G/A	Dove Proso, White Proso (75-day maturity)	May 1 – June 30	15	30		Dove-Duck-Quail-Turkey
Millet, Foxtail	G/A	Common, German, Hungarian (90-day maturity)	May 1 – July 1	15	25		Dove-Quail-Turkey
Millet, Japanese	G/A	Common, Chiwapa, Golden Millet (80- to 120-day maturity, depending on variety)	May 1 – August 1	12	25		Dove-Duck-Quail-Turkey
Oats	G/A	Arkansas 604 & 833, Buck Forage, Buck Magnet Chapman, Coker, Dallas, Florida 501, Harrison Horizon 314, Rogers, TAM 606	Aug. 15 – Oct. 15	90	120		Deer-Dove-Quail-Turkey-Rabbit
Partridge Peas	L/A	Lark Selection, Showy, Commanche	Feb. 1 – May 1	6	10	EL	Quail
Rye	G/A	Elbon, Wrens Abruzzi, Wondergraze, Vitagraze Wintergrazer 70, Maton, Bates	Aug. 15 – Oct. 15	90	120		Deer-Dove-Quail-Turkey
Ryegrass ^G	G/A	Commercial varieties, Gulf, Tetraploid, Marshall Passerel Plus	Sept. 1 – Nov. 1	20	30		Deer-Quail-Turkey-Rabbit
Soybeans ^E	L/A	Commercial varieties, Tyrone, Hutchinson	April 15 – June 1	30	60	S	Deer-Dove-Duck-Quail-Turkey
Soybeans, Wildlife	L/A	Quail Haven, Laredo	April 15 – June 15	10	25	S	Deer-Quail-Turkey-Rabbit
Sunflower ^E	F/A	Commercial Black Oil Hybrids, Peredovick (120-day maturity)	April 1 – May 15	4	15		Dove
Triticale	G/A	Tamcale 5019, Beagle 82, Trical 102 & 336	Aug. 15 – Oct. 15	90	120		Deer-Turkey
Vetch	L/A	Bigflower; Hairy-Madison, Auburn, Americus, Oregon, Lana; Common-AU Olympic, Willamette	Sept. 1 – Oct. 15	20	30	C	Deer-Dove-Quail-Turkey-Rabbit
Wheat	G/A	Commercial forage varieties, Longhorn, Lockett, GA Gore, Saluda	Aug. 15 – Oct. 15	90	120		Deer-Dove-Quail-Turkey-Rabbit

The information given here is for educational purposes only. References to commercial products or trade names are made with the understanding that no discrimination is intended against other products that may also be suitable.

^A Forage classes: A = Annual; F = Forb; G = Grass; L = Legume; P = Perennial

^B All of the above planting rates assume a complete stand for each species. If you plan to mix species, reduce planting rates (such as when broadcasting a 50/50 mixture of wheat and oats, use 60 lbs of each for a total of 120 lbs)

^C Purchase either preinoculated legume seed or inoculate with the appropriate inoculant before planting.

^D This seeding rate is based on preinoculated seed coated with clay/lime. Use 2 (drill) or 3 (broadcast) pounds of uncoated seed.

^E Broadcasting seed is not recommended for these plantings. Drilling seed in rows improves forage and seed production.

^F Potentially invasive non-native species; may require mechanical and herbicidal control in some situations.

^G Potentially invasive non-native species; may require mechanical and herbicidal control in some situations. Most appropriate for shady, acidic, or wet sites where other forages perform poorly.

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By Dr. Bronson Strickland, Assistant Extension Professor, Wildlife & Fisheries; Richard Taylor, Mississippi Seedsmen's Association; Kevin Nelms, USDA Natural Resources Conservation Service; and John Gruchy, Mississippi Department of Wildlife, Fisheries & Parks.

Soil sample boxes can be picked up at your county MSU Extension Service office. It is important that all information asked for on the container, as well as any additional paperwork, be filled out completely and accurately. Crop code 95 should be used for any wildlife seed mixtures (clover, alfalfa, ryegrass, chufa, etc.).

For more information, forms, sample boxes, sampling publications, packaging, and instructions, contact your local county Extension Office or MSU-ES Soil Testing Laboratory. The cost is \$6.00 per soil sample.

Samples may be sent directly to the MSU-ES Soil Testing laboratory at the address below or may be returned to you local MSU-ES office. Be sure to include the information sheet and check or money order with the package. Label and tightly secure the shipping container.

MAIL PACKAGES TO:
MSU-ES Soil Testing Laboratory
Box 9610
Mississippi State, MS 39762-9610

Mississippi State University Extension Service Soil Testing Laboratory is committed to meeting the needs of its clientele with an accurate and timely report of soil or plant sample for optimum production.



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By **Karl K. Crouse, Ph.D.**, Assistant Extension Professor, Plant and Soil Sciences, and **Ben West, Ph.D.**, Assistant Extension Professor, Wildlife and Fisheries

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soil tests for WILDLIFE FOOD PLOTS



IF YOU ARE INTERESTED IN *enhancing*

wildlife ON YOUR PROPERTY-

bigger deer, more quail, larger turkeys-

THEN YOU MUST UNDERSTAND THE

SIGNIFICANCE OF SOILS. SOIL FERTILITY AND

TYPE INFLUENCES MANY ASPECTS OF

WILDLIFE, INCLUDING POPULATION

DISTRIBUTION, ABUNDANCE, and QUALITY.

FOR EXAMPLE, RESEARCH HAS SHOWN THAT

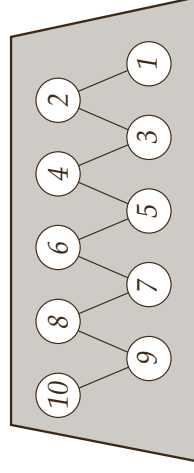
ANTLER SIZE IN WHITE-TAILED DEER IS

DIRECTLY AFFECTED BY SOIL FERTILITY.



The establishment of food plots is one management technique that more and more landowners are using to benefit wildlife. If you are interested in establishing food plots for wildlife, a soil test is necessary for success. A soil test will provide recommendations for lime and fertilizer, customized to your site and for the plants in which you are interested. The MSU-Extension Service soil testing laboratory runs a variety of tests on soil samples including: pH, buffer pH (lime requirement), phosphorus, potassium, calcium, magnesium, sodium, and zinc. Based on these tests, your report will recommend levels of nitrogen, phosphorus, and potassium needed for your specific situation. In addition, a soil test will provide you with lime recommendations to balance acidic soils, which are common in Mississippi. However, because some soils within the state are alkaline and do not require lime, a soil test is always recommended to determine the requirements for your site. Lime can improve the physical, chemical, and biological conditions in acidic soils, resulting in greater root proliferation, earlier aboveground plant growth, and improved nutrient and water uptake. Without proper liming, fertilization can be a wasted effort and expense (see table).

Proper collection of soil samples is extremely important to ensure reliable recommendations. To properly collect a soil sample, take several sub-samples from throughout the field and mix them together to obtain an average for the entire area. The number of sub-samples needed is dependent on the size of the field; as a rule of thumb, take about 10 sub-samples for every acre in the field. Thus, if you planned to establish a 1-acre wildlife food plot, plan on taking 10 sub-samples that you would combine into a single sample for that field. Sub-samples should be collected from the top layer of soil, which is 0-6 inches in depth. Mix the sub-samples together to form a uniform sample and discard any plant material that could have been collected.



SOURCE: *Practical Fertilizer Use*, 4th edition, IMC Fertilizer, Inc.

SOIL ACIDITY	NITROGEN	PHOSPHATE	POTASH	FERTILIZER WASTED
Extremely Acid 4.5 pH	30%	23%	33%	71.34%
Very Strong Acid 5.0 pH	53%	34%	52%	53.67%
Strongly Acid 5.5 pH	77%	48%	77%	32.69%
Medium Acid 6.0 pH	89%	52%	100%	19.67%
Neutral 7.0 pH	100%	100%	100%	0.00%

