Bobwhite Quail

In Georgia

History, Biology and Management

Georgia Department of Natural Resources
Wildlife Resources Division
Game Management Section
The Bobwhite Quail In Georgia: History, Biology and Management

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Authors:
Senior Wildlife Biologists
Reggie Thackston, Bobwhite Quail Initiative Coordinator
Mark Whitney, Private Lands Program Coordinator

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Preface

This booklet is intended to serve as a helpful reference for land managers and others interested in bobwhite quail. The Wildlife Resources Division hopes that this booklet will provide useful management information, which will help to ensure the well-being of Georgia's State Game Bird for generations to come.

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Introduction

For many years Georgia was recognized as the "Quail Capital of the World." This title was justified by the state's excellent population of bobwhite quail (Colinus virginianus). Georgia's high quail population resulted from the low intensity agriculture and forestry practices that were commonly applied throughout most of the state during the late 1800s through the mid-1900s.

However, as quail hunters and other wildlife conservationists know, Georgia's quail population has declined dramatically. Data from the U.S. Fish and Wildlife Service's Breeding Bird Survey indicate that from 1966 to 1998, Georgia's quail population declined by more than 70 percent (Figure 1, Appendix). This decline has led to a reduction in the number of quail hunters and the quail harvest. In 1962, an estimated 135,000 hunters harvested about 4 million quail in Georgia, but by 1998, the number of hunters had declined to 42,000, and the reported quail harvest to about 900,000 (Figure 2, Appendix).

Quail populations have declined dramatically because of the significant loss of quality habitat, due to a variety of land-use changes. More specifically, the decline has been caused by the loss of agricultural land, "clean farming" practices, larger agricultural fields, increased use of agricultural pesticides, conversion of farmland and native rangeland to exotic grass pastures, increased acreage in intensively managed short rotation pine plantations, decreased use of prescribed fire, and increased urbanization.

Habitat That Needs Help

Most agricultural fields have a "hard edge" where the field joins abruptly to closed canopy woodlands with shaded-out ground cover (above) and does not provide good habitat for quail or other early successional wildlife. Closed canopy pine stands have little ground cover vegetation and provide poor food and cover (left). Exotic grass pasture and hayfields mixed with closed canopy woodlands also provide poor habitat for quail (below).

Intensification in farming and forestry, conversion of farmlands to pasture and woodland, and increased urbanization are the main reasons for the long-term decline in Georgia's quail population.
The good news is that wildlife biologists know more about managing bobwhite quail than any other upland game bird. The first step to improving habitat conditions for quail is developing a management plan that considers the entire life history of the bobwhite quail relative to the current habitat conditions. To increase quail populations, management practices must address the factors that are most limiting the quail population. For example, planting food plots to increase fall foods will not result in more birds if the limiting factor actually is brood habitat. Game Management Section wildlife biologists are available to assist landowners in developing management plans to improve habitat conditions for quail and other wildlife.

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### LIFE HISTORY

#### Covey Formation

As summer ends and fall approaches, quail form into groups called coveys. The average covey size is 12 to 15 birds, usually consisting of birds from two or more broods. Occasionally two or more coveys may be found together resulting in the “40 bird” covey that quail hunters often talk about. If covey size becomes low during the fall and winter, the remaining birds may join with another covey for the remainder of the winter. For this reason it is not advisable to use covey size as the determinate factor in deciding whether or not to harvest additional quail from an area during the hunting season. Birds remain in coveys until spring approaches, when they “break up” and disperse to begin the mating season. In March, coveys often break up during the day and re-form just before dark. Remnant coveys may be found until early May.

#### Nesting and Reproduction

The familiar “bob-bob-white” whistle heralds the beginning of the breeding season. In spring, increasing day length and warmer temperatures trigger breeding activity. Pairing begins with covey break up, usually in March.

Quail are generally monogamous, one male mating with one female. However, studies have shown that promiscuous behavior, several different mates during the breeding season, is more common than previously thought. Populations consist of about 15 percent more cocks than hens, which is the result of additional hen mortality during the nesting season. Most of the “bob-whiting” in mid-summer through late summer is by unmated cocks in search of a hen.

May through August are the most important months for nesting, but some nesting occurs as early as March and as late as October. Preferred nesting areas are those where ground vegetation is comprised of clump-type grasses that cover about 50 percent of the total ground area. This type of cover offers optimum nest concealment while providing adequate passageways for quail movement.

Both hens and cocks collect materials used in nest construction, primarily grasses and pine needles, from within a few feet of nest sites. Hens continue to re-nest throughout the nesting season if previous attempts are unsuccessful. Hens that are in excellent physical condition may re-nest after hatching off a brood. Sometimes, cocks are left to complete incubation and brood the chicks if hens are killed by predators or when hens find another mate and begin another nesting attempt.

The number of eggs per nest (clutch) decreases with each attempt, ranging from an average of 16 eggs in April to only nine in August. On average, it takes about 18 days for a hen to lay a clutch of eggs and the incubation period is 23-24 days.

Generally, a pair of quail raises only one brood of chicks per year. However, it is not unusual to see chicks of different ages with an adult bird. Both cocks and hens have strong brooding instincts and will adopt strayed or orphaned young.

#### Mortality

More than 20 different wildlife species have been identified that prey on quail and/or their eggs. Annual mortality rates average about 80 percent depending on habitat quality, weather, predator densities, hunting pressure and other factors. Proper habitat and harvest management increase over-winter survival, which allows more adults to enter into the nesting season, thereby increasing reproductive potential and recruitment into the fall population.

Studies suggest quail chick mortality is 50 percent or more between hatching and 15 weeks of age. This loss can be reduced by improving brood habitat, particularly by creating large blocks (two to five acres) of annual weeds that are canopied above but open underneath. During the first few weeks of life, chicks require a high protein diet provided by animal matter, primarily insects. Management practices, such as winter disking or prescribed burning, which produce an abundance of insects at or near ground level, with a protective weed canopy overhead, increase chick survival.
Excluding summer losses of chicks, the greatest loss of bobwhites occurs during either the hunting season or the breeding season. If habitat conditions on an area are good and hunter harvest is low, spring and summer mortality will equal or exceed that of winter.

The quality of available habitat controls the size of a quail population. Summer quail production usually exceeds the ability of the habitat to support the young through an entire year. Natural mortality occurs from factors such as predation, disease, accidents, weather and starvation. Studies show that annual losses of 80 percent remain fairly constant, whether or not an area is hunted. Therefore, depending on habitat quality and the current year’s reproduction, a hunter harvest of 25 to 35 percent of a fall population may replace part of the natural losses without endangering next year’s population.

Weather can be an important mortality factor for quail. Prolonged drought during the spring and summer creates a negative impact on quail populations by reducing weed seed production, available cover and insect abundance. These factors ultimately result in lowered quail reproduction, survival and recruitment into the fall population. The best safeguard against negative impacts by drought is to provide high quality habitat, especially nesting cover, brood habitat and food, so that when rainfall does occur, quail populations can respond quickly.

Sex and Age Determination

Quail exhibit sexual dimorphism, meaning that males and females differ in appearance. The primary visual difference is in feather coloration, especially noticeable on their heads. Both sexes have a dark stripe that originates at the beak and runs through the eye to the base of the skull. In males, the stripe above and below the eye is white, as is the throat patch. In females, this stripe and throat patch are a buff-brown tan color. Generally speaking, males have brown and white head feathers and females have brown and tan head feathers.

Determining age ratios in the fall hunter harvest can lend insight into the previous summer’s reproductive output and success. Age determination can be somewhat more difficult than sex determination, but can be accomplished with a little practice. Biologists group quail into two age classes: adults and juveniles. The key to determining the age class is to locate the greater primary coverts, the group of feathers overlaying the primary flight feathers. In juveniles, the greater primary coverts will have buff-brown or tan tips (Figure 3).
Habitat Requirements

Bobwhite quail depend upon habitat called early succession, an interspersion of cover that is predominated by annual and perennial weeds and legumes, clumped native warm season grasses, and a mosaic distribution of briar and shrub thickets. Quail densities are highest, and respond best to management, in areas where there is a contiguous distribution of suitable habitat (perhaps 5,000 acres or more). Fragmented landscapes comprised of small isolated blocks or "islands" of habitat are not capable of sustaining high densities of quail. These habitat fragments may limit the potential of quail to respond to management.

Soil conditions are important to consider when managing land for quail. Soils with the highest quail management potential are well-drained sandy loams and clays. Deep sands and wet soils provide poor quality food and cover for quail and therefore limit prospects for improving populations. Due to site conditions and current land use patterns in Georgia, the Upper Coastal Plain generally offers greater potential for quail management. Within the Upper Coastal Plain, the best zone tends to be in Southwest Georgia due to better soil fertility, higher rainfall, and a greater abundance of lands being managed for quail. This is not to say that quail management is futile in other regions, but expectations must be tempered with realization of the bird's habitat needs and the condition of the land.

Across Georgia's rural landscape, the primary habitat components missing for quail are nesting cover and brood range along with year-round food availability. Most lands have vegetative cover that is either too dense or too sparse at ground level.
Food Habits

Bobwhite quail eat a variety of seeds, insects and fruit, depending on seasonal availability and nutritive needs. Quail eat more fruit in late spring and summer, and consume more insects during the summer and fall. The annual bobwhite diet consists of 60-65 percent seeds, 15-20 percent fruits, 15 percent animal matter and 5 percent green vegetation. The most important foods during the fall and winter are seeds of various annual and perennial plants such as ragweed, beggarweed, partridge peas, wild beans, native lespedezas, sumacs, oaks and pines. During spring and summer, the quail's diet shifts to green vegetation, insects, fleshy fruits and seeds of grasses, and other early seeding plants. Blackberry thickets provide fruit during the nesting season as well as roosting and escape cover. Plum and other shrub thickets provide fruit as well as screening cover and areas for loafing. Bobwhite quail can survive without drinking water, when succulent vegetation and insects are readily available.

Ragweed and other erect weeds form a canopy above but are open at ground level, providing good habitat for quail broods.

Nesting and Brood Habitat

Quail construct their nests on the ground from the previous year's dead vegetation. Nesting cover must be clumped to facilitate freedom of movement for both adults and chicks. Broomsedge and other native warm season grasses occur throughout Georgia, and provide ideal nesting cover when managed to maintain a clumped structure. However, left unmanaged, these grasses quickly become too thick for quail. Periodic disturbance by fire or winter disking is necessary to maintain the desired structure and distribution.

Quail typically nest in close proximity to brood rearing habitat. Erect weeds, like ragweed, partridge pea and beggarweed, that are canopied above but open at ground level, provide ideal habitat for brood rearing. These plants provide an abundance of insects and seed at ground level while providing protective cover above.
PLANNING HABITAT IMPROVEMENTS

Developing A Plan

Agricultural fields and woodlands can be enhanced for quail through judicious management practices. However, management must address the **limiting factors** if the quail population is to increase. Additionally, both harvest and habitat management should be conducted in anticipation of the worst weather conditions. This is best accomplished by developing a detailed management plan that is tailored to the property under management consideration. At a minimum, the plan should include specific population and harvest goals, an inventory of current habitat conditions, and specific recommendations relative to the type, timing, location and costs of needed management practices.

Getting Technical Assistance

Identifying limiting factors and determining the correct management tools to use can be difficult for many landowners. Enlist the help of a professional wildlife biologist who can assess the property by examining existing habitats and current management practices. After viewing a tract of land, the biologist then can discuss the landowner’s objectives relative to the capacity of the property to meet the owner’s needs and begin developing the management plan.

To assist in developing a detailed management plan, the landowner should have as much information about the tract as possible. Helpful information includes aerial photos of the property (infrared photos are best), a soils map, timber stand descriptions, past management practices, neighboring management activities, and a list of any restrictions on the property such as rights-of-way agreements or contracts for federal programs. The landowner must be able to convey clearly defined objectives to the biologist who is developing the plan.

In 1999, WRD began implementation of the Bobwhite Quail Initiative (BQI). BQI is a pilot program in selected counties that provides technical assistance and/or financial incentives to private landowners for improving quail habitat.

In addition to BQI, other Game Management Section wildlife biologists are available to assist landowners in developing management plans (see the listing of offices at the back of this booklet). Often landowners want someone who can write a management plan, conduct the recommended management practices and provide frequent on-site visits. Private consultants are available to fill this need. If you decide to hire a wildlife consultant to write a management plan, look for one who has quail management experience, and ask for references.

Quail management can be expensive because of the constant effort necessary to maintain early plant successions. However, programs administered by the federal government, state government, private industry, and conservation organizations may help offset the costs of some management practices. The person who develops your management plan should be familiar with the types of land eligible for these programs.

Lastly, be realistic in your expectations. It is the responsibility of the biologist assisting you to tell you if what you want to accomplish will work. If your desire is to own land that will support heavy hunting pressure for wild bobwhite quail, you must have a large tract of land comprised of suitable soils. Be ready to work hard and continuously to manage the habitat. On the other hand, land managers can expect some success when appropriate management is applied and expectations are based on a reasonable assessment of the land’s potential.
When establishing linear practices like field borders, hedgerows, wetlands borders and ditch banks, remember that wider is better. They should be at least 10 feet in width, and widths of 30 to 100 feet are preferred. A good approach is to use the width of the available disk harrow, or multiples of the width, which will facilitate strip management. When possible, field borders should be maintained around the entire crop field. However, field borders, even on one side of a crop field, may provide significant benefits to quail. When feasible, all fallow habitats should be connected to facilitate the protected movement of quail throughout the cropland area.

**Disking** — Strip disking during fall/winter can be used to maintain favorable structure and plant species composition for quail. For example, one-third to one-half of the site can be disked each year in November through February and allowed to remain fallow the following summer. Fall/winter disking encourages the development of ragweed, partridge pea, beggarweeds, and other important food and cover plants. As a general rule, fallow habitats should not be disked, or otherwise disturbed during spring and summer, as this may disrupt nesting activity. Disking during spring and summer also encourages undesirable plants like coffee weed, sicklepod, Johnson grass and Bermuda grass.

**Croplands**

Providing suitable conditions for quail on as little as two to five percent of commercial crop fields can result in substantial increases in the bird population. Croplands can be enhanced for quail by providing fallow habitats through the management of field borders, hedgerows, field corners, ditch banks, roadsides, wetland borders and other marginal sites. Combinations of winter disking, burning, planting, and selective application of herbicides can be used on these sites to provide nesting cover and brood habitat during the spring/summer and food and cover during the fall/winter. Precision farming has shown that field edges are often marginally productive for crops, at best. Additionally, research has shown that weed borders harbor many beneficial insects that actually prey on crop pests, thereby providing a biological pest control. By utilizing these sites, quail management can often be integrated with agriculture without significant economic impacts to the farming operation.
Plantings should be established in strips, and then allowed to remain fallow the following year and rotated across the site. Another option is to plant reseeding annuals like partridge pea, kobe lespedeza and beggarweed, then encourage these to reseed with periodic fall/winter disking. Plant only a small portion of the managed site (generally less than 25 percent) in any given year, maintaining the remainder in desirable weeds, grasses and briars to provide adequate nesting cover, brood habitat and escape cover.

**Herbicides** — Periodically, the use of herbicides and/or mechanical treatments may be needed to control the invasion of trees and/or exotic grasses into fallow habitats. Even with frequent soil disturbance, sweetgum and other light-seeded trees may invade fallow areas and shade out desirable food and cover plants. When this occurs, practices should be implemented to remove the trees and restore the weeds, grasses and briars that quail need. It is beneficial to leave an occasional water oak, black cherry, sassafras, or plum thicket within these sites.

**Exotic grasses** — In fallow habitats another common problem is the invasion of Bermuda and other exotic grasses, into and underneath the weed canopy. These grasses restrict quail movement and can become so thick as to out-compete desirable vegetation. The best solution is broadcast spraying of an approved herbicide to control exotic grasses within and adjacent to fallow habitats prior to establishment. For specific herbicide types and rates, managers should consult their county extension agent or an herbicide company representative.

**Conservation tillage** — In recent years interest has grown in the use of conservation tillage as a farming practice that reduces soil erosion and conserves water. Conservation tillage is the process whereby the current year's crop is planted into the previous year’s crop residue or stubble. Research has shown that crop fields managed with conservation tillage can provide superior brood range over fields managed by conventional tillage. This is due to the greater abundance of insects associated with the previous year's residue of the cover crop. When conservation tillage is combined with the proper management of field borders, field corners, hedgerows, fallow patches and other idle areas, the effects can be synergistic.

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**Planting** — Planting can be used as an integral part of managing fallow habitats for quail (see Table 1 for specific recommendations). Plantings can be incorporated into field borders and hedgerows that are being managed by fall/winter disking. Plant annual grains like corn, Egyptian wheat, brown top millet and grain sorghum in the spring and summer to provide food and cover into the fall and winter. Wheat or oats can be planted during late fall.

*Strip disking is an often under-utilized technique that can be effective next to woods or fields. As a general rule, do not disk fields during spring and summer. Fall/winter disking can help establish favorable vegetative structure with beneficial plant species that quail prefer.*
Conservation tillage, where this year's crop is planted in last year's stubble, can provide superior brood range and other benefits that conventional tillage (inset) does not supply.

Grazing Lands and Hayfields

Moderate to heavy grazing by livestock of native rangeland detrimentally affects food and cover conditions for quail. At high stocking densities, livestock may trample and destroy quail nests. Livestock also utilize many of the foods preferred by quail, and heavy grazing reduces the abundance of cover thereby making quail more vulnerable to predators. On native rangelands where quail management is part of the objective, low stocking levels and rotational grazing systems are recommended to protect and maintain the quantity and quality of food and cover.

The conversion of native cover to improved pastures and hayfields greatly degrades habitat conditions for quail, songbirds and other early succession wildlife. Common exotic pasture grasses in Georgia include fescue, bahia and Bermuda grass. None of these grasses provide suitable food or cover for quail and they tend to out-compete desirable plants. The best approach for blending quail management with pasture management is to fence out, or set aside, corners, borders, drainage courses and other odd areas. Manage these sites with the same techniques previously described for croplands.

Additionally, with hayfields or where rotational grazing is a management option, conversion of a portion of the exotic grass fields or pastures to native warm season grasses can enhance habitat values for quail and other wildlife. Herbicide treatments are necessary for successfully converting exotic grasses to native warm season grasses. As with the other management practices, landowners should contact their local wildlife biologist for technical assistance before initiating management practices.

As with croplands, grazing lands and hayfields can be improved for quail through the proper management of field borders, corners and other transition zones.
Managing For Quail In Forested Habitats

Pine Forest Management Practices

In Georgia, longleaf/slash, loblolly/shortleaf, and oak/pine forests comprise a substantial proportion of the bobwhite’s geographic range. Pines produce pine seeds, used by quail as fall food, and large quantities of pine needles, which serve as a fuel for prescribed burning. However, on many sites, trees occur at densities that shade and out compete desirable food and cover plants. Within pine forests, the abundance of quail and the presence of several priority nongame birds are strongly associated with the structure and composition of the ground layer vegetation.

In general, quail benefit by grass and forb ground cover that develops in open and frequently burned pine forests, and for the first two to four years following forest regeneration cuts. Management for maximum economic return from timber is not consistent with providing optimum habitat for quail. However, through careful planning, timber can be managed for reasonable economic returns while maintaining huntable quail populations.

A variety of silvicultural techniques and habitat management practices can be used to integrate quail habitat with pine forest management. These practices include timber harvest and regeneration, establishment of openings, and prescribed burning. The specific timing and intensity of implementing these practices often must be varied to meet site-specific conditions. However, there are some general management guidelines that can be followed to enhance habitat for quail and other early successional wildlife in pine forests.

Forest Management Methods

All-aged and even-aged management are the two primary methods of forest management. All-aged management results from harvesting a portion of a timber stand, and by selecting individual trees or small groups of trees throughout the life of a stand. The stand then will be comprised of trees of all ages. When appropriately applied, this is the most complex and intensive method of forest management. It requires an extensive access system throughout the forest stand and increases the complexity of prescribed burning since young pine regeneration areas (except for longleaf) must be protected from fire. Since southern pines are shade intolerant, all-aged management necessitates maintaining a low density of overstory trees, which also enhances ground cover conditions for bobwhite quail.

Even-aged management is the most commonly used forest management method. It results from the harvest and regeneration of entire stands of trees at a given point in time (called the rotation age) thus creating a new stand of trees of the same age. Regeneration methods for even-aged management include clear-cutting with artificial regeneration, seed tree and shelterwood. Even-aged management is less complex and less costly to implement on an extensive scale than all-aged management. Quail populations often increase during the first two to four years after a stand has been cleared for regeneration. However, even-aged management results in entire stands of trees passing through the sapling stage (ages four to 15 years depending on the site) at stocking densities that are not conducive to providing quality habitat or desirable hunting conditions for quail.

Quail habitat can be maintained in pine forests that are managed with even-aged or all-aged methods. The management goal is to keep most of the ground in direct sunlight, control plant succession to maintain a diversity of grasses and forbs in the understory, and control hardwood invasion.

Pine Species Selection

All pine forest types can be managed to enhance habitat conditions for quail. However, pine species historically indigenous to the site should be used when regenerating pine stands. Longleaf pine, within its historic range, is better suited for quail management than loblolly, shortleaf or slash pine because: 1) it has a sparse crown thereby allowing more sunlight to reach the forest floor; 2) it is long-lived thereby providing increased management flexibility and a greater percentage of the total stand life in a suitable habitat condition; 3) it has a seed that is nutrient rich and highly preferred by quail; 4) it is relatively disease and insect resistant; 5) it is less prone to windthrow; and 6) it can be burned while in the grass stage.

The longleaf pine ecosystem once occupied approximately 21 million acres in Georgia, covering most of the Upper and Lower Coastal Plain and extending into the Ridge and Valley Province. Unfortunately, the longleaf ecosystem has been greatly diminished due to conversion to
Within its historic range, longleaf pine is better suited for blending quail management with timber management than are the other southern pine species. Longleaf pine can be burned while in the grass stage and is relatively disease and insect resistant.

The longleaf pine ecosystem once occupied about 21 million acres in Georgia, but now occupies only 300,000 acres. The dramatic reduction has contributed to the decline in quail populations.

other forest types and land uses, contributing substantially to the decline in quail populations.

Site Preparation

Sites can be prepared for regeneration in a variety of ways ranging from those of low intensity, like prescribed burning, to those of high intensity, like shearing, raking, piling, burning and/or herbicides. The method or methods used affects plant succession. Prescribed burning and intense mechanical methods, especially when applied during winter months, seem to produce the most desirable food and cover conditions for quail. These techniques result in extensive stands of erect annual weeds including important quail food plants like ragweed, partridge pea and lespedezas. This provides excellent brood range, fall/winter food and screening cover.

Herbicides are commonly used for site preparation, as well as later in the life of the stand, to retard or kill competing vegetation. The impact of herbicides on quail habitat varies greatly depending on the herbicide(s) used and the method of application. In general, using herbicides that leave legumes, blackberries and other important quail food and cover plants should be favored over those that control all vegetation. Banded or spot application methods are sometimes better than broadcast applications. Additional research is needed to determine the impacts of various site preparation techniques on short-term and long-term habitat conditions for quail and other wildlife.

Wide seedling spacing within pine regeneration areas facilitates the establishment and maintenance of desirable food and cover plants.

Seedling Spacing

Pine stand re-establishment requires artificial or natural regeneration. Seedling spacing determines the number of years until the tree crowns overlap and shade out the understory. With artificial regeneration, wide tree row spacing (such as eight feet by 10 feet, or eight feet by 12 feet) allows for the establishment and maintenance of grasses, forbs, legumes, soft mast producers and other desirable food and cover plants. Additionally, 15 to 40 percent of each stand should be established in openings of two to five acres in size. These openings can be managed through combinations of winter disking, prescribed burning, herbicide application, mowing and planting to provide food, cover and brood range.

Natural regeneration by seed tree or shelterwood often results in dense seedling stands that quickly out-compete grasses and forbs. These seedling stands should be thinned pre-commercially or the stem density otherwise reduced by judicious skidding of residual seed or shelterwood trees at the time of their removal.
Thinning

Thinning can be used in pine stands to improve quail habitat, upgrade timber quality, and provide revenue to the landowner. Stands should be thinned so that 40 to 60 percent of the ground is in direct sunlight at noon. Heavier thinnings are necessary on infertile soils to produce the desired ground cover. Within pine plantations, removing every second or third row and then thinning out the diseased or deformed trees within rows, is recommended.

When practical, conduct thinning operations during the winter months so that the resulting soil disturbance stimulates the growth of important quail foods and cover plants.

Heavy and frequent thinning is required to maintain adequate ground cover within pine stands. Thin stands so that 40-60 percent of the ground is in direct sunlight at noon.

Rotation Age

The time to harvest and regenerate pine stands depends on economic, wildlife and aesthetic objectives, pine species present, site fertility and overall stand health. Where quail are part of the management objective, long rotations should be favored. This can be over 60 years for loblolly, slash and shortleaf pine, and over 200 years for longleaf pine. Long rotations present managers with the opportunity to maintain a greater percentage of the total stand life in a suitable condition for quail. They also offer greater flexibility and ease in management. However, huntable populations of quail can be maintained on sites under short rotation management if careful planning occurs to ensure the establishment and maintenance of suitable ground cover conditions. Where short rotations are used, special consideration should be given to the location and distribution of forest regeneration areas, establishment and maintenance of openings, and the management of roads and roadsides to provide food, cover and travel avenues for quail.

Managing Hardwoods Within Pine Stands

Most pine stands have drainage courses, depressional wetlands, or other types of hardwood inclusions. These areas provide critical habitat for many wildlife species. However, they shade-out understory quail food and cover, and also may serve to increase the abundance of predators that impact quail reproduction and survival. Thinning the hardwoods combined with prescribed burning along the edges and within these habitats will result in improved ground cover for quail and may reduce predator abundance and efficiency. However, the manager must be aware that this can result in lower habitat quality for a variety of game and nongame species that require closed canopy hardwoods and abundant hard mast such as acorns.

Likewise, when hardwoods invade and occupy the midstory of pine stands they shade out the grass and forb ground cover needed by quail. On longleaf/wiregrass sites, this condition can be controlled by the use of growing season prescribed fire. However, in pine stands established on old field sites, it may be necessary to periodically use mechanical or chemical techniques in conjunction with prescribed fire to remove hardwoods and restore desirable ground cover conditions.
Prescribed Burning

When used correctly, prescribed burning is one of the most cost-effective and efficient tools available for managing quail habitat. Prescribed fire: 1) increases insect, legume, and soft mast abundance; 2) improves ground layer vegetative structure to enhance nesting cover, brood range, and insect and seed foraging conditions; 3) helps to control hardwood invasion into the forest midstory; 4) decreases the abundance of invertebrates that parasitize quail; and 5) decreases the chances of wildfire.

Prescribed burns should be applied to recently-thinned stands that have at least 40 percent of the ground in sunlight. Burning is of little wildlife value in forest stands where sunlight cannot reach the forest floor. Prescribed burns should be conducted annually, with approximately 30 to 50 percent of the land left unburned to provide food, nesting and escape cover.

Another alternative is to establish permanent firebreaks that divide the site in a checkerboard fashion into 10-acre to 50-acre blocks (smaller is better). Then, these blocks can be burned in a mosaic pattern on a two-year cycle where one half of the woodlands are burned each year. On infertile soils, burning on a three-year or longer cycle may be sufficient. On most sites, prescribed burns should be conducted during winter through early spring. Occasional growing season burns may be needed to more effectively control hardwood encroachment into pine stands. More specifically, pine stands established on old agricultural fields have fuel conditions that are best suited to winter burning, while longleaf/wiregrass stands are well adapted for growing season fires.

Prescribed burning should be initiated in pine stands at the earliest possible age. Longleaf stands can be burned in their second year when seedlings are still in the grass stage. Other pine species usually can be burned for the first time when they are 10 to 15 feet tall. Timber stands managed under all-aged systems require special consideration for prescribed fire. Prior to prescribed burning, young pine regeneration areas which are scattered throughout the stand, must be protected by firebreaks. Longleaf pine seedlings are the exception, and should be burned when in the grass stage to control brown spot disease.

Dense scrub hardwood stands have little value for quail and are difficult to manage. Repeated late spring burning helps open the stand, allowing the growth of beneficial quail plants. However, if the sprouts are more than one and one-half inches in diameter at chest height, mechanical means such as cutting, rotary mowing and bulldozing, may be required in initial control attempts. Herbicides provide another alternative for hardwood control.

Before burning, a person experienced in fire behavior must evaluate the property’s fuel type, planning the timing of the burn with relative humidity, fuel moisture, wind speed and direction. The fire plan should allow for adequate firebreaks, identifying smoke sensitive areas. Burn permits and proper equipment are required. Permits may be obtained from the Georgia Forestry Commission (GFC). The GFC and the Department of Natural Resources can make recommendations for controlled burning.

Prescribed fire is one of the most cost-effective and efficient tools available for managing quail habitat.
Forest Openings, Roads and Permanent Firebreaks

Idle openings are critical for providing brood range, food and cover for quail. As previously indicated, 15 to 40 percent of each forest stand should be maintained in openings that are two to five acres in size. Rotational winter disking, planting, and burning, should be applied to these openings so that one-third to two-thirds of each opening remains fallow each year. Herbicides may be needed if exotic grasses and/or hardwoods invade the site. (Figure 5, Appendix)

Roads and firebreaks are necessary components of timber management and can be managed as fallow opening habitat. They can be especially important for providing food, cover and travel avenues for quail while young pine stands are in the sapling stage. When a stand is regenerated or thinned, roadsides can be widened to 20 feet to 40 feet on each side, and these areas can be managed as long, linear fallow fields. Roads and firebreaks with north-south orientation are best suited for planting as they receive the most sunlight during the growing season. These linear habitats can be used to connect fallow openings within pine stands.

OTHER CONSIDERATIONS

A common misconception is that pen-raised quail can be used to restore wild quail populations. A number of research studies have shown that survival rates are very low for pen-raised quail released into the wild. Pen-raised birds that do survive may pair and mate with wild birds, but so few birds survive that they will not significantly contribute to the establishment or maintenance of a wild population. Also, there may be potential risks to wild quail and wild turkeys from the release of pen-raised quail. These risks are not well documented scientifically, but include disease, increased predation and genetic degradation.

The use of pen-raised quail should be viewed strictly as a means to provide the desired level of shooting on areas that are not capable of producing enough wild birds to meet the objective. Obtaining quality birds and releasing these in areas with good habitat structure and with a protective feeding system is the key to providing good shooting. It is illegal to release pen-reared birds in Georgia without obtaining a shooting preserve license. People considering the release of pen-raised quail should check with the Wildlife Resources Division, Game Management Section to ensure compliance with laws and regulations.

Research has shown that releasing pen-raised quail will not significantly contribute to establishing and maintaining wild quail populations.
Supplemental Feeding

A frequent topic of discussion among quail hunters and managers concerns the provision of supplemental feed to increase quail populations. Research has shown that supplemental feed can increase over-winter survival, body weights and reproduction in quail. Additionally, studies have shown: 1) the benefits of supplemental feeding to be most pronounced during drought years; 2) feeders were just as effective as spreading feed; 3) feeding did not increase the probability of finding a particular covey while hunting; and 4) did not increase predation. However, it is important to note that these studies were conducted on sites where nesting cover and brood habitat were excellent.

Where supplemental feeding is being considered as a quail management practice, landowners should: 1) consult Wildlife Resources Division regulations to make sure that feeding is conducted so as not to constitute an illegal lure or attraction, commonly referred to as baiting; 2) provide feed continuously from November to July; 3) provide feed throughout the property being managed for quail; and 4) provide feed under protective cover. The bottom line is that supplemental feeding is not a “silver bullet” and cannot take the place of providing quality habitat, particularly nesting and brood rearing cover.

Predator Management

The control or management of predators to increase quail populations is an age-old, controversial and complex subject. At first glance, it would seem to be logical that if an animal is eating quail and you remove that animal, the end result would be more quail. However, this may not be the case. For example, coyotes eat quail, but they also eat rats, snakes, foxes and other animals that eat quail. Controlling coyotes may increase populations of these other predators, which will actually increase predation on quail. As previously discussed, habitat loss and change, not predation, is the primary cause of the quail decline.

Quail are a prey species, and a variety of predators consume them at all seasons of the year and at all stages of their lives. Predation can be beneficial in removing diseased birds from the population, and it has helped mold the bobwhite into the sporting game bird that it is today. However, in certain situations predator pressure may be preventing the quail population from fully utilizing the available habitat. In these situations, management practices that reduce predation may allow for quail population increases.

Providing high quality habitat that reduces the exposure of the birds to predators can help minimize predation impacts. For example, removing trees from hedgerows improves the ground cover and takes away perch sites for avian predators. Thinning and burning woodlands improves food and cover for quail, and reduces the efficiency of avian and mammalian predators. Locating nesting cover and brood range away from creek drains and other predator sources may increase nesting success. Encouraging the legal trapping and hunting of fur-bearers may or may not enhance quail populations but should be considered. Landowners should consult with a professional wildlife biologist before beginning a predator management program and must always comply with state and federal laws and regulations. The Wildlife Resources Division has a permitting process to allow landowners who have an approved management plan to conduct mammalian predator control during the quail-nesting season. For more information, contact the local Game Management Section office.

Management Costs and Benefits

More quail can be produced through management, but the old saying, “You can’t get something for nothing” is all too true. Increasing quail populations requires effort and money. The amount required is based on the current habitat conditions, habitat development needed and the density of quail desired. Where maximum quail production is the objective both direct costs and opportunity costs can be great. However, with enough land that has suitable soils and vegetative cover, and is appropriately located, huntable populations can be sustained at reasonable costs to the landowner. In some cases, particularly with croplands, integrating quail management with other land management objectives may actually increase total economic potential through the returns realized from quail hunting leases.

The bobwhite quail is a bird worth working for and an important part of Georgia’s heritage. Quail hunting is a great way to introduce a young person to the outdoors and to keep the tradition alive.
Summary Of Primary Quail Management Recommendations

- Prior to implementing management practices: determine specific harvest and habitat management objectives; contact a professional wildlife biologist for technical assistance; and develop a detailed management plan.

- Use combinations of winter diskng, planting, burning, or herbicides to establish and maintain fallow fields, field borders, hedgerows, field corners, ditch banks, wetland borders, forest openings, widened roadsides, thinned pine stands and other habitats in a mixture of erect weeds, cultivated plantings, clumped native grasses and briars.

- Restore ground cover to existing hedgerows and other fallow habitats by using mechanical or chemical methods to remove trees.

- Convert portions of exotic grass pastures and fields to native warm season grasses and implement rotational haying or grazing.

- Within the original range, favor longleaf pine over other pine species.

- Use wide seedling spacing, such as 8 feet by 10 feet or 8 feet by 12 feet when regenerating pine stands.

- Thin pine stands regularly to maintain 40 to 60 percent of the ground in direct sunlight.

- Prescribe burn so that 50 to 70 percent of the area is burned yearly.

- Manage forest stands on long rotations.

- Use prescribed fire, chemical and/or mechanical methods to control hardwood invasion of pine stands.

- Establish 15 to 40 percent of forest stands in openings that are two to five acres in size.

- Maintain openings as fallow fields with combinations of winter diskng, planting, burning and herbicides.

- Do not disk, mow or otherwise disturb field borders, openings, or other fallow habitats during the April through October nesting and brood rearing season.

Quail hunting is a great way to introduce a young person to the outdoors and to share the hunting tradition.

For more information about quail conservation efforts contact the WRD offices listed in the back of this booklet.
### Suggested Plantings for Bobwhite Quail

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Method</th>
<th>Seeding Rate</th>
<th>Planting Season</th>
<th>Season Of Use</th>
<th>Treatments/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>Drill</td>
<td>7 lbs. per acre</td>
<td>April-May</td>
<td>Summer-Winter</td>
<td>Expensive &amp; difficult to grow; eaten by many wildlife species.</td>
</tr>
<tr>
<td>Grain Sorghum</td>
<td>Broadcast</td>
<td>15 lbs. per acre, 7 lbs. per acre</td>
<td>April-May</td>
<td>Summer-Winter</td>
<td>Savannah 5 or WGF varieties; nutritionally similar to corn but easier to grow and less expensive. May be damaged by deer during drought years.</td>
</tr>
<tr>
<td>Kobe Lespedeza</td>
<td>Broadcast</td>
<td>30 lbs. per acre</td>
<td>Feb.-March</td>
<td>Fall-Spring</td>
<td>Can be encouraged to reseed by light disking in March.</td>
</tr>
<tr>
<td>Browntop Millet</td>
<td>Broadcast</td>
<td>15 lbs. per acre</td>
<td>April-May</td>
<td>Summer-Fall</td>
<td>Does not persist into winter months.</td>
</tr>
<tr>
<td>Bicolor Lespedeza</td>
<td>Seedlings</td>
<td>Plant seedlings in rows 2 ft. x 3 ft., 20 lbs. per acre</td>
<td>Dec.-Feb., Feb.-March</td>
<td>Fall-Winter</td>
<td>Plant in 1/8 to 1/4 acre patches. Once established, maintain by mowing and fertilizing every 2 years with 0-20-20 in March. If broadcast seeded, mix with 15 lbs. acre of Kobe Lespedeza. May become invasive on clay soils.</td>
</tr>
<tr>
<td>Egyptian Wheat</td>
<td>Broadcast</td>
<td>20 lbs. per acre</td>
<td>April-July</td>
<td>Summer-Winter</td>
<td>Less prone to deer damage than corn or sorghum. Stands erect and holds seed into winter. Can be mixed with millet or sorghum.</td>
</tr>
<tr>
<td>Wheat</td>
<td>Broadcast</td>
<td>60 lbs. per acre</td>
<td>Sept.-Nov.</td>
<td>Spring-Summer</td>
<td>Allow to stand fallow the following summer.</td>
</tr>
<tr>
<td>Partridge Pea</td>
<td>Broadcast</td>
<td>15 lbs. per acre</td>
<td>Feb.-March</td>
<td>Fall-Winter</td>
<td>Can be encouraged to reseed by light disking in Dec.-Feb.</td>
</tr>
<tr>
<td>Switch Grass</td>
<td>Broadcast on top of seedbed. Culti-pak but do not cover deeply. Do not fertilize.</td>
<td>2 lbs. per acre each</td>
<td>March-May</td>
<td>Spring-Summer (nesting cover)</td>
<td>Can become too thick for quail and must be maintained in clump structure by periodic fire or light disking.</td>
</tr>
</tbody>
</table>

Plantings can be an integral part of managing land for quail, but should not be viewed as a magic bullet.

Get soil tested through the County Extension Service for fertilizer and lime recommendations.
Figure 1

Bobwhite Quail Population Trends
Southeast 1966-98 *
Annual Breeding Bird Survey

![Graph showing Bobwhite Quail Population Trends from 1966 to 1998.](image)

* AL, AR, FL, GA, KY, LA, MD, MS, NC, SC, TN, VA

Figure 2

Trends in Georgia Quail Harvest and Hunter Numbers

![Graph showing trends in Georgia Quail Harvest and Hunter Numbers from 1962-63 to 1999-00.](image)
Opening Management Options
For Bobwhite Quail

The objective in managing openings is to maintain various structural components of early successional habitat. To accomplish this goal, openings should be managed using rotational techniques over a three-year to four-year period. Three appropriate management options follow:

Option 1 (most intensive)

AREA:
A. During winter of the first year, lightly disk (one pass with disks set straight) the entire border and center strip area. In subsequent years, winter disk only one-third of the border and center strip each year to maintain "older cover" (i.e., a mixture of clumped grasses, briars and scattered shrub thickets). Consider planting a couple small clumps of wild plum in the center strip. Occasionally, invading trees will need to be removed by chemical or mechanical methods.
B. Plant annual grains (e.g., Egyptian wheat, grain sorghum, corn or millet) in spring of year one and fallow (let stand idle) until fall of year two.
C. Plant wheat in the fall of year one and fallow until spring of year three.

In following years, alternate practices between B & C.

Option 2 (moderate intensity)

A. Same as Option 1A.
B. Plant wheat in the fall of year one and fallow until fall of year three.
C. Plant wheat in fall of year two and fallow until fall of year four.

Option 3 (least intensive)

A. Same as Option 1A.
B. Disk during late winter of year one and fallow until winter of year three.
C. Disk during late winter of year two and fallow until winter of year four.

Openings that are managed to maintain proper structure and plant species composition can provide critical habitat for quail. Desirable structure includes a mixture of clumped grasses, briars and erect weeds that are canopied above but open underneath. Various combinations of planting, winter disking and herbicide treatments can be used to achieve the desired results. Openings should be two to five acres in size, distributed throughout the property, and should comprise 15 to 40 percent or more of the available habitat.
Record keeping is an important component of managing quail on your lands. Hunting records can provide valuable information on population trends, relative abundance, and distribution of quail on a tract of land, helping managers target specific areas and management techniques. Records also can bring you hours of enjoyment by helping you re-live experiences with friends and family. Below is a sample record sheet that can be copied and used to help you enjoy your management and hunting experiences.

<table>
<thead>
<tr>
<th>Hunt Date</th>
<th>County/State</th>
<th>No. of Hunters</th>
<th>Weather/Temp.</th>
<th>Hours Hunted</th>
<th>Coveys Flushed</th>
<th>Birds Killed</th>
<th>Shots Fired</th>
<th>Comments*</th>
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**Literature Sources**


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June 2001

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Bobwhite Quail Initiative Offices

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BQI Headquarters...........(478) 994-7583

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Fitzgerald.....................(229) 426-5267
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