

Ecology & Management

of the

Northern Bobwhite

Early Europeans who settled in North America brought with them a rich tradition of hunting wild fowl, and they adapted their practices to game birds they found in the New World. Bobwhite, native to the new land, quickly became the premier upland game bird, possibly because interest centered around the challenging sport-hunting opportunities, excellent table fare, and the bird's princely appearance and familiar call.



The northern bobwhite is the most widespread of the six species of quail in this country. The range of its five subspecies covers the South, where early on quail hunting quickly became known as **the** gentleman's sport. Since early times, large blocks of land across the South have been devoted to the sport of bobwhite quail hunting. Photographs and stories of great hunts on Southern plantations chronicle the plentiful supply of birds beginning before the turn of the 20th century.

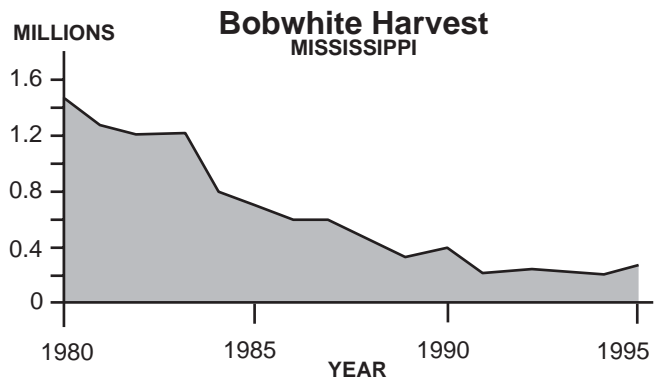
At the turn of the century, interest in bobwhite hunting was high in Mississippi. Numerous properties such as the Bailey Place in Yalobusha County, Cameron Plantation in Madison County, and Longleaf Farms in Lamar County were managed intensively for quail. Bobwhite quail numbers reached peak levels from 1900 to the mid-1950's, and then began a slow decline. The high quail populations were, for the most part, a by-product of existing land-man-

agement practices developed as early settlers carved out farms in large expanses of forestland. As forests were cleared, small patch farms sprang up. Annual burning of cutovers and open pine forests, along with associated grazing of livestock and cropping, provided the right patchwork or "mosaic" of early successional habitats that birds require—and the birds flourished.

Population Trends

As human activity once accidentally created optimal habitat, changes in the ways people used lands contributed to declining habitat quality. In Mississippi and other southeastern states, bobwhite quail and many other small game species associated with early successional stages and grasslands have declined over the last several decades to historically low population levels. In fact, the bobwhite quail population has declined in over three-fourths

of the states in its geographic range. Specifically, bobwhite populations have declined in Mississippi by more than 70 percent over the last 30 years, which translates to an average decline of 3.6 percent from 1966 through 1994. This rate of decline escalated from an average of 1.5 percent per year during the 1960's and 1970's to nearly 5 percent per year during the 1980's and 1990's. These population declines are attributed to many causes, including predators, pathogens, and pesticides. The primary cause of decline, however, is deteriorating bobwhite habitat quality due to advanced natural succession, intensive monoculture farming, more intensive timber management, reduced use of prescribed burning, and the extensive use of exotic grasses (e.g., fescue and bermuda).



Courtesy of Mississippi Department of Wildlife, Fisheries and Parks

Bobwhite harvest trend reflects the population decline

Historical Land-Use Patterns

High bobwhite populations of past decades were accidental by-products of diverse land-use practices that created a patchwork of row crops, grasses, fallow acres, and forested lands to which bobwhite were ideally suited.

In 1931 Herbert Stoddard, the “dean” of bobwhite quail research, published *The Bobwhite Quail: Its Habits, Preservation, and Increase*. Beginning in 1935 and continuing for the next several decades, there was an explosion of bobwhite research conducted by wildlife biologists. Researchers and other professionals learned that bobwhites require patchy habitats that provide a mix of bare ground, seeds, and insects, and vegetation for nesting, brood-rearing cover, and protection from predators.

Although bobwhites require grasslands, agricultural crops, and woodlands, too much of one component results in a deficiency of another and reduces habitat quality. Modern land-use practices simplify the landscape by producing an abundance of one habitat type and excluding others. For example, agricultural and forestry practices emphasize optimal food and fiber production but eliminate the patchy landscape bobwhites require. Changes in agricultural and forestry practices over the last three decades have contributed to declining bobwhite populations.

Since the end of World War II, agricultural farming methods have progressively become more mechanized, and chemical control of pests has increased dramatically. Farm sizes increased in Mississippi from 22 hectares in 1942 to 337 hectares in 1992, and farm numbers decreased from 291,092 to 12,800 over the same period. These broad-scaled changes eliminated thousands of miles of weedy ditch banks and fence rows, and millions of acres of small fields that once provided nesting, brood rearing, and protective cover for the bobwhite. Marginal areas once farmed for crops were abandoned or converted to modern, intensively managed pine plantations.

Abandoned agricultural areas may be suitable bobwhite habitat for 2 to 3 years after abandonment; however, within a few years, plant succession causes these types of areas to “grow out” of bobwhite habitat. Stoddard noted, “The grass-bound field is the greatest enemy of the bobwhite quail.”

Like abandoned fields, areas converted to pine plantations are acceptable bobwhite habitat for a short time, but because of reduced soil disturbance and diminished sunlight to the forest floor, pine plantations quickly eliminate understory conditions favorable for the bobwhite.

Selective cutting of mature pine forests has been replaced by short rotation, high-tree-density pine plantations. Intensive mechanical and prescribed fire-site-preparation practices have been replaced by more soil-conserving practices. The soil

disturbance and scarification associated with more intensive site-preparation methods stimulate germination of important seed-producing plants.

Another factor used historically in conjunction with agriculture and forestry further complicates the habitat question. Native Americans typically burned vast areas of natural pine forests for purposes that included game management, increasing hunting success, and improving access. Fire improves habitat for the bobwhite quail. In the past, controlled burning also played an important role in the management of agricultural and forested lands.

Prescribed burning was a common practice in this century until recent decades. Its use has declined because of alternative methods of accomplishing the same objectives, declining ownership tract size, and the human health and liability risks associated with smoke and fire.

Where pine lands were historically burned frequently, such as every year or two, now fire is eliminated from the landscape, or is used less frequently. Many forest landowners burn on 5- to 7-year cycles, or less frequently. In the absence of fire, the grassy/weedy understory is replaced by dense hardwood brush that shades and outcompetes the herbaceous ground cover essential for bobwhite nesting, brooding, and foraging. Bobwhite do not tolerate the thick vegetative conditions produced with infrequent burns; and hence, diminished use of fire contributes in part to the bobwhite's decline.

Grazing practices have also changed significantly over the years. Some 30 years ago, sheep and cattle grazed on native grasses and vegetation. Farmers rotated livestock among native grass fields and woodlots. Today, most pastures are planted to fields of exotic grasses such as fescue, bermuda, or bahia, which provide high-quality grazing but poor quail habitat. Additionally, open-range grazing practices that produced an irregular mosaic of grazed and ungrazed patches have been

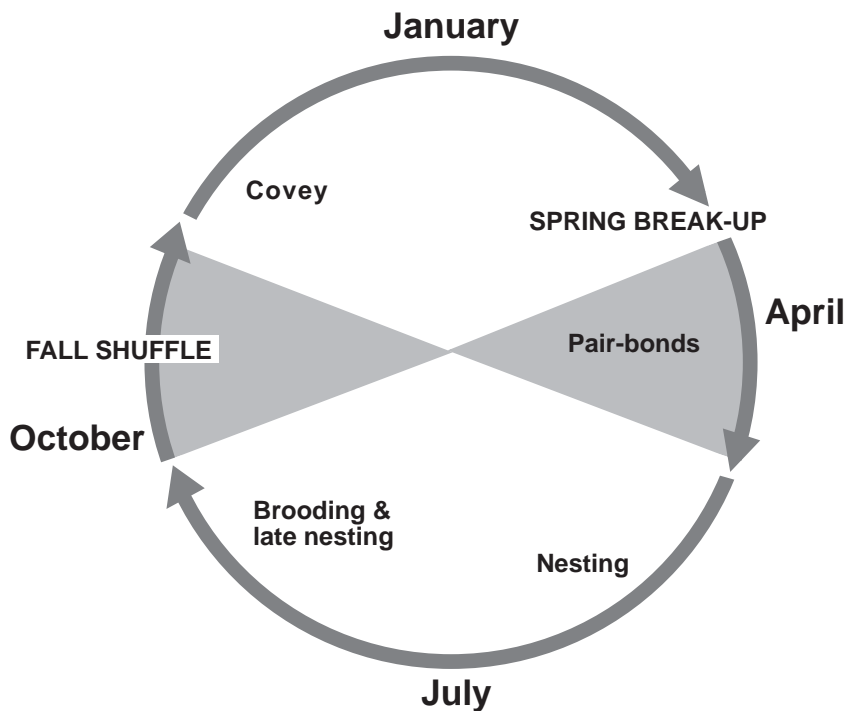
replaced with uniform, intensive grazing by animals confined to smaller areas. Higher stocking rates result in better use of forage resources but do not produce the diverse plant community created by former grazing practices.

In general, although other factors cloud the bobwhite picture, changing land-use patterns and conditions have resulted in the declining quantity and quality of habitat for the bobwhite. Unless active management of bobwhite habitat is pursued, the tremendous populations of bobwhite quail once enjoyed might become part of the past.

Can Quail Be Managed Successfully?

While the declining bobwhite population trend can be discouraging, the good news is that bobwhites do respond well to certain habitat-management practices. If effort is put into on-the-ground management, bobwhite numbers can be dramatically increased, usually in just a few years! Bobwhites are a prolific species and can respond rapidly to habitat management; however, it is important to recognize that the magnitude of bobwhite response is related to the intensity of management. A little management produces a little response, and a large population increase requires intensive habitat management.

Several years ago, Lucian Minor's covey records of his 3,400-acre Rainey Farm in north Mississippi revealed that his bobwhite population was at an all-time low of 16 coveys. He initiated the necessary bobwhite habitat management practices, including strip disking old fields of broomsedge, and he developed vast stands of bobwhite foods that volunteered following the soil disturbance. Other practices included burning and food planting. Within 4 years, covey numbers had increased by 7.5 times to 120 coveys! Intensive bobwhite habitat management does work, and usually produces acceptable results.



Life History

Courtship and Nesting

The familiar two- or three-note “bob-white” whistle made by males in early spring to attract a female is the earliest sign the reproductive season is starting. Courting pairs are initially formed in March and April; however, pair bonds will form and break, then re-form throughout the breeding season, which runs from May to September. During a given breeding season, individual bobwhites may mate and initiate nesting attempts with as many as three different mates. Nests are incubated by the male or the female, but bobwhite rarely alternate incubation duties. This complex social structure allows multiple nesting attempts during the breeding season and contributes to the bird’s high reproductive potential.

Bobwhites usually select a nest site where grasses are the predominant vegetative type. Bobwhites prefer knee-high cover for nesting, near an edge that adjoins an opening or bare ground. Some scattered woody vegetation can enhance the site. The male constructs the nest under the

critical eye of the female. The nest is built on a slight depression in the soil, using available dead grasses and stems, which often include broomsedge and pine straw. Construction takes about a day. The hen lays about one egg daily until the clutch of 12 to 15 eggs is produced. This usually requires from 15 to 20 days following completion of nest construction, often with a slight delay between construction and the onset of egg-laying. The average clutch is 14 eggs. Within 2 to 5 days of the last egg laid, the hen or cock will start incubation.

Females incubate three-fourths of the nests and, thus, are most susceptible to nest predators, which take their toll. Incubation is a risky job, and 55 to 70 percent of the nests are destroyed by predators, mowing activities, or weather events. The attending adult is killed in about 25 percent of nest failures. After 23 days of incubation, with only a couple of brief feeding periods each day, the eggs hatch. Once hatching begins, most chicks emerge within an hour or two. As soon as the precocial chicks are dry, the hen uses her survival instincts to lead them away from the nest. Those not hatching or hatching late are left behind.

Brood Rearing

Reproductive attempts may require from 44 to 53 days, and peak hatch is around mid-July. About one-third of the birds are successful with the first nesting attempt, and quail may re-nest two to three times attempting to bring off a brood. Even then, because of weather, predators, field clipping, or other disturbances, not all pairs successfully produce a brood. Through repeated re-nesting, about 75 percent of those birds surviving the breeding season ultimately hatch a nest. Double clutching/brooding does occur but is so rare the impact on populations is insignificant.

Newly-hatched chicks are covered with natal down, weigh about one-quarter of an ounce, and are not much larger than bumble bees. They are very alert, move

around on the ground quite readily, and are flightless for the first 2 weeks. Parents watch the chicks closely, and the brood may cover from 2 to 100 acres during the flightless period. Hens take the chicks to open, insect-rich “bugging” habitat that provides the right amount of protection from predators, intense heat, or wet conditions, yet allows the small chicks to move freely around and through vegetation. The first 2 weeks are the most critical, because loss to predation and bad weather may take 50 percent or more of the hatch.

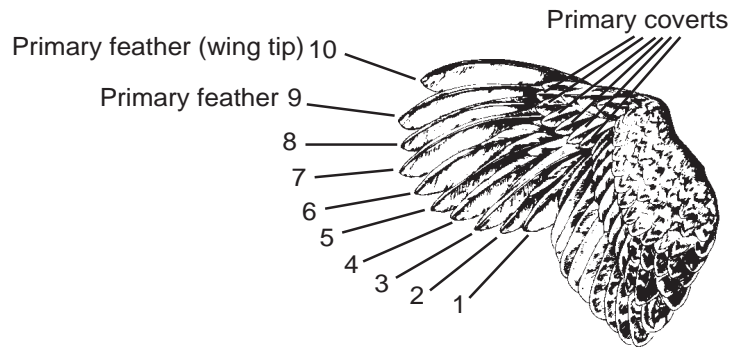
“Brooding” or covering of chicks at night and during much of the day is accomplished by one or both adults. The danger to the attending adult is not over yet. During the first 14 days after hatch, the flightless chicks are quite vulnerable to predators. Bobwhites are tenacious parents and hesitate leaving the flightless chicks, even when attacked by a predator. Although predation is high during incubation, attending flightless chicks is twice as risky as incubating a nest.

Between weeks 2 and 6, chicks develop juvenile plumage and flight abilities; by 6 weeks of age, the chick’s diet shifts partially from insects to seeds and berries. At 12 to 16 weeks, juvenile size closely resembles that of adults. By the age of 21 weeks, bobwhite have the plumage that will be worn into the next breeding season. At 2 months, 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. 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. Some broods may hatch in early October, but most are complete by mid- to late summer.

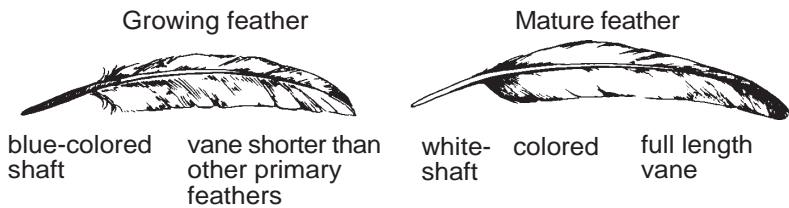
Summer life for birds of all ages consists of daytime activities of traveling, feeding, dusting to clean feathers, and loafing. They may feed during early morning, rest during midmorning, loaf, sleep, and dust during the middle of the day, and feed during the 2 to 3 hours before dark.

Identifying Age

Wing Nomenclature



Primary Feather Growth Characteristics



Age Characteristics

Bird less than one year old

Primary covert buff-tipped or sharp-pointed



Primaries #10 and 9 frayed and pointed



Bird more than one year old

Primary covert **not** buff-tipped and rounded



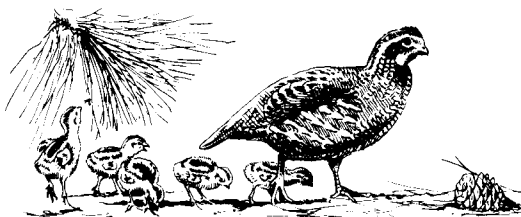
Primaries #10 and 9 smooth and rounded



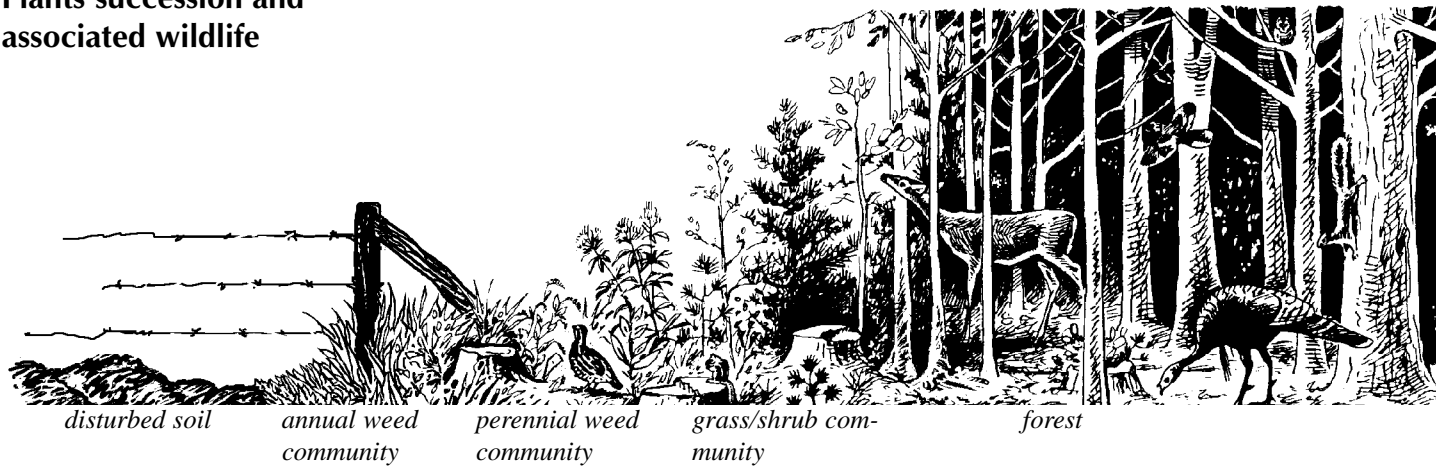
Primary feather replacement sequence

—look for the growing feathers—

Growing primary feather	1	2	3	4	5	6	7	8	9	10
Quail age—feather growth (weeks)	4	5	6	7	8	9	10	14	Not replaced this season	



Plants succession and associated wildlife



To meet food and cover requirements, bobwhite need a mix of bare ground and early successional stages of vegetation.

Covey Structure

By late summer, bobwhites begin to exhibit 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 implications. The bobwhite's preferred mode of travel is by foot. Flying is energetically expensive and exposes birds to avian predators (e.g., hawks and owls).

During late summer and early fall, birds begin to intermix from brood to brood and form "coveys" or social groups of birds that band together in groups of 20 to 30. These groups ultimately may be reduced to coveys of 10 to 15 as birds settle into their winter ranges. This period of transition and increased movement is often called the "fall shuffle," and populations have reached their peaks for the year. As fall and winter arrive, food is most abundant, bird movements can be reduced, and the tight-knit coveys are composed of 75 to 80 percent juvenile birds. A covey will not normally mix with another covey, although covey ranges may overlap. Depending on habitat quality, coveys may require from 20 to 160 acres or more each to meet their needs.

As much as 80 percent of the early fall population may be lost to natural mortality by the following spring. As winter progresses, cover and food conditions deteriorate. Food is at an all-time low in late winter, just before spring green-up. Environmental and other factors take their

tolls on populations. As spring gets closer, longer days and better weather trigger the gradual breakup of the coveys. The bobwhite calls begin in earnest, and pairing begins again as the breeding season arrives.

Habitat Needs

Bobwhite quail are adapted to survive and flourish under habitat conditions that provide early successional stages of plant vegetation, whether under the open canopy of a pine forest, around cultivated areas, or on lands that are actively grazed. Bobwhites are impacted by soil and site quality and do best on moderately fertile, well-drained soils with a high clay-silt component.

If left undisturbed, natural plant communities gradually change over time. Following soil disturbance, an annual weed community develops initially. Within 2 to 3 years, this community is replaced by a perennial weed community, which gradually transitions into a perennial grass community, then a grass/shrub/old field community. This process may take from 5 to 10 years, depending on soil fertility, moisture conditions, length of growing season, etc. If left undisturbed, this grass/shrub community eventually becomes a forest. This process is called "natural or ecological succession." Bobwhite depend on different early successional stages of this continuum to meet specific seasonal habitat

needs. Management must set back natural plant succession and create early successional annual weed and grass plant communities; **frequent soil and vegetation disturbance is critical to maintaining good bobwhite habitat.**

Like other animals, bobwhites have basic habitat requirements for survival. They are water, food, cover, and space—all must be present. The requirement that is in shortest supply, or the limiting factor, will restrict bobwhite populations. Fortunately, water is rarely a limiting factor in Mississippi, as bobwhite generally meet their water needs through dew, moisture in food items such as berries and insects, and metabolic water that is produced during digestion. Free-standing water may be used when available, but is usually not required.

Specific food and cover needs of the bobwhite change throughout the year. These needs are provided by distinct, early successional plant communities that are present in differing habitat combinations. Food and cover really cannot be separated, since many important cover-plant species also provide equally important foods, and vice versa. What is important is for cover and food to be provided close together and present year-round. Bobwhites forage on the ground; therefore, dense vegetation or thick litter restricts movement and inhibits foraging. Cover should be open at the ground level so birds can move and feed easily, but bobwhites also need a dense overhead canopy to provide protection from predators and the elements.

In the late spring and summer, nesting cover consists of fallow grasslands, or grassland conditions under open forests, which have been undisturbed for 2 to 3 years. These contain dead grasses and litter (e.g., pine straw) that may be used in nest construction. As the time since disturbance increases beyond 3 years, litter accumulates, grasses become too dense, and nesting habitat quality declines. Stoddard found that 75 percent of nest sites were within 50 feet of openings such as roads,

paths, and edges of fields, and nearly 90 percent of nests were constructed of vegetation produced during the previous season. The microsite for the nest is usually a place slightly thicker than its surroundings, such as a tuft of grass or a fallen tree limb. Nests are often near a summer food source like blackberries, so that less time away from the nest is required for foraging.

Although weed and grain seeds are dietary components of the adult bobwhite, newly hatched chicks require a different diet. In the first 6 weeks of life, bobwhite chicks eat a high protein diet composed almost exclusively of insects. These are abundant in stands of annual grasses and broad-leaved weeds, and are easily accessible in areas with abundant bare ground.

Brood rearing requires a totally different type cover from nesting and is characterized by the annual weed community found in areas that have been left fallow 1 to 2 years after soil disturbance. A fallow row-crop field planted the year before is a good example and often provides an abundance of high-protein insects chicks need for rapid development. Good brood habitat also provides overhead cover to conceal birds from predators, while remaining relatively open at ground level for easy chick movement. More than 50 percent bare ground, with little accumulated plant litter, allows easy access by chicks.

Dusting areas are needed year-round and can consist of small, drier, open areas of bare ground located close to overhead cover. Edges of crop fields adjacent to hedge rows are examples of suitable dusting areas.

Escape cover allows the bobwhite to avoid predators. Dense stands of overgrown shrubby cover such as plum thickets or shrub lespedeza patches can provide protection and food sources together. If they have shrubby components, grown-up fence rows and ditch banks interspersed among cultivated fields can also provide



Pair bonds will form and break, then reform throughout the breeding season, which runs from May to September.

Important native and planted quail foods

Native Foods

Trees and Shrubs	Forbs, Legumes, Grasses
Ash	Annual/Perennial
Black Cherry	Lespedezas
Black Gum	Barnyardgrass
Dogwood	Beggarweed
Hawthorn	Butterfly pea
Huckleberry	Croton
Oak	Common Ragweed
Pine	Foxtail
Plum	Johnsongrass
Mulberry	Milk Pea
Sumac	Panic Grass
Sweetgum	Partridge Pea
Viburnum	Paspalum
Vines	Vetches
Blackberry	
Dewberry	
Greenbriar	
Honeysuckle	
Wild Grape	

Planted Foods

Autumn Olive	Grain Sorghum
Bicolor Lespedeza	Kobe Lespedeza
Browntop Millet	Korean Lespedeza
Common Lespedeza	Laredo Soybeans
Corn	Partridge Pea
Crimson Clover	Proso Millet
Egyptian Wheat	Wheat

Note: Quail eat the seeds, fruits, and some green vegetation from these plants. Several of these plants provide excellent cover for nesting, brood rearing, escape, and roosting.

escape cover and food. Escape cover is needed year-round in proximity to other cover and food needs. Transition zones, where different heights and types of cover are found that “feather” habitat changes (from woods to an open agricultural field, for example) provide a mix of escape cover and feeding areas.

During moderate weather, sparse vegetation about 2 feet tall and open overhead provides preferred roosting cover. Bobwhites select sites with good drainage and southwestern exposures that have been warmed by the afternoon sun. These sites are often on bare ground and need to be in or adjacent to suitable early morning or

late-afternoon feeding areas. Sites with dense cover such as a honeysuckle thicket or dense stand of shrubs may be used during severe weather to provide a break from wind, rain, or freezing conditions.

Loafing cover is normally close to feeding and escape cover so movements are minimized. If the covey is disturbed, only a short flight to suitable escape cover is required.

Diet

The bobwhite quail is a seed eater, although seasonal diets vary considerably, depending on food availability and nutritional requirements. In early spring, green plant leaves are the most frequently used food and are thought to be an important vitamin source. Insects are a major food item from spring through fall, especially during the nesting and brood-rearing seasons, when insects make up as much as 80 percent of the diet of chicks. Hens also eat more insects than do the cocks during the period of egg formation. During the summer, soft fruits and seeds such as blackberries, wild grapes, and grass seeds of various types provide carbohydrate-rich, high-energy foods. The fall period furnishes a variety of native foods, and quail prefer large grass seeds early on. Legume seeds are important nearly year-round. These are particularly important later in the fall and may be taken almost exclusively by winter’s end. Legume seeds may include beggar weeds, milk peas, butterfly peas, wild lespedezas, and partridge peas. When available, hard-mast items such as acorns and pine seed are important from fall through late winter. Other mast items such as dogwood fruit are also important at this time. Agricultural crops such as corn, soybeans, and millets can supplement or replace certain native foods when they are not available.

Within a home range, or area that a covey will normally use to meet year-round needs, all the seasonal food and cover needs must be available. You can

establish a distinct covey “headquarters” in an area of 1 acre or less. With all needs met nearby, little covey movement is necessary, energy is conserved, and predation is reduced. The headquarters’ area may be rather open, with only low vegetative cover, but if disturbed frequently, the birds will find increased use for heavier cover.

Habitat Management

Now that the life history and seasonal habitat needs of bobwhite quail have been explored, the next step is to look at management practices proven to increase bobwhite populations. Good bobwhite populations require careful thought and planning, followed by on-the-ground, labor-intensive management practices.

The objective with habitat management is to provide the mosaic of early successional stage habitat attractive to bobwhite and meet all the seasonal food and cover needs mentioned earlier in this publication. In general, interspersing habitat types as closely together as possible and providing the maximum amount of edge and transition zones will, on a broad scale, accomplish this goal. For example, small cultivated crops such as corn or soybeans adjacent to weedy ditch banks and fence rows, open, burned pine forests, and 2- to 3-year-old fallow fields provide ideal habitat conditions.

Tools and Prescriptions

Fire

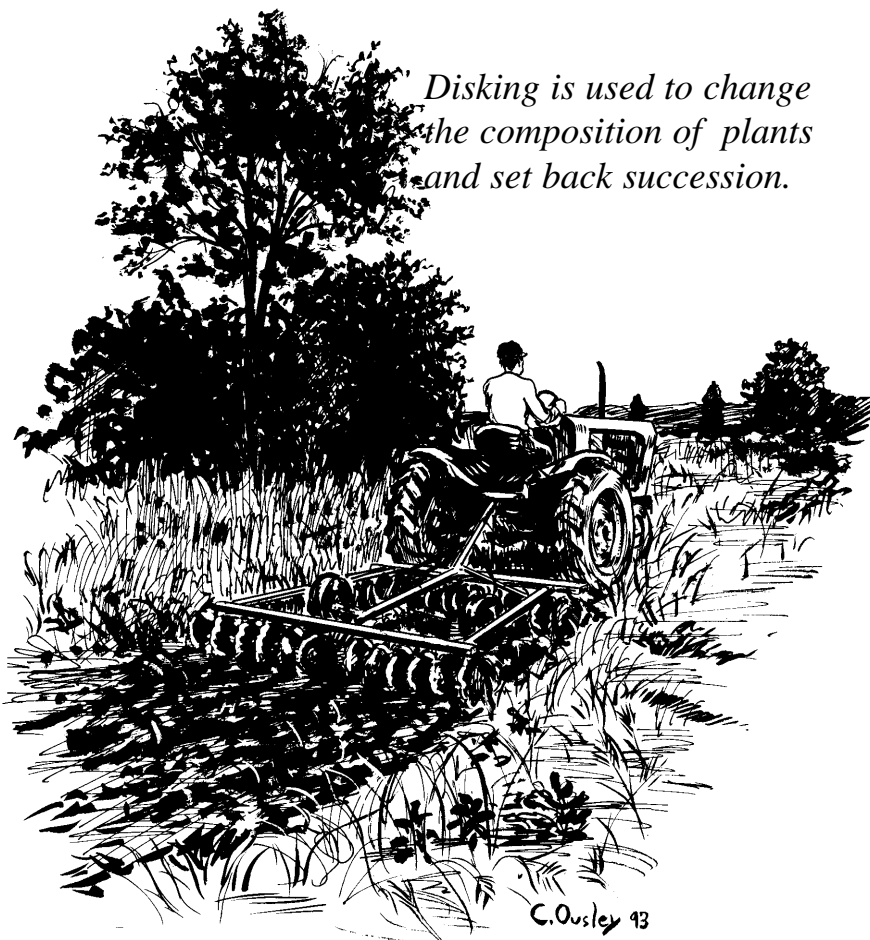
One of the most important tools in a manager’s arsenal is wise use of prescribed fire, which is the most cost effective and best tool. Use fire in pine or mixed pine/hardwood forests, old fields, pastures, fallow cropland, CRP fields, and transition areas. Fire is best employed on a 1- to 3-year cycle outside of the nesting season. Late-winter burns are often safest, but late-summer burns may increase legume production and, in forested stands, offer the

best control on undesirable hardwood sprouts. Fire reduces dead plant material, stimulates desirable legume growth, exposes mineral soil, and provides open, early successional vegetation stages. Professional guidance is always important when using fire.

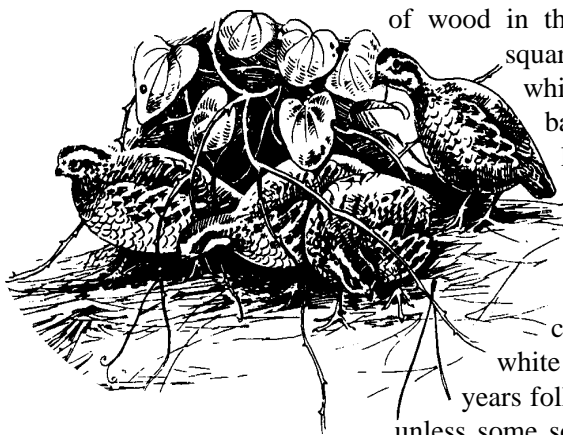
Strip Disking

Soil disturbance is also critical. Disking is used to change the composition of plants and set back succession. Removing dense grasses provides room for better seed producers. Strip disking is a technique that involves disking strips through a fallow field or open woods during the fall or spring. Make these strips 30 to 50 feet wide, and separate them by undisked strips 60 to 100 feet wide. Make the strips as long as possible, and follow

Disking is used to change the composition of plants and set back succession.



Bobwhites need overhead protective cover to avoid predators and bare ground to have easy access to seeds and other foods.



the contour of the land. Think of the strips as a rest-rotation system. After a year, disk another swath next to the previously disked strip. This develops a mosaic of vegetation that is 1 to 3 years old. Do not allow any vegetation to get older than 3 years. In addition to the same benefits as burning, disking can increase insect populations by up to four times. It increases natural seed production at a fraction of the cost of cultivated plantings.

Mowing

Mowing is often an underused or misapplied tool. Periodic mowing keeps brush at a preferred height, and in wooded habitat, bushhogging thick hardwood sprouts is beneficial. Annual mowing of grass fields, however, is detrimental because it encourages dense stands of perennial grasses and causes buildup of a dense litter or thatch layer that inhibits movement. Avoid using mowers during the nesting season.

Timber Harvest

When tree canopies close, sunlight is eliminated from the forest floor and smaller seed-producing plants do not germinate. It is important to keep forest stands as open as economically feasible. Conduct thinning or select removal of certain trees in pine or hardwood stands as early as possible. Do this precommercially, before trees are saleable, or commercially, which is usually at age 13 to 18, depending on quality of pine plantation sites. For bobwhites, tree canopies should never cover more than 50 percent of the ground area. Basal area, or the total cross-sectional area of wood in the stand, is expressed as square feet per acre. For bobwhites, thin timber to a basal area of 25 square feet less than a typical forestry thin. Leave clumps of mast-producing trees in these stands.

Clear-cutting/ forests can provide excellent bobwhite habitat for the first 2 to 4 years following harvest; thereafter, unless some soil disturbance or vegeta-

tion control is employed, bobwhite habitat is lost. Make cuts as irregularly shaped as possible; streams need a protective management zone of trees.

Reforestation

Reforest using fewer trees per acre than normally planted. Reducing stocking to 450 to 550 pine trees per acre can maintain bobwhite habitat for an additional year or two. On pine sites, generally the more intensive the site preparation, the longer bobwhite habitat will be present. In forests, leave permanent openings of 1 to 10 acres; often right-of-ways can meet these needs.

On drier sites in south Mississippi, replanting with longleaf pine instead of loblolly or slash will benefit bobwhites by increasing the range of management options available during the early years of the rotation. Longleaf is fire tolerant and can be safely burned in the second or third year after planting. Conversely, loblolly cannot tolerate fire until 10 to 12 years old. Careful application of prescribed fire at 2- to 3-year intervals throughout the rotation can maintain bobwhite habitat in a pine plantation. In a forested environment, leave as little as 10 percent of the landscape in small, 2- to 5-acre rotationally cropped agricultural fields. This practice, in conjunction with careful thinning and burning, can increase the overall bobwhite population level by providing essential brood-rearing and winter-foraging habitats.

Farm Lands

Bobwhite populations on farmlands are affected by the crop grown, field size and shape, extent of chemical usage, and condition of idle areas such as fence rows and ditches. Keep acreage of individual fields as small and irregular as possible so edge is maximized. Minimize turn and moving time by linking small fields together with lanes planted to the same crop. Preferred crops include corn, soybeans, and wheat. Bobwhites benefit greatly if the outer few rows are left unharvested. Field borders are also critical and can be improved by leaving a 15-yard-wide unplanted band around the edge. Avoid

treating field borders with chemicals, and reduce in-field chemical use as much as possible. Some chemicals can have toxic impacts on bobwhites, particularly chicks, if they directly contact the birds. Most of the negative pesticide effects on bobwhites occur indirectly from reduction of insect populations. Leave fence rows, field corners, ditch banks, and lanes between fields, and manage them as 2- to 3-year rough areas with plums, bush lespedeza, and other natural foods present. Periodically burn or otherwise control vegetation in these areas before it gets out of hand. An optimal agricultural landscape contains 15 to 20 percent woody cover, 10 to 15 percent fallow areas, 15 to 25 percent grassy areas, and 40 to 60 percent row crop. Woody cover should be available every 200 yards.

Food Plots

Besides commercial row-crop areas, use rotational food planting to provide late-winter food sources. Plant one plot every 20 acres to row crops or lespedeza, and move the location of food plots annually to create a mosaic of plots and annual weed patches.

Hayfields

Hayfields provide valuable nesting habitat; maintain unmowed 15-foot field borders of **native** grasses. Burn, disk, or mow the border on a 3-year rotation to control woody invasion.

Use light to moderate grazing to hold succession in check. Overgrazing reduces available cover and selectively eliminates important legume food plants. The best bobwhite situations include native forage management instead of improved pasture like fescue and bermuda.

Manage grasslands using rotational strip disking and prescribed fire on a 2- to 3-year rotation to encourage legumes, annual weeds, and insects.

Harvest of bobwhites may or may not impact annual losses. Ethical hunters regulate harvest levels to remove only 25 to 45 percent of the fall population. Harvest low densities or isolated populations more conservatively.

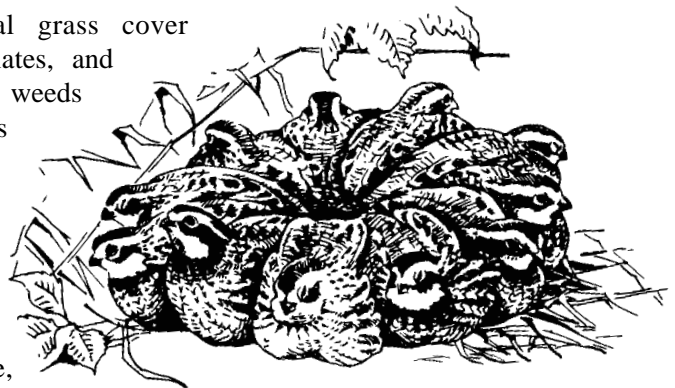
Conservation Reserve Program

In Mississippi, under the Conservation Reserve Program, nearly 1 million acres of highly erodible agricultural land were taken out of production and planted to permanent cover. Under this program, landowners receive an annual rental from the USDA to remove these lands from production for a 10-year contracted period. The conservation of wildlife habitat is listed as a primary objective of CRP in the Farm Bill. In Mississippi, nearly two-thirds of the CRP acreage was planted to pine trees, and several hundred thousand acres were enrolled as permanent grass cover. Tremendous opportunities for development of bobwhite habitat exist on CRP lands; however, this program requires proactive management.

The plant community and subsequently the bobwhite habitat quality on CRP fields change over time. During the first 1 to 3 years after the fields are enrolled, they contain a diverse mixture of grasses, annual weeds, and bare ground. As the fields age, however, perennial grass cover increases, litter accumulates, and bare ground and annual weeds decline. As these changes occur, bobwhite habitat quality declines. Quality bobwhite habitat can be re-created on CRP fields through careful implementation of strip disking, prescribed fire, and rotational food plotting. In Mississippi, these management practices can be implemented on CRP fields within certain guidelines that still protect the soil-conserving objectives of the program. Strip disking can be applied to no more than one-third of the field and must be in accordance with soil-loss guidelines. The width of strips and spacing is based on the erodibility of the field. Rotational food plotting can also be implemented; however, size of individual food plots and total acreage are based on field size and total acres enrolled in the program.

Implementation of these management practices on CRP fields requires USDA approval and contract modification. If you

Roosting bobwhites form a circle on the ground with tails together and heads pointing out.



are interested, contact your county Natural Resources Conservation Service (NRCS) office.

CRP lands planted to pine trees also offer substantial opportunities for bobwhite management.

On fertile sites, some 10-year-old pine plantings may be ready for a commercial thinning. Landowners can generate income and enhance bobwhite habitat by thinning these pines. Thinning increases sunlight to the ground and stimulates germination of grasses and seed-producing plants. Thin by removing select trees and/or entire rows. Clearing one or more rows creates openings in the stand where strip disking or food plotting can be implemented.

These tools and applications will help provide for successful management of the bobwhite quail. Each property is unique and needs an individual prescription for management. You can be productive in your management of bobwhite quail if you give careful thought to determine limiting factors and then implement active management to address these factors.

Incentives and Professional Assistance

Landowners and managers can receive bobwhite assistance from a variety of sources in Mississippi. This can vary from individual assistance with surveys of habitat characteristics onsite to preparation of management plans.

The Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) provides bobwhite technical guidance statewide to landowners. District wildlife biologists can help with habitat evalua-

tions and management recommendations. Information booklets on ecology and management are available at no cost. To get information, contact your local MDWFP district office.

The NRCS plays a critical role in administering federal farm programs such as the Wildlife Habitat Incentive Program (WHIP) and the Conservation Reserve Program (CRP), which have great potential to enhance bobwhite habitat. Contact your county district conservationist for more information.

The Mississippi State University Extension Service (MSU-ES) disseminates information and educational materials from current knowledge and university research. Publications, videos, and other media are used; frequently, Extension sponsors field days and short courses. For information, contact your county Extension office.

Quail Unlimited (QU) is a private organization working at the national and state levels for the bobwhite quail. Membership includes a magazine and other opportunities to learn more about the bobwhite. Fund-raising activities educate and provide on-the-ground assistance through local chapters. Contact the local chapter or regional director for more information.

The Mississippi Forestry Commission (MFC) provides sound timber-management recommendations that will help integrate forestry and bobwhite quail habitat management. Cost-share programs may be available through MFC; contact your county forester for more information.

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