The Northern Bobwhite of the Mid-Atlantic

A Landowners Guide to Their Ecology and Management

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College of Agriculture & Natural Resources Northern bobwhite (*Colinus virginianus*) have long been aesthetically and economically prized gamebirds in North America. Historically, bobwhite flourished in traditional farmlands where farming and grazing practices created an early successional patchwork of agriculture, grasslands, old fields, and woody edges; under persistent social and biological pressures like predation and hunting, suitable habitat was bobwhite's safeguard against obliteration.

Since WWII, however, farming practices have changed, and the bobwhite's habitat has changed with them. For those who grew up before the 1960's the "bob-white" song echoing over the farmlands of eastern America provides a nostalgic memory of a landscape that is quickly disappearing.

Current trends toward cleaner farming, larger plot sizes and conversion to non-native grasses or crowded pine stands, and conversion to suburbia have reduced the amount of habitat available to bobwhite nesting and escape cover. For states such as New Jersey, which is the most developed state in the Union, these habitat conversions are especially drastic. Consequently, for at least half a century, bobwhite numbers have followed a downward trend throughout the bird's range.

In 2008, the Audubon Society reported the Northern Bobwhite has suffered the most severe population decline of any North American bird: at a rate of 82 percent in the last forty years. Some of the steepest declines have been recorded in the Mid-Atlantic region of the U.S. This decline is especially troublesome given that in 1966 the national Breeding Bird Survey recorded the highest densities of bobwhite in the country right in Delaware (Figure 1). In New Jersey, bobwhite population trends are among the most negative of any state, with declines of 13.0% per year between 1980 and 2007. This case is sadly representative of northern bobwhite throughout the Mid-Atlantic.

Northern bobwhite population trends in three Mid-Atlantic states (New Jersey, Delaware, and Maryland) between 1966-1979 and 1980-2007 as estimated from the Breeding Bird Survey.



Luckily for bobwhite, the cause of the decline is no mystery, and a number of state and federal wildlife biologists, non-governmental conservation organizations, as well as many private landowners have dedicated themselves to improving bobwhite habitat. Of particular note, beginning in 1992, a collaborative Northern Bobwhite Conservation Initiative began in an effort to develop management strategies for implementation on public and private lands throughout the bobwhite range. To encourage cooperation, federal, state, and private programs offer technical and financial assistance to private landowners hoping to manage bobwhite on their property. Without their help, bobwhite conservation would be much more difficult.

Northern Bobwhite Conservation Initiative 2009 habitat priority areas in the Mid-Atlantic. Green areas indicate little to no possibility of bobwhite present. Blue areas indicate bobwhite are present but management efforts may have low success. Red areas indicate priority areas with higher probability of bobwhite presence and management success.



With proper care for habitat, bobwhite can flourish again in the Mid-Atlantic. This bulletin has been written to provide an overview to understanding the bobwhite decline and provide suggestions for habitat management to promote their success in future years.

Photo taken by Mike Lohr



LIFE HISTORY AND HABITAT REQUIREMENTS

Bobwhite's habitat needs are dictated by its seasonal behaviors and daily routine; effective management starts with a clear understanding of its habits in mating, nesting, brooding and everything in between.

Spring and Early Summer: Breeding and Nesting

Just like many crops, the life of a bobwhite follows an annual cycle. The perpetuation of this cycle hinges on several delicate factors, beginning with successful reproduction and nesting. In early spring, male bobwhites begin their distinctive "bob-white" whistle to attract a mate. Males and females generally form monogamous pair-bonds throughout the breeding and nesting season, which is lengthy enough to allow bobwhite to make multiple nesting attempts if the first fails, or if habitat conditions will support a second brood. A successful attempt takes between 44-55 days from nesting through incubation, with the majority of hatching complete by late July. Broods are typically about 11 chicks, which soon leave the nest to forage for insects.

Bobwhite nest woven under warn season grass holding 16 eggs. Photo taken in Cumberland County, New Jersey by Bridget Collins.



Bobwhites are active and thrive in a patchwork of cultivated lands with plenty of woody edge, but they need old fields, pastures, or grasslands for nesting. Nests are often found at the base of native warm-season bunch grasses like big and little bluestems, switchgrass, and Indiangrass. Consequently, early harvest of warm-season grasses or removal of last-year's debris can disturb bobwhite nesting.

Set aside lands in Cumberland County, New Jersey with warm season grasses, native forbes, and woody edge that supported northern bobwhite nests.



Late Summer – Brood Rearing

The first six weeks after hatching are the most critical in a quail's life. Without adequate brood-rearing cover for chick survival, bobwhite restoration is a near impossibility. Newly-hatched chicks are active fairly quickly, leaving the nest to forage for insects (which make up about 85% of the juvenile diet), but have trouble navigating dense understory. For this reason, brood habitat occurs ideally in fields with a mixture of bare ground, forbs, and grasses for ease of movement, concealment from predators, and abundant seed and insect foods. As a simple test to see if a field is suitable for chicks, landowners should put their head on the ground and look around. If they see obvious bare ground corridors with a mixture of forbs and grasses there is a good chance the habitat is suitable for chicks. Weedy field borders and legume plantings provide great concealment while still remaining open at ground level.

Open spaces between plants provide ideal cover to allow quail chicks to travel undetected by predators.



Photo taken by Randy Cass

Fall and Winter – Coveys and Roosting

In early fall, bobwhites prepare for winter by moving to more shrubby and woody portions of the landscape and breaking into social groups called coveys. Coveys are approximately 11 birds, made up of adult pairs and their young, unmated cocks, or pairs that failed to produce broods during the breeding and nesting season. Coveys provide a degree of security to bobwhites over the winter when food is scarce and temperatures are low. To conserve energy at night, a covey roosts in a characteristic outward-facing circle, a practice also vital in detecting predators. For quicker perception of predators and to facilitate escape, coveys generally roost in grassy vegetation no taller than six inches.



Typical winter cover along agricultural edge habitat comprised of warm season grasses, thickets, and trees. Photo taken in Cumberland County, New Jersey by Bridget Collins.

Bobwhites fulfill most of their nutritional needs over the winter by consuming the seeds and vegetation of preferred cover plants and the insects that live among them. In years of low food availability, food plots may be helpful in bringing winter food and cover closer together. A collection of native preferred food and cover plants can be found in the "planting recommendations" section.

Daily activities: The home range

When they are not mating or nesting, bobwhites spend most of their days foraging for food and loafing about. These activities are carried out over a geographical space called a home range, or the total area of land that a quail uses regularly. Bobwhites do not have a fixed home range; on the contrary, the size of the home range is contingent upon habitat conditions. Birds will modify their home range to meet their survival needs: If a particular tract of land does not fulfill all of the bobwhite's habitat requirements, then the bird must travel to find them, wasting energy and risking predation. Landowners can increase the possibility of survival, and thus bobwhite numbers, by managing "conceptual" home ranges across their property. Locations and home range of a single radiocollared female bobwhite in summer 2007 in Cumberland County, New Jersey.



APPROACHING HABITAT MANAGEMENT

Cleaner farming practices and conversion of agricultural land prevail as the main culprits of bobwhite habitat destruction. On the farm, cleaner practices remove residual plant material like the grasses used for nesting or the overgrown fencerows, hedgerows and windbreaks that create essential edge habitat. Conversion of native grasslands and woodland edge to monocultures of introduced grasses or developed land additionally stresses struggling populations. Increased fire control, grazing pressure, and the use of agrichemicals also contribute, though to a lesser degree.

Fortunately, a suitable environment can often be cultivated through vigilance and subtle management of the existing landscape. Moreover, the intensity of management is entirely within the landowner's discretion. To begin a management project, landowners should evaluate their property and set a personal objective for the land. This entails setting conceptual home ranges and identifying their limiting factors.

Setting a conceptual home range

Quail are mobile groundbirds but do not travel long distances easily, so a space with the most usable resources over the least amount of land will be most attractive. The home range can be as small as you decide to manage it: the smaller the desired home range, the more intensive the management. A series of "conceptual home ranges" will span the property and set boundaries for targeted instances of management.

Under optimal conditions, one covey (~11 birds) can comfortably exist on as little as 15 acres of ideal bobwhite habitat, though it is

more reasonable for a covey to stretch its home range to about 80 acres. Bobwhites spend the majority of their time in a "core area" of an average 22 acres and seldom establish this area more than a half mile from where they were hatched. Native nesting grasses should appear in close proximity to other habitat components for this reason.

Visualize an area between 15 and 80 acres inside which you will attempt to create a landscape that includes all the necessities for survival: an array of cover types in early succession, closely interspersed. In theory, at least one covey will occupy each conceptual home range after management practices are implemented. Note, however, that if human dominated land uses (houses, clean agriculture, etc) exist within the conceptual home range, the planned acreage will need to be increased to perhaps 160-320 acres.

Landowners interested in improving habitats for bobwhite quail can make initial management decisions based on a chosen conceptual home range size. Aerial maps can be used to outline and assess these areas on your farm. Taken from the Missouri Bobwhite Quail Habitat Appraisal Guide (University of Missouri Extension MP902)



Images courtesy of University of Missouri Extension

Identifying limiting factors

In general, the ideal quail home range should encompass about:

- 40-60% annual weeds, legumes, and crops
- 30-40% grasses
- 5-20% shrubby cover and trees

With this information, it is time to assess your land. Does it have potential for harboring quail? How can you increase that potential and make it a reality? What is the limiting factor on your particular property?

The limiting factor on a particular expanse of land is that which hinders quail survival. It can be a matter of space or substance. For instance, the absence of native warm season grasses for nesting is a glaring deficiency in substance. However, if the existing nesting grasses are not situated near brood rearing habitat, the home range is spatially inadequate. The habitat puzzle may seem impossible to complete at first, but it will become simpler after the most formidable limiting factors are addressed.



Nesting cover

Bobwhites require native warm season bunch grasses for nesting. They are formed in clumps from the previous year's growth. One 12" clump of grass should appear between every 4 to 160 square feet (e.g., about 250-10,000 clumps per acre), although consider an average value of one bunchgrass per 36 square feet (6 foot by 6 foot area). A nesting site must be stationed 50-70 feet from an edge or opening for brood rearing. Disturbances (fire or mowing) every 2-4 years maintain the early successional stage of the grass and reduce litter buildup. If you manage a tree nursery or orchard, consider not mowing grasses in between trees to create a savannah habitat that quail can use for nesting.

Brooding cover

Legumes, annual weeds, fallow fields, minimum or no-till crop fields can all be used as brooding cover for newly hatched chicks. At least 25% bare ground should be present, though 50% is optimum. Patches of brooding cover should be fairly close to nesting grasses as well as woody thickets or stands of taller dense weeds for midday loafing. Rotate in fallow crop fields for 2 years or disc every 2-4 years in permanently established plots.

NESTING AND BROODING COMBINED RECOMMENDATION

In a 36 sq. ft. (6' x 6') area make sure you have:

- 1 sq. ft. of native warm season bunch grass
 - 17 sq ft. of native forbs
 - 18 sq. ft. of bare ground

Loafing and escape cover

Trees and shrubs with low canopies (thickets and briars) are essential to escaping or remaining concealed from predators. Quail rarely use habitat more than 70 feet from escape cover, so it should be distributed liberally about the landscape. Patches with canopy closure at three feet offer the best protection. Loafing and headquarters sites may be as small as 100 square feet but ideally are at least 400 square feet, or more. The preferred size is 1500 square feet. No less than 5% or more than 25% of a covey home range should be in woody cover that is 3 feet to 6 feet tall.

Food

Scattered, irregularly shaped plots of preferred foods can be placed at the edges of other habitat components to fortify the bobwhite food supply. One-quarter to two acres, including some bare ground for movement, is sufficient; but plots should be larger where there is significant competition from white-tailed deer. Demand may be met through existing brooding cover and escape cover, but food plots (see box for recommended seeding rates) are helpful in years of low food availability due to drought, etc. Consider conservation tillage to increase waste grain to supplement the winter food supply.

SEEDING RATES	LBS. PER ACRE
Milo (with planter)	4–5
Milo (broadcast)	6–8
Soybeans (with planter)	30–40
Soybeans (broadcast)	50-80
Corn (with planter)	12–15
Corn (broadcast)	15–20
Sunflowers (with planter)	3–4
Sunflowers (broadcast)	4-8
Egyptian wheat (planted)	4–5
Egyptian wheat (broadcast)	6–10
Proso millet	20–30

Buffers

Patchy cover can be further enhanced through the planting of buffers, especially as borders around the edges of crop fields but also as a soft transition along wooded areas. CP33 – "Buffers for Bobwhite" is a conservation practice under the Conservation Reserve Program that offers compensation for retiring farmland and marginal pasture. Consider 45-90 foot buffers planted in a mixture of native grass species plus one or two legumes. Shrubs can also be incorporated to create hedgerows through open areas, creating a corridor for wildlife movement and providing food and cover for wildlife and habitat for beneficial insects. Buffers also reduce erosion and inputs on lower production land and improves water quality.

Agricultural lands with 2 rows of corn food plot followed by a fortyfive foot buffer of warm season grass in Kent County, Delaware. Photo by Chris Williams



Forest Management

Woodlands present unique management challenges. When the canopy closes above the forest floor, sunlight is unable to reach vegetation at ground level, preventing early successional bobwhite habitat from developing. Measures of timber density are helpful in managing pine stands to the proper thickness. Basal area—the crosssectional area of wood in a stand—should be kept below 40 square feet/acre to permit movement and adequate sunlight at ground level.

Tall Timbers Research Station, Florida, has had success rebuilding populations on public lands by thinning pine stands through mechanical and herbicidal treatments and burning every 1-2 years. Since 1996, the bobwhite population there has increased 10-fold reaching as high as 2 bobwhites per acre in the fall.

Management Practices

Periodic thinning of thick vegetation is necessary to accommodate bobwhite locomotion. An occasional soil disturbance will additionally promote regrowth of native food and cover plants that bobwhites prefer. If implemented on a rotational basis over a 2-3 year cycle, disturbances will stagger stages of succession and help create the patchwork of essential nesting, brooding and screening habitat.

Disking

Disking is a cost-effective method of maintaining succession and promoting annual plant communities. Depending on the time of year, disking will yield different results. Fall disking tends to stimulate the growth of food plants while spring disking promotes annual grasses. So that there is no disturbance to bobwhite nesting, disking should be done between October and March. A depth of two to three inches is enough to disturb the soil and promote new growth. Adjacent strips approximately ten to twenty feet wide, no less than 100 feet long, should be patterned along woodlots, grassy fields and fence- and hedgerows. About one third to one half of fields should be disked each year, rotating which strips are disked on a two or three year basis. This will maintain various early successional plant communities while establishing assorted cover types in close proximity to one another.



15 ft²/acre Photos taken by Shane Wellendorf

40 ft²/acre

80 ft²/acre

Where disking is not possible, mowing may be used as an alternative. Best done in the fall, mowing should cut vegetation as short as possible, in travel lanes at least 15 feet wide. Since it does not disturb the soil surface, the benefits are fewer. It may even leave a dense layer of litter at ground level, impeding the movement of small birds. Use disking wherever possible and mow with care, primarily for controlling brush and not for creating or managing habitat.

Burning

Controlled burning is another practical method for managing succession. Like disking, it removes litter from ground level and promotes native growth while returning nutrients to the soil. Burning should be done one day after a storm front has moved through the area and the atmosphere is stable, with winds between five and fifteen mph and humidity above 40%. "Cool" fires set to back into the wind, or with a line of fire parallel to the wind, are easiest to control. Disked firebreaks should be included around the burn area. Aim for about one third of the area, distributed in small patches.

Thinking Beyond Your Back Forty

Management on individual properties is the cornerstone of bobwhite habitat management. In many cases it will sustain small populations but may do little to promote long-term recovery of the species. Broad-scale, multi-property cooperation in management is the key to contiguous usable habitat and increased bobwhite abundance. When property limits define bobwhite habitat, biological needs can be ignored. If landowners can institute a shift away from confined management and toward ecological habitat boundaries, the land will more closely resemble native habitat.

Prescribed fires at Buckshutem Wildlife Management Area, Cumberland County, New Jersey to thin forest to promote pine savannah. Photos by Mike Lohr and Bridget Collins.

PLANTING RECOMMENDATIONS

Spatial and temporal variations in weather, rainfall, and mast and seed abundance complicate generalizations regarding bobwhite feeding behavior. A covey might appear to favor certain plant foods one year and not the next, or in one locality and not another. For example, bobwhites ate an inordinate amount of wax myrtle over one particularly harsh winter in Maryland. Fourteen inches of snowfall buried their staple food items, so bobwhites resorted to the accessible wax myrtle. When staple foods are available, wax myrtle is of little value to bobwhite.

Accounts like this one tell us one thing for sure: bobwhites are opportunistic feeders, and they will eat what is available. However, what they find may not be an ideal source of energy and nutrition. For the concerned landowner, planting is an option. The following table compiles plant genera and species found in the crops and droppings of bobwhites inhabiting Maryland and Virginia. All included species are native to the Mid-Atlantic region. Peculiar cases of consumption (as with wax myrtle, described above) are marked with an asterisk. Though such plants are not ordinarily preferred as a food source, they can sustain a population in times of severe food shortage and thus warrant mentioning as emergency food sources.

Grass seeds are taken so scarcely that their contribution to the bobwhite diet is negligible when seeds of preferred herbs and trees are available. Bobwhites will eat the seeds of the native grass species listed below, but their primary use is in nesting.

To hasten the decision process, a more manageable table of the more perennially preferred food plants is included. These show up in the quail diet consistently when available. In addition to foods the following table also provides recommendations for grasses, forbs, and trees that are known to be useful for escape cover, nesting cover, loafing cover, and brooding cover.



Photo taken by Christopher Williams

PREFERRED FOOD PLANTS

Ambrosia artemisiifolia (annual ragweed)

Chamaecrista (partridge pea)

Desmodium (tick-trefoil: showy, hoary, hairy small-leaf, largebract, pointedleaf, panicledleaf)

Robinia pseudoacacia (black locust)

Liquidambar styraciflua (sweet gum)

Pinus (pines: eastern white, pitch, red)

Quercus (oaks: northern red, black, pin, swamp white)

	Food	NESTING	BROODING	ESCAPE/ LOAFING
GRASSES				
<i>Andropogon</i> (broomsedge bluestem, big bluestem)	Х	Х		
Digitaria (crabgrass: slender, hairy)	Х	Х		
Panicum (witchgrass, switchgrass)	Х	Х		
Paspalum (thin, field)	Х	Х		
Schizachyrium scoparium (little bluestem)	Х	Х		
Sorghastrum nutans (Indiangrass)	Х	Х		

	Food	NESTING	BROODING	ESCAPE/ LOAFING
Herbs				
<i>Ambrosia artemisiifolia</i> (annual ragweed)	Х		Х	
<i>Amphicarpaea bracteata</i> (American hogpeanut)	Х			Х
Apios americana (groundnut)	Х			Х
Bidens bipinnata (Spanish needles)	Х		Х	
<i>Chamaecrista</i> (partridge pea)	Х		Х	
<i>Commelina</i> (dayflower: climbing, whitemouth, Virginia)	Х		Х	
<i>Desmodium</i> (ticktrefoil: showy, hoary, hairy small-leaf, largebract, pointedleaf, panicledleaf)	Х			Х
<i>Galactia</i> (milkpea: eastern, downy)	Х		Х	
Impatiens capensis (jewelweed)	Х		Х	
<i>Lespedeza</i> (native lespedeza: roundhead, shrubby, hairy, violet)	Х		Х	
Parthenocissus quinquefolia (Virginia creeper)	Х			Х
<i>Polygonum</i> (knotweed: water, erect, curly top, bushy; smartweed: swamp, Pennsylvania, dotted)	Х			Х
<i>Rumex</i> (dock: pale, swamp)	Х			Х
<i>Strophostyles</i> (amberique-bean, pink fuzzybean)	Х			Х
Symplocarpus foetidus (skunk cabbage)	Х			Х
<i>Toxicodendron radicans</i> (eastern poison ivy)	х			Х
<i>Trichostema dichotomum</i> (forked bluecurls)	х			Х
Vicia caroliniana (Carolina vetch)	Х			Х
<i>Vitis</i> (grape: summer, fox, riverbank, frost)	Х			Х

	Food	NESTING	BROODING	ESCAPE/ LOAFING
SHRUBS/TREES				
<i>Acer</i> (maple: black, striped, red, silver, sugar; boxelder)	Х			Х
Betula (birch: paper, gray)	Х			Х
<i>Carpinus caroliniana</i> (American hornbeam)	Х			Х
Cornus florida (flowering dogwood)	Х			Х
<i>Diospyros virginiana</i> (common persimmon)	Х			Х
Fagus grandifolia (beech)	Х			Х
Fraxinus (ash: white, green)	Х			Х
Hamamelis virginiana (witch hazel)	Х			Х
Juniperus virginiana (eastern redcedar)	Х			Х
Liquidambar styraciflua (sweet gum)	Х			Х
<i>Morella cerifera</i> *(wax myrtle)	Х			Х
<i>Morella pensylvanica</i> (northern bayberry)	Х			Х
Nyssa sylvatica (black gum)	Х			Х
Pinus (pines: eastern white, pitch, red)	Х			Х
<i>Prunus</i> (plum: American, Allegheny, Chickasaw)	Х			Х
<i>Rhus*</i> (sumac: fragrant, winged, smooth, staghorn)	Х			Х
<i>Quercus</i> (oaks: northern red, black, pin, swamp white)	Х			Х
Robinia pseudoacacia (black locust)	Х			Х
Sassafras albidum (sassafras)	Х			Х

Sources of Information

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

University of Delaware Department of Entomology and Wildlife Ecology – http://ag.udel.edu/enwc/

Mid-Atlantic Bobwhite Conservation Initiative - http://ag.udel.edu/enwc/MABCI/

Quail Forever - http://www.quailforever.org/

Quail Unlimited - http://www.qu.org/

Mississippi State University northern bobwhite extension documents http://www.naturalresources.msstate.edu/resources/ bobwhite-quail.html

University of Missouri northern bobwhite extension documents http://extension.missouri.edu/publications/DisplayPub.aspx?P=g9431

Technical Assistance

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

New Jersey Division of Fish and Wildlife Website: http://www.state.nj.us/dep/fgw/ Phone: 609-292-2965 New Jersey Quail Project – Local organization assisting with habitat restoration Website: http://www.NJQuailProject.org Phone: 856-456-7804

Pennsylvania Game Commission Website: http://www.pgc.state.pa.us Phone: 717-787-4250

Delaware Division of Fish and Wildlife Website: http://www.fw.delaware.gov/ Phone: 302-739-9912

Maryland Department of Natural Resources Website: http://www.dnr.state.md.us/ Phone: 410-260-8367

Virginia Department of Game and Inland Fisheries Website: http://www.dgif.virginia.gov/ Phone: 804-367-1000

USDA-Farm Service Agency administers the Conservation Reserve Program. Website: http://www.fsa.usda.gov/ Phone: 601-965-4300

USDA-Natural Resources Conservation Service has wildlife biologists and foresters to assist landowners with wildlife and forest management planning. Website: http://www.ms.nrcs.usda.gov/ Phone: 601-965-4339

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