



ecology & management of the **NORTHERN BOBWHITE**

*A*bundant 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*).

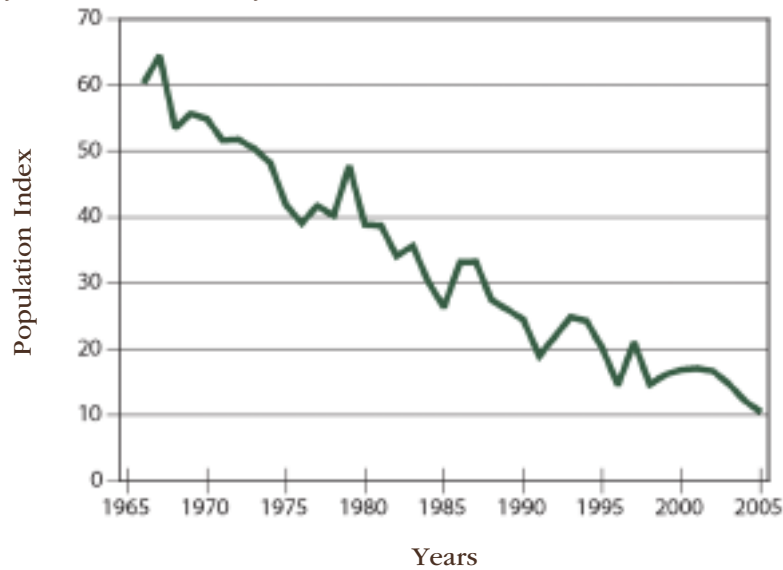
The main cause of the decline in bobwhite populations has been loss of habitat associated with advanced natural plant succession (closed-canopy forests), industrialization of farming and forestry, reduced use of prescribed fire, and extensive conversions of native plant communities to non-native, invasive 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.



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



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



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.

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.

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

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

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.

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.”

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.

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.

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



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



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



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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

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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 (*Radiolida* 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.



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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-

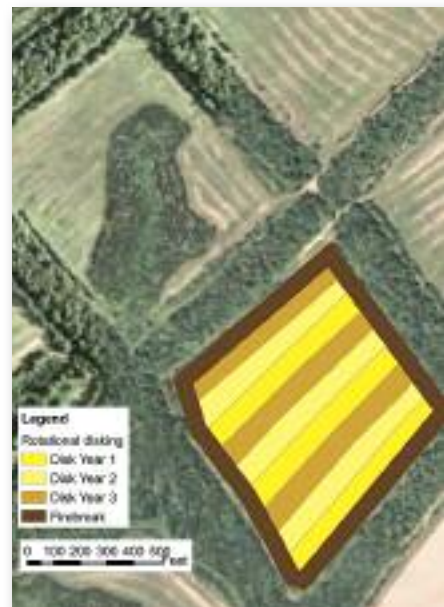
prescribed burning



strip disking



vegetation response after prescribed burning or strip disking



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



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.



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.

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

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

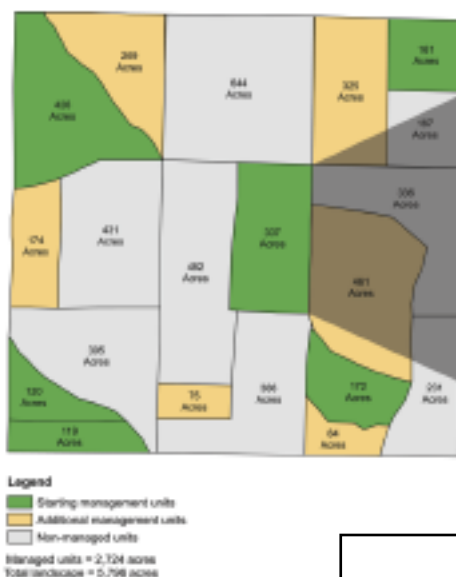
Landscape-level Habitat Management

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

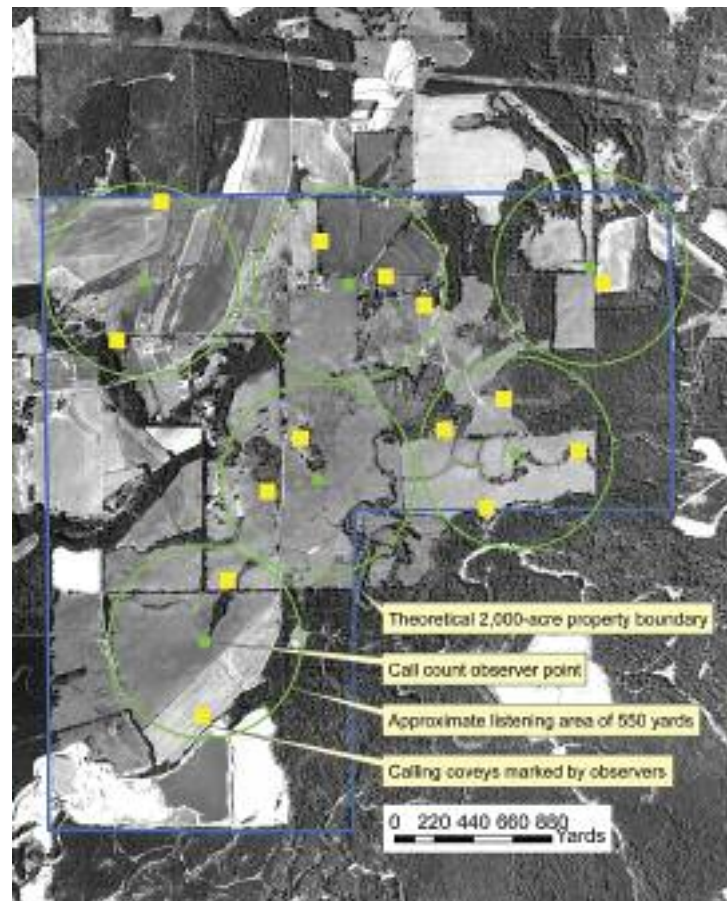
Fall Population Estimation

Population monitoring allows you to evaluate the effectiveness of your habitat management program. You can use covey-call surveys to estimate fall bob-white 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 bob-white 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/>

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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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Revised by Rick Hamrick, Research Associate, Forest and Wildlife Research Center – Wildlife and Fisheries; Wes Burger, Professor, Forest and Wildlife Research Center – Wildlife and Fisheries; **Bronson Strickland**, Assistant Extension Professor, Forest and Wildlife Research Center – Wildlife and Fisheries; David Godwin, Small Game Coordinator, Mississippi Department of Wildlife, Fisheries and Parks; from an earlier edition by Dean Stewart, former Extension Wildlife Specialist; David Godwin, and Wes Burger. This project was partially funded by Mississippi State University, Mississippi Department of Wildlife Fisheries and Parks, National Fish and Wildlife Foundation, and Quail Unlimited, Inc. with support from the U.S. Fish and Wildlife Service and the Southern Company 'Power of Flight' program.

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