Bringing Back Bobwhites

A Landowner's Guide

MP506

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The familiar whistle of the bobwhite (*Colinus virginianus*; Figure 1) is less prevalent in Arkansas landscapes. According to data collected from the annual Breeding Bird Survey, bobwhites have been declining for 30 years (Figure 2). Studies indicate the major factor contributing to declining bobwhite populations is habitat loss. Arkansas' landscape has changed dramatically since the 1940s and 1950s when bobwhites were prevalent. In rural areas, 40-acre homesteads have been replaced by larger landholdings as many moved to cities. These once small patches of diverse habitat have become large expanses of forests, row crops, livestock pastures and overgrown idle lands. The key to bringing back bobwhites is designing suitable habitat for the survival of this species.

FIGURE 1. The fate of declining bobwhite populations rests with Arkansas farmers and landowners.
Photo by Jeff Vanuga, NRCS.

Some evidence indicates predation combined with habitat loss has affected bobwhite populations locally. Trapping has become less profitable, and with fewer trappers, furbearing predators such as coyotes and raccoons are plentiful. Other non-game predators such as snakes, hawks and owls are protected by law. Invading species such as armadillos and fire ants also have been blamed for declining bobwhites.

Adequate escape and nesting cover is key to the bobwhite's survival. With suitable cover, a larger component of the bobwhite population can escape predation and thrive. Landowners, farmers and hunters who want to help bring back bobwhites can implement habitat practices which benefit these native birds. These ground-nesting birds are highly susceptible to nest and brood disturbance from mowing, haying and grazing during spring and summer. Providing undisturbed nesting cover adjacent to brood-rearing cover greatly improves survival.

The Arkansas Bobwhite Habitat Restoration Team, also called Arkansas Quail Committee, is comprised of numerous state and non-government wildlife conservation organizations. Recently, the team has improved

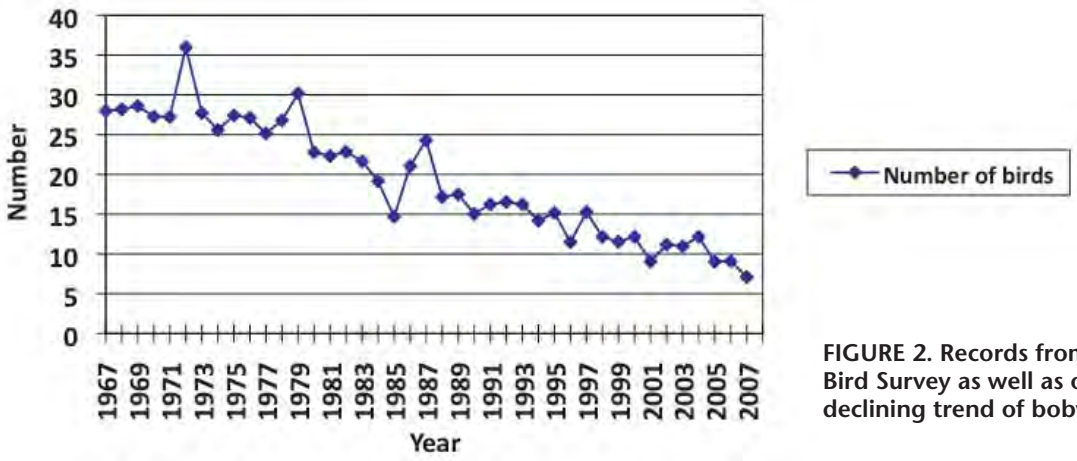

FIGURE 2. Records from the annual Breeding Bird Survey as well as other sources show a declining trend of bobwhites in Arkansas.

bobwhite habitat and conducted research studies at two focal areas of more than 19,000 acres of privately owned land to demonstrate bobwhite management practices in Fulton and Searcy Counties. Results from these focal areas contributed to habitat recommendations made in this publication.

Information presented here is for improving bobwhite habitat in areas where no birds are present currently. Where bobwhites are present, these habitat management practices may be counter-productive and cause a population decline. Manipulating habitat where bobwhites currently live is not advisable, though having birds nearby will help expand bobwhites into new habitat.

Nesting and Brood-Rearing Habitat

Ideally, a mix of mature native warm-season grasses (e.g., big bluestem, broomsedge) and forbs (e.g., broad-leafed herbaceous plants) provides nesting and brood-rearing habitat. Native clump grasses form an umbrella which conceals bobwhites from avian predators (Figure 3). Forbs produce seeds and attract insects which are an important protein source for growing chicks.

Bobwhites nest successfully in thick tall grass stands near areas with shrubs and bare ground (Figure 4). Nesting cover is thicker than brood-rearing cover with less plant diversity. Bobwhites prefer nesting in clumps of dry grass from a previous year's growth. An Arkansas study indicates good nesting habitat consists of dense overhead cover (77% cover), dead plant materials at ground level (35% cover), lots of tall grass (66% cover) and taller vegetation (26 inches) with few forbs (9% cover), very little bare ground (3% cover) and little open space from ground level to six inches above ground (25%-30%).

FIGURE 3. Tall, unmowed clump grasses conceal bobwhite nests from predators.
Photo by Kevin Labrum, Arkansas Tech Univ.

FIGURE 4. Thick stands of undisturbed tall grass near open shrubby areas provide ideal nesting habitat for bobwhites.
Photo by Kevin Labrum, Arkansas Tech Univ.

FIGURE 5. The ideal brood-rearing habitat is a mix of grasses, forbs and shrubs near nesting habitat.
Photo by Kevin Labrum, Arkansas Tech Univ.

Bobwhites will also nest in pure stands of tall grasses three feet or higher which conceal nests from predators, though they will also nest in grasses one or two feet high. A few acres of unmowed, moderately grazed fescue growing above waist high can provide suitable nesting habitat for bobwhites when brood-rearing habitat comprised of shrubs, forbs and bare ground is within 100 yards.

Within a day of nesting, the hen moves the brood to nearby areas with more bare ground and where insects are abundant. Brood-rearing habitat is comprised of forbs which attract insects intermixed with bare ground for unimpeded movement and dusting (Figure 5). Small patches of tall grasses and shrubs

distributed through the feeding habitat provide protective cover for adult bobwhites and their thumb-sized chicks (Figure 6). Bare ground between basal clumps of native grasses allows for movement and probably increases prey availability, while the grass is thick enough to conceal birds from predators.

FIGURE 6. Newborn bobwhite chicks are about the size of a thumb and are vulnerable to predators and inclement weather.
Photo by Dale Rollins, Texas A&M University.

The abundance of available insects is an important component of brood-rearing habitat. Avoid using pesticides in bugging areas. Studies show a direct relationship between growth rate of chicks and survivability. Typically chicks which grow faster are capable of escaping predators at an earlier age when suitable cover is present. Insect abundance alone doesn't improve chick survivability. Rather, it's the combination of insect abundance with the appropriate plant structure (e.g., a mix of forbs, clump grasses, shrubs and bare ground) which improves survivability. Where grasses and forbs are too thick at ground level, chicks are unable to find insects and move quickly to capture them. Where the density of grasses and forbs is too thin, chicks are vulnerable to predation.

Large expanses of grasslands are **not** conducive to nesting and brooding (Figure 7). Typically, bobwhites move only a short distance (< 70 feet) from a protective edge where shrubby cover offers refuge from predators. Ideal shrubby cover is thick enough that a predator has difficulty gaining access, though birds will use isolated shrubs for shade when chicks might otherwise succumb to heat exhaustion. Break larger fields into smaller fields by incorporating thick patches of native shrubs, prickly thickets and hedgerows. Examples of shrubby plants providing bobwhite cover are aromatic sumac, blackberry, false indigo, roughleaf dogwood and wild plum.

FIGURE 7. Large expanses of grasslands are unsuitable for bobwhites.
Photo by Kevin Labrum, Arkansas Tech Univ.

Covey headquarters are necessary for bobwhite survival. A covey headquarters has clumps of dense shrubby/woody cover with a canopy of at least three-feet-high and limited vegetation at ground level. Bobwhites use this area for escaping predators, harsh winter weather and extreme heat of summer. Covey headquarters are adjacent to where birds daily feed, loaf and dust. The minimum size is 30 by 50 feet, or 1,500 square feet. (Three of these equals 1/10 acre.) A 1/10 to one acre of headquarters is recommended every 5 to 40 acres on field edges. When food and cover needs are met nearby, little covey movement is necessary, energy is conserved and predation is reduced.

Nesting and brood-rearing success is reduced when habitats are disturbed or destroyed during this critical life stage. Mowing, haying and heavy grazing destroy nests and move broods to less-suitable habitat resulting in mortality. Mowing and haying probably represent the biggest threat to bobwhite nesting in fescue fields and pastures. Many bobwhites nest in June, with some nesting in late May. Re-nesting can occur as late as August or, on rare occasions, in September. Leaving undisturbed habitat during the nesting and brooding season is the ideal circumstance, though it may not be practical for active hay and livestock operations. Mowing fields for aesthetic purposes should be delayed until the latest possible time. Delay mowing until September 1 or later to improve survivability of bobwhite coveys. Suggestions for blending bobwhite habitat practices with current land uses are presented later in this publication.

Winter Habitat

Bobwhites need thermal cover and a supply of seeds to survive the winter. A strategically placed covey headquarters provides bobwhites access to seed sources. Plants which provide seeds throughout winter and early spring provide food during the lean months (Table 1). Seeds must be accessible and available to bobwhites for their survival. If seeds fall on thick layers of leaves or grass and filter into a mat of dead material, bobwhites likely won't find them (Figure 8). Likewise, seeds remaining on aerial stems will likely be consumed by perching songbirds and unavailable to bobwhites. Topping seed-bearing plants in winter may improve seed availability for bobwhites and other songbirds.

FIGURE 8. Bobwhites are visual feeders and cannot find seeds such as small acorns which filter into thick layers of leaves.
Photo by Becky McPeake, U of A Division of Agriculture.

Proximity of Habitat Types

A covey's home range can be from 15 to 80 acres depending on the quality of habitat. *The ideal mix of habitat types for each covey is about 30%-50% in annual weeds or legumes, 10%-30% in tall grass and 20%-60% in shrubby, brushy cover.* In woodlands, prescribed burning and thinning trees to open the canopy (to less than 50 feet of basal area per acre) promote annual weeds and improve seed availability. Nesting and brood-rearing cover should be adjacent to each other within a covey management area.

An aerial photo is an excellent planning tool for identifying existing and potential covey management areas on your property (Figure 9). Mark covey locations and identify habitat needs. The size of the covey

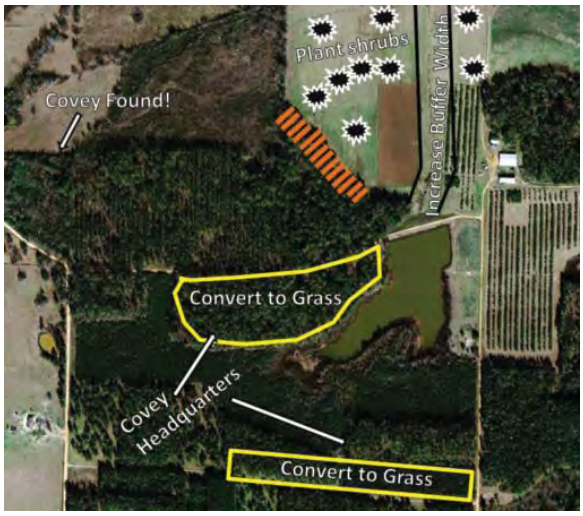

FIGURE 9. Use an aerial photo of your property to identify bobwhite home ranges and locations for habitat practices where bobwhites are not found.

management area should range from 15 to 80 acres, depending on how much of an investment you wish to make. Avoid establishing habitat where bobwhites are already present and instead focus on nearby areas lacking suitable habitat and birds.

Note that landowners may not be able to manage a sustainable bobwhite population (i.e., multiple coveys) on smaller acreages. Unfavorable climate conditions, surrounding habitat loss or other factors can cause bird numbers to fall so low that a lone covey is unable to recover. Better results are obtained when multiple coveys are managed over larger areas. Small-acreage landowners are encouraged to coordinate habitat plans with neighbors to develop bobwhite management areas of at least 1,000 acres. Financial assistance is available through the Farm Bill for some bobwhite habitat practices. Contact a private lands biologist with the Arkansas Game and Fish Commission if you and your neighbors are interested in developing a bobwhite management plan (1-800-364-4263, *www.agfc.com*). See the Extension publication *FSA9104, Financial Assistance for Wildlife Habitat* (available online at *www.uaex.uada.edu* or at your local county Extension office), for additional information.

Habitat Practices

Bobwhites are *an early successional species* which relies on annual and perennial plants colonizing bare ground. Without fire or some other management technique, annuals and herbaceous perennials decline within three to five years and are replaced by longer-lived shrubs and trees. Shrubs and trees provide

TABLE 1. Recommended seed and cover plants for bobwhites.*

Plant Family	Plant Species	Season of Seed Production	Practices
Pine	Shortleaf, loblolly pine (*Pinus* spp.)	Fall and early winter	Use fire to keep undergrowth in grass stage and minimal needles on ground to improve seed access; recommend a 50-foot basal area for bobwhites.
Grass	Goose grass (*Eleusine indica*)	Summer	Withstands disking and fire in winter, common weed; can be invasive.
	Foxtail grass (*Setaria geniculata*)	Summer	Annuals respond to disking, perennials withstand disking in alternate years; native but can be invasive.
	Bull or water grass (*Paspalum boscianum*)	Fall and winter	Withstands fire and disking, will respond to fertilizer.
	Crab grass (*Digitaria sanguinalis*)	Summer and fall	Withstands fire and disking, can be invasive.
	Panic grass (*Panicum* spp.)	Summer	Annuals can be encouraged by fire and light disking.
	Browntop millet (*Panicum fasciculatum*)	September to December	Cultivate in strips of 1/8 acre planted in June and fertilized with nitrogen; consider putting strips next to woody cover.
	Broomsedge (*Andropogon* spp.)	April to September	Will withstand fire, heavy disking will destroy; two-year plants are ideal nesting cover when maintained in open stands with bare ground between plants, need unburned grass to build nests.
Sedge	Sedge (*Cyperus* spp.)	Fall and winter	Can be burned, not disked.
	Spike Rush (*Eleocharis obtusa*)	Spring to fall	Seed is persistent; medium fire tolerance and fertility requirement; propagated by bare root, seed and sprigs.
	Nut rushes (*Scleria* spp.)	Fall and winter	Open woodlands on dry to wet soil, withstands fire and light disking, much sought after by bobwhites.
Lilly	Greenbrier	Winter	Withstands fire, continued disking will destroy plant, thickets used for protection and seeds for food, invasive in Arkansas.
Beech	Water oak (*Quercus nigra*)	Fall and early winter	Found along edges of streams in bottomlands, fire will scar.
	Willow oak (*Quercus phellos*)	Fall and early winter	Found along stream banks and fertile uplands, fire will scar.
	Laurel oak (*Quercus laurifolia*)	Fall and early winter	Found in wet soils, fire not recommended.
Elm	Hackberry (*Celtis occidentalis*)	Winter	Moderate use of seeds.
Smartweed	Sheep-sorrel (*Rumex hastatulus*)	Late spring	Grows in idle fields, disking will destroy plants.
	Smartweed (*Polygonum pensylvanicum*)	Winter	Preferred bobwhite food, found in low bottomlands, can be burned, disking in spring improves stand, responds to fertilizer.
Pigweed	Pigweed (*Chenopodium album*)	Summer through winter	Can be burned in winter, disking improves stand.
Pokeweed	Pokeweed (*Phytolacca americana*)	Summer through early winter	Withstands fire and light disking; seed used moderately.
Laurel	Sassafras (*Sassafras albidum*)	Fall and winter	Can be lightly burned in winter; use for roosting cover and seeds consumed.
Witch-Hazel	Sweet gum (*Liquidambar styraciflua*)	Fall and winter	Seeds from older trees used extensively; fire scars older trees and kills sprouts up to two inches in diameter; considered invasive.

(continued)

TABLE 1. Recommended seed and cover plants for bobwhites.* *(continued)*

Plant Family	Plant Species	Season of Seed Production	Practices
Rose	Blackberry *(Rubus argutus)*	Fall and winter	Fruits used to some degree, seed eaten in fall and winter.
	Dewberry *(Rubus trivialis)*	Fall	Propagate from tips, cuttings or seed.
	Wild crabapple *(Malus angustifolia)*	Fall and winter	Protect from fire; seed becomes available as fruits decay on the ground.
	Wild plum *(Prunus angustifolia)*	Late fall and winter	Ideal roosting cover in summer and winter, thick plants shade out ground vegetation; seed also consumed; grows old fields, open woods, idle areas; can be invasive in some locations.
	Wild black cherry *(Prunus serotina)*	Fall and winter	Fire will kill tree; however, will re-sprout; fruits drop to ground and thereafter available to bobwhites.
Bean – Legume	Sensitive brier *(Schrankia microphylla)*	Summer through winter	Light disking encourages new plants, heavy disking destroys older plants; grows in woodlands burned annually.
	Redbud *(Cercis canadensis)*	Late spring and early summer	Seedlings will not tolerate fire; older growth damaged by excessive burning.
	Partridge pea *(Cassia fasiculata)*	Summer and fall	Disking and burning improve germination.
	Small partridge pea *(Cassia nicitans)*	Fall and winter	Responds well to disking and burning; fire scarifies seed.
	Crimson clover *(Trifolium incarnatum)*	Late spring to late summer	Obtain soil test to determine appropriate levels of lime, phosphate and potash.
	Red clover *(Trifolium pratense)*	Late spring to fall	Obtain soil test to determine appropriate levels of lime, phosphate and potash.
	White sweet clover *(Melilotus alba)*	Late spring to fall	Obtain soil test to determine appropriate levels of lime, phosphate and potash; burning and disking not recommended.
	Yellow sweet clover *(Melilotus officinalis)*	Late spring to fall	Obtain soil test to determine appropriate levels of lime, phosphate and potash; burning and disking not recommended.
	Indigo bush or false indigo *(Amorpha fruticosa)*	Late spring and summer	Avoid fire and disking; shrub will persist for several years.
	Samson snakeroot *(Psoralea psoralioides)*	Summer and early fall	Found in open woodlands and fields; withstands fire and light disking.
	Pencil flower *(Stylosanthes biflora)*	Fall and winter	Found in open woodlands and field edges; will not stand heavy disking.
Bean – Beggarweed	Beggarweed *(Desmodium nudiflorum)*	Summer and fall	Fire and light disking will not damage plant; deep disking destroys root system.
	Dollar weed *(Desmodium rotundifolium)*	Late fall and winter	Responds to light disking; fire will not damage root system.
	Showy Ticktrefoil *(Desmodium canadense)*	Late fall and winter	Direct seed often with a prairie restoration seed mix of warm-season grasses.
Bean – Lespedeza	Trailing lespedeza *(Lespedeza procumbens)*	Late summer through winter	Disk lightly every three to four years to reduce competition from other plants.
	Shrubby lespedeza *(Lespedeza frutescens)*	(unknown)	Solitary plants, tolerates light disking and fire.
	Violet bush-clover *(Lespedeza violacea)*	(unknown)	Solitary plants, tolerates light disking and fire.
	Hairy lespedeza *(Lespedeza hirta)*	Late summer through winter	Can withstand light disking and fire.
(continued)	Roundhead lespedeza *(Lespedeza capitata)*	Late summer through winter	Direct seeding; tolerates fire and light disking, does not grow in a dense stand.

Plant Family	Plant Species	Season of Seed Production	Practices
Bean - Lespedeza *(cont.)*	Black locust *(Robinia pseudoacacia)*	Fall	Fire damages trees.
	Wild indigo *(Indigofera caroliniana)*	Late summer through winter	Withstands light burning, but disking kills root system.
	Goat's rue *(Tephrosia virginiana)*	Late summer and fall	Tolerates light disking and burning.
	Winter vetch *(Vicia dasycarpa)*	Late spring	Will re-seed year after year, can be invasive.
	Ground nut *(Apios americana)*	Late summer through winter	Perennial vine.
	Butterfly pea *(Centrosema virginianum)*	Fall	Perennial vine, volunteers where soil distributed by disking or logging; may be burned annually and disked lightly.
	Milk pea *(Strophostyles helvola)*	Late summer and fall	Does not tolerate severe disking but responds to light disking and fire; light application of phosphate; may volunteer after logging.
	Trailing wild bean (also pink fuzzybean) *(Strophostyles umbellate)*	Late summer and fall	Responds to light disking, preferred food for bob-whites.
	American hogpeanut *(Amphicarpaea bracteata)*	Late summer and fall	Found in thickets and open woodlands; withstands light burning.
	Downy milk pea *(Galactia volubilis)*	Late summer and fall	Responds to disking and fertilizing; fire does not damage; grows best where little plant competition; seeds fall on bare soil, sought by bobwhites.
Wood Sorrel	Yellow wood sorrel *(Oxalis stricta)*	Late summer and fall	Woodlands, field edges, cultivated land; will withstand cultivation; can be invasive.
Geranium	Wild geranium (also cranesbill) *(Geranium carolinianum)*	Late spring	Found on land disturbed by cultivation or disking; ideal bobwhite food because of early fruiting in spring; can be invasive.
Spurge	Dove weed *(Croton glandulosus)*	Late summer to winter	Found in cultivated fields and pastures; disking encourages plant, grazing discourages plant; seed falls on bare soil and readily found; can be invasive.
	Woolly croton *(Croton capitatus)*	Late summer to winter	Found in waste places and overgrazed pastures; disking encourages plant, responds to fertilizer; can be invasive.
	Three-seeded mercury *(Acalypha gracilens)*	Late summer to winter	Encourage by disking, utilizes fertilizer residues in fields planted to crops.
	Flowering spurge *(Euphorbia corollata)*	Fall	Stands can be burned in winter, disking destroys old root system but at same time promotes seed germi-nation.
Cashew	Dwarf or winged sumac *(Rhus copallina)*	Late summer and fall	Fire and disking not recommended; bobwhites use for daytime roosting and resting. Can prescribe burn when plants get tall and leggy; burn rotation mini-mum every three years.
	Smooth or common sumac *(Rhus glabra)*	Summer	Fire and disking not recommended; bobwhites use for daytime roosting and resting. Can prescribe burn when plants get tall and leggy; burn rotation mini-mum every three years.
Holly	American holly *(Ilex opaca)*	Late spring to summer	Will not withstand fire or disking, responds well to fertilizer.
	Yaupon *(Ilex vomitoria)*	Fruiting in fall and persisting into winter	Protect from fire and disking, may form a dense stand.
	Possum haw *(Ilex decidua)*	Fruiting fall and winter	Protect from fire and disking.
Maple	Box elder *(Acer negundo)*	Late summer and fall	Protect from fire.
	Red maple *(Acer rubrum)*	Spring and early summer	Protect from fire.
Balsam	Jewel-weed *(Impatiens capensis)*	Late summer to winter	

(continued)

TABLE 1. Recommended seed and cover plants for bobwhites.* *(continued)*

Plant Family	Plant Species	Season of Seed Production	Practices
Grape	Virginia creeper *(Parthenocissus quinquefolia)*	Summer and early fall	Can be invasive.
	Muscadine grape *(Vitis rotundifolia)*	Late summer	Will not tolerate fire; prune in early spring to avoid loss of sap.
Violet	Violets *(Viola* spp.*)*	Summer and fall	Will tolerate light burning; disking destroys mature plants but encourages reseeding.
Passion-Flower	Maypop *(Passiflora incarnate)*	Fall and winter	Will withstand fire and disking; can be invasive.
Evening Primrose	Evening primrose *(Oenothera biennis)*	Fall and winter	Withstands fire, but excessive disking will destroy roots; can be invasive.
Tupelo	Black gum *(Nyssa sylvatica)*	Late spring and early summer	Excessive burning leaves scars on trunk.
Dogwood	Flowering dogwood *(Cornus florida)*	Late spring and early summer	Older trees withstand fire; deep disking close to trunk harms root system.
Heath	Deerberry *(Vaccinium stamineum)*	Late summer to winter	Will not tolerate fire or disking.
Olive	American/white ash *(Fraxinus americana)*	Summer	Fire will scar tree and damage trunk.
Vervain	American beautyberry *(Callicarpa americana)*	Fall	Fire will kill growth aboveground.
Nightshade	Ground cherry *(Physalis virginiana)*	Late summer to winter	Seed enclosed by enlarged floral parts resembling a Chinese lantern.
Bignonia	Trumpet creeper *(Campsis radicans)*	Late summer to winter	Propagate by cuttings; readily roots and develops new suckers that allow species to grow rapidly; can also direct seed.
Madder	Poor-Joe *(Diodia teres)*	Late summer to winter	One of first plants to appear after disking.
Honeysuckle	Japanese honeysuckle *(Lonicera japonica)*	Late summer to winter	Will withstand fire and light disking; invasive, do not plant.
	Elderberry *(Sambucus canadensis)*	Late summer to fall	Fire and disking not recommended.
Aster	Giant ragweed *(Ambrosia trifida)*	Fall and winter	Disking every few years improves stand; can be invasive.
	Common ragweed *(Ambrosia artemisiifolia)*	Fall and winter	One of first plants to appear after soil disturbed; can be invasive.
	Native sunflowers *(Helianthus* spp.*)*	Late summer to early winter	Stands increased by disking; can be invasive.
	Beggar ticks *(Bidens* spp.*)*	Fall	Seed (nutlets) stick to clothing.
Crop Plants	Corn *(Zea mays)*	July to September	Seed fragments eaten by bobwhites.
	Wheat *(Triticum aestivum)*	May to June	
	Grain sorghum *(Sorghum bicolor)*	Fall	
	Soybean *(Glycine max)*	July to August	Whole seed and seed fragments (caused by harvesting) frequently eaten.
	Cowpeas or field peas *(Vigna unguiculata)*	Late summer to fall	Whole seed and seed fragments eaten.
	Rice *(Oryza sativa)*	August through September	
	Rye *(Secale cereale)*	May to June	
	Barley *(Hordeum vulgare)*	Late spring and summer	

* Primary Source: *A Guide to and Culture of Flowering Plants and Their Seed Important to Bobwhite* by Walter Rosene and John D. Freeman.

important brood-rearing and winter cover but should not dominate a landscape managed for quail. The goal of habitat practices for bobwhites is to set back plant succession and release seeds already present in the soil to encourage a diversity of new plant growth. Many seeds develop into native "weeds" which produce an abundance of seeds, nutritious forage and a plant structure conducive to nesting and brood rearing.

Following are brief descriptions of management practices to set back succession and improve food and cover for bobwhites. The next section discusses incorporating these practices into current land uses.

- **Build adequate cover if not present.** In many cases a lack of cover is the limiting factor which prevents bobwhites from expanding into new uninhabited areas. Bobwhites need escape cover to nest and flee from predators. Some studies indicate woody canopy coverage in the range of 30%-60% is needed within the bobwhite's home range, leaving 40%-70% in herbaceous cover. According to Dr. Fred Guthery from Oklahoma State University, woody or shrubby cover "needs to be dispersed such that no point in an opening is more than 30 yards from woody cover." Perennial grasses such as little bluestem "weather better during winter than forbs or annual grasses" and "are less sensitive to drought." Herbaceous cover needs to be neither too sparse nor too thick.

- **Encourage native seed-bearing plants** (Table 1). Half of a bobwhite's home range should be comprised of seed-bearing plants that provide food. Oftentimes these same native plants also provide bobwhites with cover. A single adult bobwhite weighs only five to seven ounces and consumes a little less than one ounce (0.8 ounce) per day. A covey of 14 birds would consume almost 3/4 pound per day. From the fall through the critical month of March (182 days), a covey needs 127 pounds of seed to survive. This can be easily accomplished using native plants.

- **Manage for bare ground** (Figure 10). Among the vegetation types, about 25%-50% of the bobwhite's home range should have small patches of bare ground at the soil surface. This includes bare soil and protected bare ground underneath grasses and shrubs. Fields with less than 5% bare ground typically have too thick vegetation. Bobwhites need open spaces to search for food and for brood-rearing.

FIGURE 10. Bobwhites use bare ground intermixed with tall cover plants for dusting, searching for seeds and insects, and raising broods.
Photo by Kevin Labrum, Arkansas Tech Univ.

- **Create habitat borders.** Borders along fields, stream banks, ditches and forests create a diversity of food and cover for bobwhites. Wider borders are better, but smaller borders such as grown-up fencerows may serve as travel lanes and temporary escape cover. Protect borders from livestock using temporary or permanent fencing.

- **Strip disking.** Lightly disk rows in fields along the contour on an annual rotation to create bare ground for bobwhites and produce a variety of plants at different successional stages. No planting is necessary, as exposed native seeds will germinate. Disking is recommended between October and March. The first year, disk a 30- to 75-foot strip and skip 100 to 150 feet, continuing across the field with this same pattern. The area between strips should be once to twice as wide as the disked strips. Alternate disking different strips the next two years until the fourth year when you start over. By the end of the rotation, the whole field has been disked. If bobwhites are already present in the area, maintain a wider interval. See *FSA9100, Light Disking to Improve Wildlife Habitat in Grasslands and Old Fields*, available online (*www.uaex.uada.edu*) or from your local county Extension office.

- **Prescribed burning.** Burning every three to five years will open the seedbed to a new generation of early successional plants. Burning in February or March is recommended when vegetation moisture content is low and reduces the amount of time winter cover is not available. Do not burn

your entire acreage at one time; unburned habitat must be available as cover. See *FSA5009, Why We Burn: Prescribed Burning as a Management Tool*, available online (*www.uaex.uada.edu*) or from your local county Extension office. Contact your local county forester for details about conducting a prescribed burn on your property (*www.forestry .state.ar.us*).

- **Thin woodlots before burning.** Remove less-desirable trees in your woodlot and open the ground to sunlight (Figure 11). A dense tree canopy will shade out grasses and forbs unless some trees are removed. A dense woodlot should be thinned to about 50-60 trees per acre after thinning to allow for suitable quail habitat. Keep the best seed- and fruit-producing trees and harvest the rest. See *FSA5010, Using Natural Regeneration to Promote Oaks in Upland Hardwood Stands,* or *FSA5001, Improve Your Pine Stand by Thinning,* available online (*www.uaex.uada.edu*) or from your local county Extension office. Note that areas with thick leaf cover may be burned annually until the ground is exposed to sunlight to improve annual plant growth and seed availability.

FIGURE 11. Open woodlots with ample grasses and forbs in the understory can provide suitable habitat for bobwhites.
Photo by Jon Barry, U of A Division of Agriculture.

- **Convert fescue, bermudagrass and bahiagrass to native grasses.** Fescue, bermudagrass and bahiagrass are of minimal value to wildlife. Though bobwhites sometimes nest in tall fescue, this plant is an aggressive, nonnative cool-season grass that tends to crowd out important food and cover plants. Reduce or eliminate tall fescue and bahiagrass using the following steps:

  1. Graze, hay or preferably burn in late winter for a spring herbicide treatment or in late summer for a fall herbicide treatment (if mowing is only option, repeat frequently throughout the summer to prevent buildup of dead material which reduces herbicide contact with living stems).
  2. Allow to greenup to a height six to ten inches to ensure herbicide contact with actively growing plant.
  3. Spray the area with glyphosate herbicide (with surfactant) according to the product label (typically 1.5 quarts per acre).
  4. In late winter (January-March) following fall spraying, options are:
     a. Burn to consume dead vegetation, stimulate germination in the seedbank and kill undesirable winter annual weeds that have germinated,
     b. Spray excessive winter annual weeds and grasses (such as chickweed and henbit) with glyphosate herbicide, or
     c. Do nothing if burning is not an option and winter annuals are not prevalent.
  5. In late March/early April, just before spring greenup, apply a preemergence application of imazapic herbicide to control undesirable warm-season grasses (such as johnsongrass and remaining bahiagrass).
  6. Repeat these steps or spot-spray with glyphosate herbicide for one or two years as needed.
  7. Treating two or more growing seasons may be required to ensure all exotic grasses are completely eradicated before planting native warm-season grasses. Therefore, it is important to maintain undisturbed cover (e.g., tall fescue or other bunch/clump grasses) in the immediate vicinity for two to three years until a stand of native warm-season grasses can be established.

The same process is used for bermudagrass except it is sprayed in the summer when the plant is actively growing or in flower (before going to seed). Note that sometimes when fescue is removed, bermudagrass may invade requiring herbicide treatment. Suggested herbicides are Chopper® or Arsenal AC®, though glyphosate herbicide may work. Following up with spot treatments is recommended.

In livestock pastures where fescue is present, reduce the dominance of fescue by grazing heavily in the winter and overseeding with lespedeza or red clover. Disk strips or apply herbicides to small strips throughout the pasture to encourage native annual weeds to grow. Refrain from excessive mowing.

For current information about controlling non-native grasses and herbicide applications, contact your local county Extension agent.

Avoid the following management practices:

- **Where bobwhites are already present, avoid drastic changes in management.** Select adjacent unoccupied habitat for bobwhite habitat improvement and implement a few practices every year.
- **Avoid mowing and hay-cutting during nesting and brood-rearing seasons.** In Arkansas, nesting and brood-rearing peak from late May through July. Disturbance of nesting and brooding birds leads to mortality of chicks and adult birds. Birds which move their broods because of mowing or other disturbances have lower survival.
- **Avoid mowing as a practice to set back succession.** The remaining thatch builds up on the ground and creates unsuitable nesting habitat. Use alternative practices such as prescribed fire which burns off excess thatch, heats up the soil and stimulates germination.
- **Avoid "letting it grow" for too many years.** Management practices creating periodic disturbance are necessary to keep a portion of the habitat in optimal nesting and brood-rearing habitat (Figure 12). A field or forest that continues to grow for years without disturbance will mature past an early successional stage and be of little value to bobwhites. Habitat disturbances should occur outside the nesting and brood-rearing seasons and when plentiful winter habitat is available.

FIGURE 12. Periodic disturbance from prescribed fire, disking or grazing keeps grasses and forbs from becoming too thick for brood-rearing and improves bobwhites' access to insects and seeds.
Photo by Becky McPeake, U of A Division of Agriculture.

- **Avoid planting fescue, bermudagrass and bahiagrass** for bobwhites and other wildlife. These exotic grasses invade natural areas and degrade wildlife habitat.
- **Use food plots only when necessary.** In most instances, native vegetation provides ample seeds for bobwhites. Rarely are food plots necessary because adequate native seed plants are available. Food plots may not help bobwhites if they are competing with other wildlife such as deer and songbirds. Food plots reportedly concentrate bobwhites and draw in predators resulting in increased mortality.
  The best practice is promoting native seed production rather than food plots. But there are circumstances when planting a cover crop to reduce soil erosion is necessary for fire breaks, logging decks or utility right-of-ways. Planting clovers with two pounds/acre of partridge pea is a good mix for bobwhites. These seeds persist through winter and provide bobwhites an alternate food source.
  Pay particular attention to the configuration of food plots to reduce predation by providing ample nearby escape cover. For additional infor- mation about food plots, see *FSA9092, Establishing Wildlife Food Plots,* and related publications avail- able online (*www.uaex.uada.edu*) or from your local county Extension office.

Incorporating Habitat Into Current Land Uses

These tips help identify beneficial land management practices for bobwhites and other wildlife. Sometimes land-use decisions are made without knowing they are detrimental to wildlife. If improving habitat is your goal, discontinue harmful practices.

Pastures

- **Establish native warm-season grasses** such as big and little bluestem, Indiangrass and sideoats grama. Switchgrass tends to be aggressive and should be planted sparsely if included in a wildlife mix.
- **Include native warm-season grasses in your grazing system.** Native warm-season grasses that grow during the hot summer months provide summer livestock grazing and wildlife nesting cover. Fence out livestock to protect prime nesting cover. Allow warm-season grasses to re-grow to 12 to 15 inches before the fall dormancy period to improve plant survival and winter cover for bobwhites.
- **Include legumes in your pastures.** Legumes add nitrogen to the soil, help provide forage for livestock and attract insects upon which wildlife feed. Insects are a very important source of protein for bobwhites, turkey and other wildlife. Establish legumes in cool-season pastures and hayfields.
- **Provide supplemental forage for wildlife (and livestock).** Over-seed with legumes (e.g., clover, cowpeas) a large area to provide forage for both livestock and wildlife. Plow strips of browntop millet or Egyptian wheat outside the fence to provide a fall and winter food supply.
- **Grow shrubby vegetation** in fields, along the field edges and in drainages. Protect shrubs along fields and in drainages from livestock with permanent fences. Develop a few shrub islands of 77 shrubs on five feet by five feet spacing in grass fields. Good plantings include wild plum, gray and roughleaf dogwood, hazelnut, indigo bush and elderberry. Blackberry also creates good cover and a food source for bobwhites but can be invasive (Figure 13). Multiple shrub islands scattered throughout the pasture or hayfield ideally should be 60 to 80 feet apart to provide escape cover for bobwhites and cottontails.

FIGURE 13. Native blackberry seeds and fruits are consumed by many wildlife species including bobwhites.
Photo by John Jennings, U of A Division of Agriculture.

- **Protect ponds, streams and other waterways from livestock.** Fence livestock from the banks of ponds, streams, creeks or rivers and provide watering tanks for livestock. Livestock reduce wildlife cover around waterways because of foraging and tromping. Fencing waterways has the added benefit of protecting fields from soil erosion and degraded water quality. Cost-share programs are available through conservation practices established by the Farm Bill. (See *FSA 9104, Financial Assistance for Wildlife Habitat*.)
- **Graze livestock on a rotation among several pastures.** Rotating livestock through different pastures can improve wildlife habitat (Figure 14). Schedule rotations such that pastures providing

FIGURE 14. Electric wire fencing is used to rotate grazing cattle on a three-week rotation in Benton, Arkansas. Pasture on right was grazed for three weeks and cattle will be rotated to the pasture on left.
Photo by Jeff Vanuga, NRCS.

optimal nesting and brood-rearing cover are kept free of livestock from April or May through August.

- **Adjust the livestock stocking rate to reach desired plant response.** Pastures overgrazed with too many cattle, horses, sheep or goats have reduced forage production, increased soil erosion and low-quality wildlife habitat. Use a low stocking rate if herbaceous cover is deficient, or a high stocking rate if herbaceous cover is excessive. Set up temporary (e.g., electrical) fencing where bobwhites are nesting to keep livestock from tromping nests.

- **Mob grazing.** Ultra high-density grazing, or mob grazing, is an experimental approach for enhancing wildlife habitat. A large number of cattle are penned together (e.g., 150-300 cattle per acre) to consume all palatable vegetation and tromp uneaten plant materials into the soil, achieving a plowed appearance. This area is left ungrazed for a year or longer. The resulting plant growth appears to emulate a prescribed fire with additional nutrients from manure. Mob grazing has been used for weed control and is being investigated as a wildlife habitat tool.

- **Light grazing.** Livestock are moved between warm-season, cool-season and mixed pastures at low stocking rates to extend pasture quality. Protect pastures set aside for bobwhite nesting and brood-rearing from April or May through August.

- **Patch-burning.** Patch-burning is a type of livestock grazing system where sections of a farm are burned every six to twelve months on a three-year rotation. Cattle naturally graze the most recently burned part of the pasture, so no interior fencing or rotations are required. The resulting patch-burn creates brood-rearing habitat for bobwhites with ample plant diversity and insect biomass which peaks one to two years after the burn.

- See ***FSA9083, Managing Pastures and Haylands for Wildlife***, for additional tips about managing pastures with wildlife in mind.

Haylands

- **Establish native warm-season grasses** such as big and little bluestem, Indiangrass and sideoats grama. Switchgrass tends to be aggressive and should be planted sparsely, especially if included in a wildlife mix.

- **Park the bush hog** from April 1 to September 1. Avoid mowing and disturbing nesting or brooding birds. Most forage hay will be of poor quality if harvested after July 15. However, delaying until after July 15 will help ensure bobwhites and other ground-nesting birds have the opportunity to successfully raise their young.

- **Mow and disk inside-out.** When bush hogging or cutting hay, start in the middle of the field and cut or mow toward the outer borders, allowing young and adult bobwhites and other wildlife to stay in existing cover while they escape. Less wildlife will be killed by a tractor and/or equipment since wildlife will not become trapped inside an ever-decreasing circle. This also applies when disking pastures or hayfields to restore forages.

- **Aim high.** Set your mower as high as possible to avoid bobwhites and other wildlife.

- **Install wildlife-flushing bars** on the front of tractor used to cut hay. Flushing bars help move wildlife from the path of dangerous tractor wheels and cutters.

- **Leave unmowed/uncut field borders for wildlife cover** (Figure 15). Leave 30- to 50-foot or wider strips of hay uncut around the outside of a field to provide nesting, escape and brood cover.

- **Topdress hayfields with fertilizer.** Improved soil fertility contributes to wildlife productivity. Proper liming is also critical to maintain forage production and wildlife benefits. Avoid fertilizing native warm-season grasses until after they become established.

FIGURE 15. Leave unmowed field borders for wildlife cover.
Photo by Kevin Labrum, Arkansas Tech Univ.

- **Develop large hayfields into smaller fields** by establishing cross-fencing and protecting a 50-foot or wider strip for planting shrubs and native warm-season grasses.
- **Provide supplemental forage for wildlife.** Overseed a 30-foot strip of wheat, oats or rye along the outside edge of hayfields. Plow strips of browntop millet or Egyptian wheat near pasture edges to provide a fall and winter food supply.
- **Grow shrubby vegetation** in fields, along the field edges and in drainages. Let shrubs grow naturally or develop shrub islands of 77 shrubs on five feet by five feet spacing in grass fields. Good plantings include wild plum, gray and roughleaf dogwood, hazelnut, indigo bush and elderberry. Multiple shrub islands scattered throughout the pasture or hayfield should be ideally 60 to 80 feet apart to provide escape cover for bobwhites and cottontails.
- **See *FSA9083, Managing Pastures and Haylands for Wildlife*,** for additional tips about managing haylands with wildlife in mind.

Croplands

- **During harvest, leave a row or two of grain at the field edge.** In larger fields, very little yield is lost by leaving edges for wildlife. Along forested edges, lower yields typically occur anyway because of shading and other factors. This standing grain provides food and cover for wildlife during winter months. Leave a minimum of 1/4 acre of grain crops unharvested for each 40 acres of crop field. Leave crops in patches or strips near cover.
- **Avoid heavy pesticide and herbicide applications.** When applied in excess of label instructions, pesticides and herbicides may eliminate important food sources by destroying insects and weeds in non-crop areas. Exceptions are when converting an area to native grasses, injecting less-desirable trees for improving forest habitat or other beneficial habitat practices.
- **Prescribe burn field borders and idle areas.** Leaving these areas as wildlife habitat can increase plants that are food and cover for a broad range of wildlife. Burn a portion of these areas between September 15 and March 15, taking care not to destroy winter habitat. Burning from December through February will invigorate plants during spring greenup. Avoid burning during the primary nesting and brood-rearing season from May 1 to September 1.
- **Manage levees in irrigation reservoirs** for bobwhites by establishing bobwhite-friendly grasses and forbs on the sides and top. Mow vegetation after September 1 and set the mower high to leave vegetation at least 12 inches in height for winter cover.
- **Allow grasses, shrubby vegetation and brushy patches to grow** (Figure 16) along field edges, in drainages and idle field corners to provide escape cover for bobwhites and cottontails. Manage agricultural drainage ditches, draws and thickets in cropland areas by burning or strip disking every three to five years when woody growth begins to invade. Burn or disk 1/3 to 1/5 of the area annually such that plenty of undisturbed habitat remains in any one year.

FIGURE 16. Leave a field buffer of native grasses and shrubs for bobwhites in marginally productive areas which are shaded or flood frequently.
Photo by Jeff Vanuga, NRCS.

- **Develop large fields into smaller fields** by establishing buffers using shrubs, grasses and forbs. Smaller field sizes will increase edge effects which benefit bobwhites. The Conservation Reserve Program and other Farm Bill programs can help farmers turn a profit while improving wildlife habitat.
- **Establish covey headquarters** every 60 to 80 feet where existing shrubs and/or trees are absent within this distance.
- **Plant winter cover crops** such as wheat or oats for green browse, erosion control and wildlife

cover on harvested crop fields. If planting the entire field is not an option, establish a 50-foot or wider strip around all field edges after harvest.

- **Seed waterways** to grass/legume mixtures beneficial to bobwhite and other wildlife. Avoid disking to the edge of streams, rivers or ponds. Establish grass and legume buffer strips along these areas.

Fencerows and Other Idle Areas

- **Allow fencerows to grow up in shrubs, vines and small trees.** Fencerows provide travel lanes between different habitat types.
- **Avoid applying herbicides and pesticides to fencerows.** Destroying fencerow vegetation reduces both the food supply and the cover provided by these areas. Applying pesticides reduces the number of insects available for birds to feed.
- **Establish brushy or grassy strips between crops, pastures and woodlands.** These buffer strips provide necessary cover, nesting and feeding areas for wildlife.

Woodlots

- **Thin woodlots** to about 50 to 60 trees per acre to develop a grassy understory suitable for quail.
- **Fence out livestock from your woodlot.** Woodlots and woodlot edges are prime wildlife habitat and yet provide marginal value for livestock.
- **Build brush piles** from trimmings rather than burning them when harvesting timber or cutting firewood. Place brush piles around a woodlot to leave an uneven, brushy edge to provide cover for bobwhites and other wildlife. Construct brush piles on a base of logs, rocks or stumps to provide tunnels and openings at ground level.
- **Maintain a border or edge between the woodlot and other habitat types.** Fields that adjoin a wooded area are more attractive to wildlife when a grassy or shrubby border is established and maintained. Develop feathered edges inside the wood line to create a transition zone of shrubs, vines and herbaceous vegetation between grassland or cropland and the woodlot. The basal area of the stand could gradually increase from 30 square feet along the edge to 50 square feet deeper into the woods.

Forests

- **Avoid cutting timber from February to September** to allow for safe and successful nesting of bobwhites, squirrels and other wildlife. Plan your timber harvest around these months to avoid the destruction of nests and young.
- **Thin (remove) less-desirable tree species** which are of minimal value to bobwhites using a chainsaw and/or herbicides (Figure 17). Removing trees opens up the canopy enabling sunlight to reach the forest floor and encourages germination of grasses and forbs. Retain fruit-producing trees and shrubs.

FIGURE 17. Use herbicides or a chainsaw to remove undesirable trees which compete with vegetation providing food and cover for bobwhites.
Photo by James H. Miller, USDA Forest Service, *www.bugwood.org.*

- **Conduct a prescribed burn** to remove mats of leaves or pine needles which hinder bobwhites' access to seeds and prevent grasses and forbs from germinating.
- **Cut small openings within open-canopy forests** to increase plant diversity and provide nesting and brood-rearing cover. Bobwhites do not use extensive closed-canopy forest habitat. However, if the surrounding forest has a very open canopy, bobwhites might benefit from forest openings.
- **Seed and fertilize disturbed soils** in openings, fire breaks, logging trails and roads to prevent erosion and provide bobwhite habitat. Leave some bare ground for dusting and brooding. Initially, plant firebreaks to wheat, oats or cereal rye to provide spring and summer food and bugging areas for bobwhite and other wildlife. Then allow native vegetation to overtake the openings.

- **Build brush piles** from timber harvests and firewood cuttings as covey headquarters with open spaces underneath for bobwhites and cottontails to gain entry, but not large enough for predators. Allow woody shrubs and trees to grow in brush piles.

- **Protect streamside areas** from timber harvest. Fence a 150-foot or wider buffer along wooded stream banks. Stop all cutting and mechanical activities inside this area.

- **Create edge feathering** where mature trees border grass or crops. Create woody escape cover along woodland edges, existing tree lines, woody draws and hedgerows. Cut trees over 15 feet tall in the area to be edge feathered. An occasional tree may be left to preserve valuable timber or nut/fruit-producing species (e.g., oak, persimmon, mulberry, etc.). Treat stumps with an approved herbicide unless cutting plum and dogwood to encourage new shoot growth. If possible, leave felled trees where they fall. Edge feathered trees may be dropped parallel to the field edge. **Do not** push downed trees into a dense brush pile. The basal area of the stand could gradually increase from 30 square feet along the edge to 50 square feet deeper into the woods.

- **Develop a transition zone** of shrubs, vines and herbaceous vegetation where mature trees border grassy openings, pastureland or crops. Disk or plant native seeds and shrubs to encourage a diversity of plants along the forest edge.

- **Leave key areas of large-diameter nut-producing hardwoods** scattered through the area.

- **Leave snags and downed wood** to attract insects for bobwhites and provide den sites for other forest species.

Old Fields

- **Do nothing . . . for a while.** Abandoned pastures and crop fields provide good wildlife habitat. When left temporarily undisturbed, these areas naturally produce plants such as goldenrod, wild aster, wild strawberry, blackberry, dewberry, greenbrier, persimmon, sassafras, sumac, coralberry (buck brush), red cedar and other plants that provide some food and/or cover for bobwhite and other wildlife.

- **Prescribed burning.** Burn fields on a three- to five-year rotation depending on woody plant growth and thatch buildup. The goal is to open the habitat and to promote natural warm-season grasses and weeds while also maintaining some woody escape cover.

- **Disk strips** on the contour to disturb the topsoil through the field. The first year, disk a 30- to 75-foot strip and skip 100 to 150 feet, continuing across the field with this same pattern. The area between strips should be one to two times as wide as the disked strips. If bobwhites are already present in the area, maintain a wider interval. Alternate disking different strips the next two years until the fourth year when you start over. By the end of the rotation, the whole field has been disked.

- **Strip herbicide applications** will encourage early successional plants which provide beneficial food and cover for bobwhites. Although prescribed fire and disking are preferred methods, herbicide applications may be the only option in some circumstances. Small ATV-mounted sprayers can be used but may take more time than truck- or tractor-mounted units. Apply herbicide in strips to thick vegetation and set back succession to bare ground. Herbicide applications will increase high seed-producing annual plants. Follow the same rotation as for strip disking. Consult with your local county Extension agent about appropriate herbicides, timing and application rates.

- **Leave undisturbed clumps of shrubby growth** with open space underneath for bobwhites and cottontails to flee from predators (Figure 18). The minimum size of a covey headquarters is 30 feet by 50 feet, or 1,500 square feet.

FIGURE 18. Establish shrubby thickets in fields to provide escape cover for bobwhites.
Photo by Becky McPeake, U of A Division of Agriculture.

- **Hinge-cut large cedars** and other small trees by cutting 2/3 of the way through the trunk and bending the tree parallel to the ground. This practice can be effective for providing cover in woodlots which lack ground cover. Along field edges, use herbicide to kill thick grass underneath before felling. Many trees will continue to live in this position several years, creating a living brush pile.
- **Convert exotic grasses to native grasses.** Exotic grasses include tall fescue, bermuda and bahiagrass. Bobwhites nest in tall fescue that has been left undisturbed for two or more growing seasons (Figure 19), and such fields should be left alone until woody growth intrudes. Replace tall fescue and other exotic grasses with native grasses as described on page 10.

FIGURE 19. Avoid mowing or grazing grasslands between April 1 and September 1 if feasible to encourage bobwhites.
Photo by John Jennings, U of A Division of Agriculture.

Evaluating Success

Start by improving the most critical habitat component first, taking care not to destroy good habitat in the process. Select a location where no bobwhites are observed, but where a nearby population can colonize the newly developed habitat. Altering habitat where birds are already present may cause them to move elsewhere or reduce their survival, so implement practices elsewhere on your property. Before and after making habitat improvements, keep a record of the estimated number of bobwhites and covey locations observed on your property.

Releasing pen-raised birds is not recommended. Decades of studies indicate practically no survival of pen-raised birds. There is some concern among biologists that the few survivors may hybridize with native bobwhites to their detriment.

Count bobwhite whistles before and after implementing habitat practices. Use whistle counts outside the hunting season either in the spring or fall (preferably late October before hunting season). Collect year-to-year counts and make note of weather, local habitat conditions and other changes in the surrounding landscape that might affect bobwhite numbers.

Identify listening stations on a map or aerial photo, and return to those same locations each year. Ideally, listening stations should be permanently marked. The farthest distance a bobwhite whistle can be heard is about 500 yards, but trees and tall grasses can impede sound. If possible, listening stations should be located at high spots or ridge tops. If using more than one listener, station yourselves at least 1,000 yards apart to avoid counting the same covey. Conduct your call count on a clear day with calm wind starting about 45 minutes before sunrise. Continue listening until about 10 minutes before sunrise. Map locations where bobwhites are seen or heard. Collect this data annually about the same time of year. Keep your data on file for making year-to-year comparisons.

Consider limiting harvest in areas where bobwhite populations are low or unstable. Hunters who harvest less than 20% of the bobwhites in a given area are thought to have little impact on the population and are simply removing surplus birds normally lost in winter. If hunting bobwhites, record the age of harvested birds by examining wing feathers (Figure 20). A guide for aging bobwhites is provided on the following pages.

FIGURE 20. Keep records of the age and gender of harvested bobwhites to measure your success.
Photo by Casey Sanders, *www.bugwood.org*.

Wing Aging Bobwhite Quail

Portions copied with permission from the Winter 2004 edition of The Covey Headquarters Newsletter, a joint publication of the Missouri Department of Conservation, USDA-Natural Resources Conservation Service, University of Missouri Extension and Quail Unlimited. (The web site for the Quail Management Section at Missouri Department of Conversation is mdc.mo.gov/node/3678.)

From studying the wings of a bobwhite, it is possible to determine:

- Old birds from young birds-of-the-year.
- The age of birds-of-the-year when they are under 15 weeks of age.
- Field and weather conditions which affected bobwhite production in any given year. Compute the age of the birds-of-the-year and count back on the calendar to determine their hatching period.

In this way, knowledge of the ratio of the young-to-old birds in the fall population and at the time of hatching periods helps measure annual bobwhite production and the condition of the bobwhite population in your area.

To age your birds:

1. Check the wings and determine whether the bird is one year or older, or a young bird of the current year. (See Figures 21 and 22.) A ratio of two to three young per adult indicates low production; a ratio of four young per adult indicates average production; a ratio of five young per adult indicates high production.

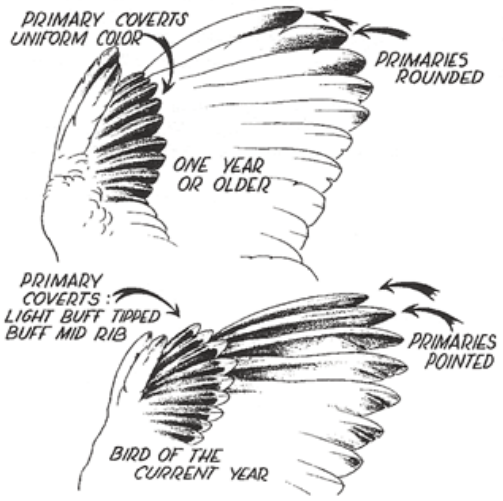

FIGURE 21. Aging young-of-the-year and older birds.

FIGURE 22. The white or light buff tipped covert feathers indicate the bird on the right is young-of-the-year.
Photo by Dale Rollins, Texas A&M University.

2. If the bird is a young-of-the-year, decide if it is less than 15 weeks of age by examining the primaries which are numbered 1 to 8. If any primary has recently been lost or replaced (evident by being only partially grown), the bird is under 15 weeks of age. (See Figure 23.)

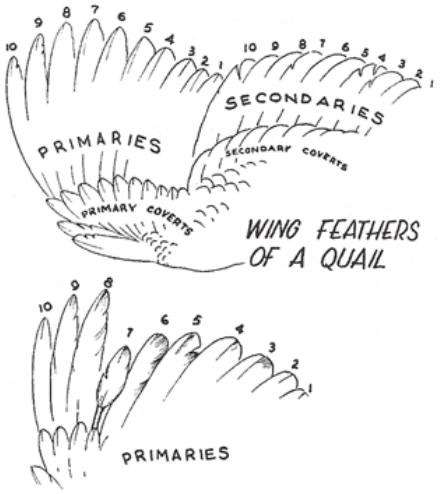

FIGURE 23. Age determination of young bobwhites under 15 weeks old. The latest feather dropping and replacement occurred in this illustration for the number 7 primary. By locating number 7 primary in the aging table, the bird is found to be 10½ weeks old.

3. If less than 15 weeks of age, determine the number of the latest primary dropped or replaced.

4. Check the aging table below for the number of the primary feather that was dropped or replaced, and determine the age of the bird.

5. Count back on the calendar, in weeks, the age of the bird, and determine the time of the hatch.

Table 2. Age determination of Northern bobwhite based on primary feather replacement.

Last Primary Feather Dropped or Replaced	Age of Young Bobwhite
Feather No.	No. of Weeks Old
1	4
2	5
3	6
4	7
5	8
6	9
7	10.5
8	14.5
All feathers	Mature 16.5

Conclusion

Bobwhites are declining in Arkansas. Since most land in Arkansas is held in private ownership, the fate of the bobwhite rests with landowners. Implementing a few practices can help this declining bird. The keys are to (1) not destroy good habitat, (2) avoid disturbing bobwhites during their critical nesting and brood-rearing periods (Figure 24), and (3) fill in the habitat gaps. Although a covey can be maintained on as little as 20 acres of prime habitat, long-term sustainability is improved when several thousand acres are managed for bobwhites. Such efforts require cooperation among landowners who are dedicated to implementing habitat practices which benefit bobwhite quail.

FIGURE 24. Mowing and other habitat disturbances can greatly reduce nesting and brood-rearing success.
Photo by Kevin Labrum, Arkansas Tech Univ.

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