

# Bobwhite Quail Biology and Management

Greg Yarrow, Professor of Wildlife Ecology, Extension Wildlife Specialist

Fact Sheet 7

Forestry and Natural Resources

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The bobwhite quail (*Colinus virginianus*) has long been considered the game bird of the South, and South Carolina's past quail population has made it known as one of the best quail states.

A review of history reveals that quail populations have increased and declined as man and the progress of civilization have continued to alter the environment. Prehistoric quail populations were relatively low, due to vast, essentially unbroken straits of timber which provided poor habitat. Early land-use practices associated with pioneer settlements were typified by a patchy farming pattern which provided ideal quail habitat, and quail increased until around 1900.

From the early 1900s to the mid-1940s, quail population densities remained high and quite stable. However, since the mid-1940s, quail numbers have declined over much of the South. This downward trend is largely associated with deteriorating habitat conditions resulting from: 1) a change to cleaner and more mechanized farming methods, 2) the joining of small patchwork fields to mark large unbroken fields suitable for intensive cultivation, 3) the development of pastures for cattle, dairy or hay production, 4) intensified timber production and 5) the restricted use of fire in pine forest, which has created woodlands too dense for permanent inhabitation by quail.

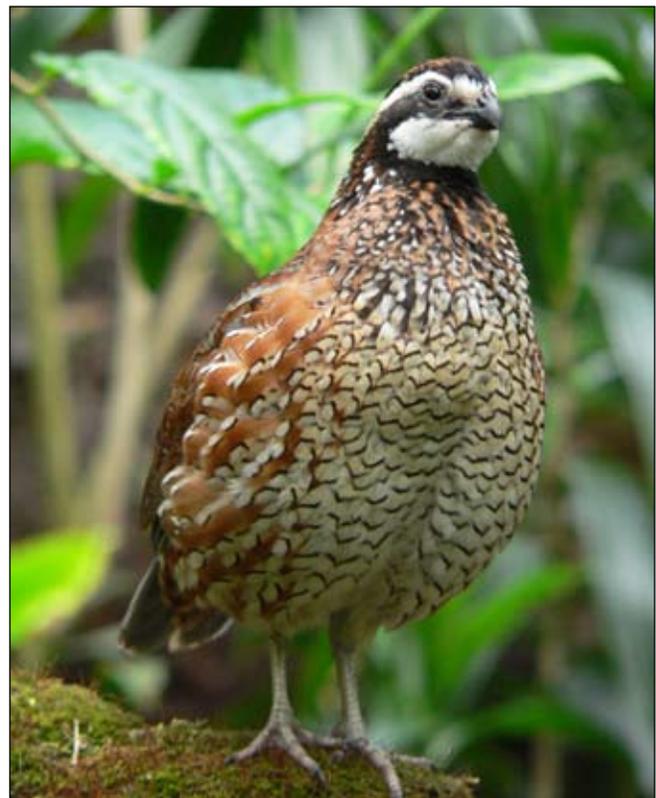
## Life History

In addition to longer, warmer days, the greening of foliage and flowering of plants, the bobwhite's whistle is one of the earliest signals of the coming of spring and summer. Shortly after the first bird is heard, winter coveys slowly begin to break up and courting pairs may be observed. After initial mating has taken place, pairs are usually inseparable and the cock has little trouble defending his mate from other males. A mated pair will normally remain together until nesting and rearing of chicks is complete. After choosing a nesting site, the pair gathers available dead plant material (grasses, stems and pine needles) and constructs the nest in a slight depression in the soil. The female generally lays the first egg within a few days after the nest is finished, and usually will continue to lay one egg daily until the clutch is complete. Clutch size averages about 14 in South Carolina, with original nesting attempts containing a slightly greater number of eggs and reneesting attempts slightly less than the average. Both male and female share the incubation, which lasts for 23 days. In most instances a pair of quail will hatch only one brood of young per year. However, if the nest

is destroyed or abandoned prior to hatching, they will attempt to reneest until a successful hatch or until the nesting season is over.

The nesting season in South Carolina runs from April to October with most hatching occurring from June to August. Commonly there are two or three hatching peaks brought on by widespread simultaneous nest failures. Nesting attempts may fail due to wild fires, detrimental weather conditions, predators, agricultural activity, or other environmental factors. Nest failures, however, are not necessarily bad in that they spread out the hatching dates and thus reduce the total effect of any mass mortality of the young due to natural disasters. Late hatched birds have a greater chance of surviving until the hunting season, and a high percentage of late hatched birds is generally associated with good fall hunting.

As both cock and hen share the responsibilities of brooding young birds, either will continue to brood the chicks following the death of a mate. The young are considered full grown at 16 weeks of age, and the young



of the year will normally make up the major portion of coveys which form during the fall.

## Food and Cover Requirements

Quail are primarily feeders of fields and open forests. Their diet is mainly vegetable and composed largely of seeds, small fruits and green forage. Animal matter may be consumed year-round, but makes up a higher percentage of the diet during the warmer months. Insects are an especially important source of protein in the diet of young quail. Seeds of legumes are probably the most important native quail foods with grasses, tick trefoil and sedges being of secondary importance. Soft and hard mast and cultivated grains are also taken.

Some of the most important quail food items utilized in South Carolina include beggarweeds, partridge peas, milk peas, butterfly peas, the native and cultivated lespedezas (common, bicolor, Kobe, Korean), sesbania, paspalum, panic grass, ragweed, chocolate weed, blackberry, mulberry, pine, oak, sweetgum, mast and cultivated crops such as cowpeas, soybeans, sorghum, wheat and corn.

Although quail are commonly seen in the vicinity of open water and are occasionally observed drinking surface water, it is not essential since they normally receive their water requirements from dew, insects and succulent green vegetation.

In general, quail like a diversity of cover types including forests, brush, grass and cultivated lands. Bobwhites prefer areas where all types are found within their normal 40-acre range.

## Bobwhite Facts and Myths

Over the decades popularity of the bobwhite quail has led to the evolution of a number of popular beliefs and tales. Many of these evolved locally, while others are heard throughout the range of the bobwhite. Nearly all have been handed down through successive generations of hunters, landowners and other interested individuals. While these beliefs add to the appeal of the species and reflect a popular interest, many are actually guilty of precipitating a waste of time, effort and money, misguidedly directed toward improving the welfare of the bobwhite. Most of these misconceptions provide little real benefit, and others hamper adequate harvest.

Probably one of the most popular misconceptions of how to permanently increase wild quail populations is through the stocking or release of pen-raised quail. This technique was widely practiced by many state wildlife agencies and private conservation groups in the Southeast during the late 1940s and early 1950s. After thorough evaluation, it was found to be extremely expensive and unsuccessful.

Most studies show that native quail (and there are essentially no areas in South Carolina without native birds) will occupy all of the suitable habitat available. Pen-reared birds released on a site are forced to live in areas not even suitable for occupation by the native birds. Since a surplus of wild quail is produced each year by natural production,

stocked birds are likely to be eliminated as part of the surplus. In other words, it is not logical to expect a pen-reared bird to survive in habitat that will not even support native quail. Releasing birds shortly before the opening of the season has limited use, and is uneconomical since only a small percentage of the released birds are normally recovered. The danger of introducing disease into the native population from pen-raised birds is also a risk. The key to increasing quail populations is habitat improvement and control of predators.

Another popular and widespread tale is that many quail found in the Southeast today are descendants of a subspecies of bobwhite commonly called Mexican quail which were released in many sections of the Southeast during the 1930s and 1940s. Local lore suggests that these Mexican birds have all but replaced our native quail, as can be evidenced by their smaller size, different coloration, tendencies to run before dogs, to flush wild, and to fly to the nearest thicket or swamp regardless of the distance.

Although many of these behavioral traits are obvious to any dedicated bird hunter, research has shown that only a few of the Mexican quail survived, and the characteristics and traits of those which did interbreed with the native bobwhites were quickly diluted and have become obscure with time.

Size differences may be simply explained by the fact that some individual birds, as with deer, man and other creatures, are simply larger than other members of the same species. The hunter who kills an adult male and compares it with several immature birds is likely to conclude that he took the larger individual from a covey of the "old bobwhites." Color variations are simply differences in color characteristics among individuals of the same species. Birds which appear to be light-colored do not have to be descendants of the Mexican quail, and dark or reddish birds do not necessarily come from the deep swamp, as some believe.

Changes in behavioral characteristics such as running, flushing wild and flying long distances to heavy cover are not the results of crossbreeding with Mexican quail but are our native birds' adaptation to increased hunting pressure and habitat changes. The hen who runs ahead of the dogs, flushes wild and consistently heads to the nearest swamp when flushed is likely to survive to produce a brood the following spring, some of which may possess the same traits. On the other hand, the hen which holds tight or flies to a narrow fence row usually won't be around the following spring to have the worries of motherhood.

Although some hunters complain about these new characteristics, most accept them as an added challenge in the sport of quail hunting. In any event, the ability of the quail to adapt to external pressures and a changing environment is one reason why this game bird has maintained population levels capable of sustaining considerable hunting pressure.

On a year following poor nesting or brood rearing conditions, such as hot dry summers or summers with unusually heavy rainfall, and when the fall quail population doesn't appear to be up to normal expectations, it is common to hear, "Why doesn't the state close the quail season this year?" Some dedicated and enthusiastic quail hunters will hang up their

guns. While this dedication and interest in the welfare of the bobwhite is commendable, they had just as well enjoy that season's hunt. Here's why: Bobwhite quail (and most other small game species) are extremely short-lived. That is, of every 100 birds alive in the fall, between 75 and 80 will die or be killed within the next 12 months, and mortality rates will remain essentially the same in both hunted and unhunted populations. Hunting only removes surplus birds before they are lost to natural causes. For this reason, hunting in years of lower than average quail populations will not reduce the prospects for a quick return to normal levels, if food, cover and general habitat conditions remain unchanged.

Few subjects invoke more discussion and occasional anger than the topic of predation. It is common to hear "If it wasn't for the foxes and the hawks, we'd have lots of birds," or "Those old house cats wiped out three of my biggest coveys." It's true that foxes, hawks, cats and other predators kill an occasional quail, but before we condemn these animals, let's take a close look at the actual effect predation may have on a game species.

Predation is the act of an animal killing and eating another, and it must be remembered that man is the most important, if not the most efficient predator on earth.

There are numerous factors controlling the extent of predation on game species. The available habitat is important, especially the quantity, quality and distribution of escape cover. The ratio of predators to prey is also important. Predation, therefore, is likely to be heaviest when unnaturally high populations of prey species exist in habitat which is incapable of support or protection.

The presence of a buffer species may also affect the amount of predation on quail or other game species. For example, if cotton rat populations are high, foxes will normally prey on these species instead of quail because they are easier to catch. However, if cotton rats are low in number or not available, the fox may prey on quail although he will have to work harder at taking them.

A thorough view of predation, although rarely noted, takes in its beneficial aspects. Predators may actually benefit game species (especially big game species) by removing surplus individuals, therefore preventing a population buildup beyond the carrying capacity of the land which may result in food shortages, habitat damage, and die-offs. Predators normally remove or catch the unfit (weaker, deformed, sick and diseased individuals). This helps to reduce the spread of disease and allows the fittest to survive and reproduce, resulting in an improved genetic quality of the species.

Predators often remove a number of species which compete with the desired game animal for the necessities of life. For example, intensive efforts to increase quail populations on one Georgia plantation by killing or trapping all hawks, owls, foxes, cats and skunks, resulted in a decline in the quail population instead of the expected increase. It was later learned that the predators were primarily preying on cotton rats. After the predators were removed, the cotton rat population increased to a

density at which they were destroying a majority of all quail nesting attempts, resulting in fewer quail being produced. A certain amount of nest predation, however, may be beneficial in that the resulting re-nesting spreads the hatch out over a longer period of time, thus reducing the probability of losing all of a year's production of chicks to a short period of bad weather.

As was stated earlier, natural predation, hunting, disease, exposure and other mortality factors take about 80 of every 100 birds present in the fall. The problem of the quail manager, is to improve land and habitat so that it can produce and carry a larger number of quail and not attempt to decrease the natural conservationist, Aldo Leopold said, "If a habitat can't support game in spite of predators, it simply isn't good game habitat." Past and current studies however, have shown that unusually high populations of predators (raccoon, skunks, opossum, feral cats) can depress quail populations.

It is a common belief in many areas that a pair of bobwhites will rear more than one brood a year under ideal conditions. One theory holds that two nests are built by the pair, after which the hen lays two clutches of eggs, one of which is incubated by her and the other by the cock. A simpler tale is that a pair will bring off one brood which will be cared for by the male, while the hen lays and incubates another clutch. This situation is probably not as common as generally believed, although two broods from one pair during a single nesting season has been documented.

Two other tales concerning nesting are common in certain local areas. The most common of these holds that if you trap hens from one area and release them in areas where there is an abundance of unmated cocks (usually on your land), you can increase the quail population on that particular piece of land. This idea is erroneous or impractical for several reasons. First, you may trap a hen which is already mated and in some state of nest building or incubation. If this happens, you may have destroyed one potential hatch of young birds. Secondly, should the hen mate with an excess cock and begin the nesting process when nesting habitat is a limiting factor in the quail population, their nesting attempts will be in unfavorable habitat, and chances of a successful hatch are extremely low. Thirdly, and most important, this practice may actually result in less reproduction and a lower fall population by suppressing nesting attempts due to an artificially high spring population.

It boils down to the fact that an excess of males, whether it is quail, dogs or man, is a natural phenomenon and, regardless of the techniques or procedures tried, you can never permanently increase quail populations beyond what the habitat will support.

The second misconception regarding nesting is that if you see two cocks with one hen you had better kill one of the roosters or he will destroy the nest of the other two. The problem is to make sure you kill the right cock. Seriously, it is common, especially during the early part of the breeding season, to see more than one rooster courting a hen. Normally one of the roosters will be dominant and will successfully mate with

the hen. Once the pair have mated, the cock has little trouble in driving away all callers and home wreckers.

One of the oldest ideas pertaining to quail hunting is the “shoot’em up to prevent interbreeding” theory. This idea has been unconditionally disproved. Birds hatched during the summer do not remain in family groups but may move to several different coveys during the “fall shuffle” of covey formation. This movement between coveys continues during the winter months and, during covey breakup in the spring, individual birds may move a distance of several miles. The reason unshot coveys can’t continue to increase until they are knee-deep is as we mentioned earlier, due to the high annual turnover rate (80 percent) in quail populations and the fact that birds will not increase beyond the bounds of the existing good habitat.

## Habitat Development

The following quail management recommendations are general in nature but should provide some ideas as to what may be done. Specific management recommendations can be made only after an area has been investigated and a management plan prepared.

As has been mentioned many times previously, the only way to permanently increase quail populations on any property is through the maintenance and/or development of quality quail habitat. Quail must be grown as a crop of the land if we are to have better hunting or just more quail. All other theories, tales and methods simply will not work. The procedure involved in producing more quail, however, is relatively simple.

First, if you’re a landowner, hunter or land manager, think back over the years to places where you consistently found quail in winter. All will be different in appearance but they will all contain essentially the same elements: adequate cover within a short distance of a food supply containing several important food plants, either cultivated or native. Next look over the land, decide where you can afford to and would like to develop the land for birds, and try to determine just why birds are not using areas where you would like to have them. If adequate cover exists, grow food. If cover is scarce, develop it before growing food.

## Developing Cover

Although there is generally an abundance of cover in most of South Carolina, in cases where it is lacking or needs improvement, it is necessary to know what constitutes good cover types. In any instance, the amount of cover needed depends on the quality. Preferred cover types are relatively thick above and quite open at ground level. If cover is of high quality, a relatively narrow fence row may be adequate or a covert of 75 to 100 feet square may be sufficient. Some of the better cover plants include wild plum, wild cherry, sumac, greenbriar, palmetto, the viburnums, sassafras, honeysuckle and grapevines. In most areas, however, adequate cover may be developed simply by protecting areas from such disturbances as fire, disking, mowing and over-grazing.

Woodlands, especially pine types, usually provide adequate cover because they generally make up in quantity what they lack in quality. However, tall trees provide little security and thick spots of shrubs or other vegetation may be required.

More important than developing cover for quail is the preservation of existing cover. Quail habitat is being destroyed daily to create more farmlands and pastures for cultivation. Much of this land is of marginal value to the farmer. For example, there are only two acres of land in two miles of grown up fence row eight feet wide, but those two acres could provide cover and some food for six to eight coveys of quail. One acre of high quality cover for every 10 to 12 acres is usually sufficient.

So far we have discussed cover used primarily for escape and protection. However, other types of cover are equally important, such as vegetative cover provided in transition zones.

Transition zones are simply a third habitat type developed between two existing and different habitat types. In most instances transition zones will be developed along an adjoining edge between fence rows, roads, ditch banks, timbered areas and cultivated fields.

Modern and intensive farming methods, coupled with the rising cost of farm machinery, dictates that landowners get the most return for their investments. This in turn has led to abandonment of tenant-type farming, where the common practice was to leave basically nonproductive field edges in native vegetation. While this could not be considered progressive agriculture, it did provide ideal habitat for quail. The practice of plowing and planting fields to the edge has done little to increase total production, since returns are poor on crops planted in the “shaded out” areas. These practices have, however, reduced the ability of that particular piece of land to produce quail.

In the past, these nonproductive areas also provided proper nesting cover around crop fields and created a suitable environment for a wide variety of insects. Insects provide high protein food important to adults and young birds during the nesting season. In addition, these zones grow many native quail food plants which provided seed during the winter months.

Transition zones between forest and field are extremely important because the bobwhite is an “edge” species, and the amount and quality of edge present usually dictates the abundance of quail on a particular area. Properly managed and maintained, these areas will provide much of a quail’s needs year round.

Transition zones may be established in the agriculturally unproductive field corners, edges or borders. These zones may be located where woodlands meet crop fields or exposed pastures, and along fence lines and roadways. These transition strips may cover all the unproductive field edge but should never be less than 15 feet wide. The species and composition of the vegetation which invades these areas depends on soil type, fertility, and pH.

The establishment of transition zones is perhaps the easiest and cheapest quail management practice on agricultural land because

nature does the work. These zones may be established by simply removing strips of land from its previous use and protecting it from any disturbance such as disking, fire or grazing except for maintenance.

To maintain transition zones in a mixture of legumes, grasses and weeds, they must be burned, plowed or disked in early spring. It is not always necessary, however, to do this every year, and a good rule of thumb is that when more than 50 percent of the soil is covered in dead vegetation, the land needs maintenance. In South Carolina this will occur sometime between two and six years after establishment. Fields having transition zones around three or four sides may be maintained on one side annually, starting approximately 2 years after the transition zones are established.

The importance of transition zones in quail management depends largely upon the type of habitat adjoining cultivated areas. Transition zones are of less value in situations where early successional habitat types or ground cover immediately adjoin cultivated areas and are of more value where unusually dense or sparse ground cover exists.

Other types of vegetative cover are also important under certain conditions. Large fields and pasture, for example, contain areas within the center which are not utilized by quail. Generally, quail will not venture more than 100 feet into the open from the nearest adequate cover type. To provide access routes into these areas, large fields may be broken into smaller tracts by providing travel lanes across or into these fields. This may be accomplished by leaving undisturbed strips in native vegetation. The strips should be maintained by mowing, disking or burning one side of each strip every two or three years in the early spring. In order to receive some economic return from crop land removed from production by fallow strips, these areas may be established in pine seedlings on a spacing between 8' x 10' and 12' x 12'. These plantings will provide a permanent cover type as well as some future fiscal return.

As quail are basically an annual crop, each year's production of young and the number of quail available in the fall for hunting is dependent on numerous factors, one of the most important is the quality and quantity of nesting cover available during the nesting seasons.

Recent studies in the South suggest that the lack of proper nesting areas may be a factor limiting quail populations. Quail prefer to construct their nests in areas where ground is only partially covered with dead vegetation and along openings such as field edges, disked strips, roadways, fence rows, fire breaks, and around cut-over areas and recent plantation sites. Areas containing thick ground vegetation are seldom used as it makes movement in the areas of the nest difficult for both the adult and young.

Although prescribed burning is often essential in quail management, areas containing the preferred type of nesting vegetation should be disked out and fire excluded. New nesting areas should be located every two years as ground vegetation quickly becomes too thick for use. Areas which have become too thick may be burned to develop future nesting sites.

Due to the importance of nesting habitat to quail production, efforts should be made to maintain as many of the preferred nesting sites as possible in the proper vegetative composition to encourage nesting. Because much of the lower part of South Carolina is poorly drained, nesting areas should be developed in locations which will minimize the risk of flooding.

## Developing Food

Food is naturally an important part of any animal's survival and is one key to proper quail management in some areas of South Carolina. It is beneficial to know the more important quail food plants and become familiar with favored food items in your areas.

In the past, quail management has been based on providing food during the critical late winter period. While this approach appears to be practical for northern areas, it is of less value in the South. Here, fall and winter food sources may be just as important in making an area attractive to birds and concentrating coveys for the hunting season as it is for survival.

Managing for quail food plants is generally no more complicated than being familiar with the preferred local food-producing plants and maintaining these as a byproduct of general farming. This generally may be done by knocking back plant succession through the manipulation of native vegetation by proper burning, mowing or disking.

In these days of rapidly climbing prices, it would probably be better to consider the cheapest and also the easiest method of increasing quail food supplies. Disking, except where it is practical to burn, is probably the cheapest method of manipulating the land to produce desirable quail food plants. Nearly all old fields which contain broomsedge or other vegetation will provide an abundance of native food plants through light disking of strips around the edge of these fields, allowing for a transition zone if needed. New ground may be used the second year, as an established strip will continue to produce food for several years.

Strips should always be established close to adequate cover. If an increase in seed production is desired, use fertilizers recommended for legumes and at rates dictated by soil test. Fertilizers may be applied to the strip shortly after disking is completed. The results of fertilization should be closely observed as in some instances undesirable grasses may be encouraged by the increase in soil fertility.

Disking in open pine woods is equally beneficial to disking in fallow fields. In addition to providing food, disking also creates an additional edge which may be used for nesting. Disking may be done any time following the first full frost until the following May.

Another method of providing food for quail is through the proper manipulation or harvest of the more important row crops planted in South Carolina. Corn is probably the best all-round cultivated food source for quail, as cornfields help to provide year-round quail needs. Soybeans and smaller grains and sorghums are also good.

Present day methods of planting corn in thick stands, especially for silage, has reduced the overall value of these fields for quail since dense stands and herbicide applications seriously reduce the volunteer growth of annual weeds and other plants preferred by quail. All modern harvest methods, however, waste corn and this will provide food for quail a short time after harvest. If possible, a couple of rows of corn should be left standing around the field edge after harvest is complete. Portions of these may be rotary mowed at intervals during the winter months to supply food for coveys during this period.

Soybeans and grain sorghums are of more value to birds when a few rows are left standing on field edges. The vegetative part of these plants offer some cover and, in most cases, seeds will scatter out gradually providing a source of food over a period of time. All of these food supplies should, when possible, be left close to available escape cover. Late summer or fall plowing should be avoided whenever possible. If this practice is necessary, unplowed strips containing crop residue should be left around field edges.

In areas where disking, burning, or available row crops will not provide enough desired foods, plantings of various high quality quail food plants may be established. Plantings for quail may be divided into two general types. One is for fall use to concentrate birds for hunting and the second for winter use during periods of low food availability. A combination of the two is probably best. Late winter food helps to make an area attractive to the birds year round. Fall plantings help to hold birds during the hunting season and may draw some birds from adjoining unmanaged land.

Numerous plantings have been used to provide food for quail. Some of the better ones for fall include annual lespedezas (common, Korean and Kobe), browntop millet, Florida beggarweed and sesbania. Low maintenance late winter foods include bicolor lespedeza and large partridge pea. All of these plants require good seedbed preparation and fertilization and some require cultivation. In many areas of coastal South Carolina, bicolor patches are difficult to establish due to high deer populations. Recent work in these areas have indicated that two other quail food-producing shrub lespedezas, *Lespedeza thumbergii* and *Lespedeza japonica*, may be more resistant to deer depredation. Specific planting recommendations on these quail food plants are given in the appendix section of this reference manual.

Size of the plantings should be at least 1/16 of an acre and normally should not be larger than 1/4 acre. Plantings should be in large, narrow strips about 15 to 20 feet wide paralleling field borders, forest edges, roadways, grown-up ditches or other areas adjacent to suitable escape cover.

Plantings may also be used to improve suitable woodland types of quail in order to provide additional food and to concentrate birds for hunting. Woodland plantings should be in strips containing both a fall and a winter food plant. One planting for every 15 to 20 acres should be adequate.

In general it is difficult to maintain good quail populations on land established in temporary or permanent pastures. Temporary pastures usually have little value for quail since they are planted in the fall and are usually heavily grazed the following spring and summer. Permanent improved pastures may be of some value to quail if they are properly managed. Moderately grazed permanent pastures will provide some nesting cover. In some areas, food may be provided by adding common lespedeza to the pasture mixture. Necessary mowing may be done in early spring providing enough cover is left for nesting. Summer mowing should be avoided if possible as it may destroy nests or cause them to be abandoned. If summer mowing or hay harvest is necessary, a strip approximately 50 feet wide would be left undisturbed on field edges. Normally this practice will greatly reduce the number of quail nests destroyed.

Large pastures should have areas of existing cover protected, or developed if none exists. Usually these cover spots should be ¼ acre in size and protected from grazing. If possible, encourage cover plants which are seldom grazed and which will offer some protection to existing food plants. A better method of protecting food and cover patches is through fencing.

## Forest Management for Quail

High quail populations and good quail hunting are normally associated with cultivated areas and farmlands, but properly managed forest types can also provide quality quail hunting. With an ever increasing acreage of land being converted to pine tree production in South Carolina, development of timber management practices that provide the needed habitat is essential if quail are to continue to be abundant game birds.

Of all the techniques used in forest management, prescribed burning is probably the cheapest and most effective method known to improve quail habitat. During the past several decades, we have gone through a succession of guidelines and advice from both state and federal agencies; encouraging the use of fire in certain types one year, and discouraging its use the next. Today we know, through much research and study, that the proper use of fire in pine types is beneficial not only in increasing timber production, but also in improving these woodlands for quail as well as for deer, wild turkey, and many other wildlife species.

Many quail hunters have been frustrated by birds located in open fields which flew to pine woods containing a dense understory of hardwood sprouts which makes penetration by the hunter difficult and shooting impossible. In these instances, the quail, hunter and timber could all benefit from the proper use of fire. Quail benefit by the opening of a new preferred habitat, through a reduction of dense understory vegetation, through a reduction in rough areas likely to harbor predators, through the reduction of ground litter which will make more seeds available, through an increased food supply the following fall due to an increase in legume and other quail food plant germination in the spring, through additional nesting habitat and probably through a reduction in both internal and external parasites. The hunter benefits

from the opening of new accessible hunting territory, through better shooting conditions and more enjoyable hunts. The timber benefits in many ways, including the quick release of needed nutrients into the soil and through reduced competition from the understory hardwoods killed back by prescribed burning.

Since the proper use of fire depends on many factors such as topography, amount of fuel, combustibility, relative humidity, temperature, wind direction and velocity, time of day and the composition, age and condition of the timber to be burned, it is wise to seek the advice of your local South Carolina Forestry Commission representative prior to burning.

There are, however, some general guidelines which may be useful in burning for quail. Burning should normally be conducted only in forests managed for pine production. Mature hardwoods and pine regeneration areas may be seriously damaged by a small amount of fire. Burning should be conducted annually or semiannually during the early morning or late afternoon hours between the middle of February and the last of March. The use of fire after April may do more harm than good. With rare exceptions, only a backfire (into the wind) should be used. Headfires may be necessary in some instances to clear dense, rough areas of hardwood sprouts or other vegetation, but should be used with care. Backfires should normally be burned with a steady breeze of five to eight miles per hour.

Relative humidity is important in that it affects the combustibility of the ground litter. As the humidity falls, the fire is likely to become hotter. Temperature affects fire in that an increase in combustibility and better burning conditions are generally associated with higher temperatures. Fires normally burn faster up hill than down, but the use of fire on steep slopes may remove ground cover material and speed up soil erosion. Fire breaks should be available should the fire get out of control. A state law requires that a representative of the South Carolina Forestry Commission be notified of any plan to burn.

The use of fire during February and March on open farmlands provides some of the benefits of disking at a reduced cost. Fire may be used in some locations to reduce dense herbaceous vegetation and provide for an increase in quail food plants. Fields of broomsedge containing one to several years' growth may come in to various native quail food plants following a winter burn.

In addition to forest characteristics affected by fire, other factors such as the density of the timber stand should also be considered in quail management. In general, quail prefer moderate to open pine stands. If quail are to be managed in addition to timber, long rotations (saw timber production) are preferred over short rotations (pulpwood production) as the latter usually result in dense timber stands which provide little quail food or cover after the first three or four years. Properly managed long rotations in which merchantable trees are removed and natural reproduction periodically thinned can provide good quail habitat. If you are interested in optimum quail habitat, timber harvest and thinning should be extensive enough to reduce the

stand density 25 to 30 percent below that recommended for maximum timber production. This will provide better than average quail habitat providing the understory is kept open and the timber thinned.

If maximum quail management on timbered land is desired, timber harvest and regeneration may be used to develop permanent one to two acre forest openings which may be planted to a variety of the quail food crops discussed earlier. Permanent openings should average one per 15 to 20 acres. If permanent openings take too much land from timber production, food patches may be established in existing timber stands as discussed previously.