NORTHERN BOBWHITE CONSERVATION INITIATIVE

March 2002

Department of Tennessee Wildlife Resources, Authorization No. 328672, 750 copies, March, 2002. This public document was promulgated at a cost of $1.20 per copy.

Printing costs for this publication were reimbursed to the
Tennessee Wildlife Resources Agency by the
Southeast Quail Study Group

THE NORTHERN BOBWHITE CONSERVATION INITIATIVE

A Report on the Status of the Northern Bobwhite

And a Plan for Recovery of the Species

Submitted by the

Southeast Quail Study Group Technical Committee

to the

State Wildlife Agency Directors of the

Southeastern Association of Fish and Wildlife Agencies

Coordinators/Editors

Ralph W. Dimmick, Department of Forestry, Wildlife and Fisheries, University of Tennessee, 274 Ellington Plant Sciences Building, Knoxville, TN 37901

Mark J. Gudlin, Tennessee Wildlife Resources Agency, P.O. Box 40747, Nashville, TN 37204

Donald F. McKenzie, Wildlife Management Institute, 2396 Cocklebur Road, Ward, AR 72176

This publication should be cited as:

Dimmick, R.W., M.J. Gudlin, and D.F. McKenzie. 2002. The northern bobwhite conservation initiative. Miscellaneous publication of the Southeastern Association of Fish and Wildlife Agencies, South Carolina. 96 pp.

ACKNOWLEDGEMENTS

We gratefully acknowledge the many contributions to the compilation of this document of the following persons:

National Resources Inventory (NRI) Land Use Data

Stephen J. Brady, USDA-NRCS National Resources Inventory & Analysis Institute and FS Inventory & Monitoring Institute, Suite 300, NRRC, 2150-A Centre Ave., Ft. Collins, CO 80526-1891

Breeding Bird Survey Data

John R. Sauer, USGS Patuxent Wildlife Research Center, 11510 American Holly Drive, Laurel, MD 20708-4017

Maps/Graphics

Jeanette M. Jones, Tennessee Wildlife Resources Agency, P.O. Box 40747, Nashville, TN 37204

Secretarial Assistance

Melissa Cunningham, Tennessee Wildlife Resources Agency, P.O. Box 40747, Nashville, TN 37204

In addition to the Authors listed for each chapter, the following people were instrumental in providing data for and the review of individual chapters:

Todd Bogenschutz, Iowa Department of Natural Resources, Boone, IA
Bob Bryant, Quail Unlimited Forked Deer Chapter, Beech Bluff, TN
Wes Burger, Mississippi State University, Mississippi State, MS
Mike Butler, Tennessee Conservation League, Nashville, TN
John Cole, Illinois Department of Conservation, Springfield, IL
Larry David, Illinois Department of Conservation, Gibson City, IL
Billy Dukes, South Carolina Department of Natural Resources, Columbia, SC
Michael Fies, Virginia Department of Game and Inland Fisheries, Verona, VA
Dan Figert, Kentucky Department of Fish and Wildlife Resources, Frankfort, KY
Robert Ford, U.S. Fish and Wildlife Service, Washington, DC
Chris Garland, Kentucky Department of Fish and Wildlife Resources, Frankfort, KY
David Godwin, Mississippi Department of Wildlife, Fisheries and Parks, Starkville, MS
Mike Hansbrough, USDA Natural Resources Conservation Service, Jackson, TN
Ed Harsson, Tennessee Wildlife Resources Agency, Jackson, TN
Bill Harvey, Maryland Department of Natural Resources, Annapolis, MD

Tommy Hines, Florida Fish and Wildlife Conservation Commission, Lake City, FL
Harold Hurst, Tennessee Wildlife Resources Agency, Henderson, TN
Rhett Johnson, The Longleaf Alliance, Andalusia, AL
Pat Keyser, Westvaco Corporation, Rupert, WV
Fred Kimmel, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA
Randy Kipley, Hatchie National Wildlife Refuge, Brownsville, TN
David Long, Arkansas Game and Fish Commission, Jonesboro, AR
Clark McCreedy, Indiana Division of Fish and Wildlife, West Lafayette, IN
William McGuire, Missouri Department of Conservation, Jefferson City, MO
Greg Moore, Delaware Division of Fish and Wildlife, Dover, DE
Jim Pack, West Virginia Division of Natural Resources, Charleston, WV
Markus Peterson, Texas A&M University, College Station, TX
Randy Rodgers, Kansas Department of Wildlife and Parks, Hays, KS
John Roseberry, Coop.Wildlife Research Laboratory, So.Illinois Univ., Carbondale, IL
Dave Scott, Ohio Division of Wildlife, Ashley, OH
Kathy Shipley, Ohio Division of Wildlife, Ashley, OH
Harry Spiker, Maryland Department of Natural Resources, Annapolis, MD
Danny Swepton, Texas Parks and Wildlife Department, Canyon, TX
Stan Stewart, Alabama Department of Conservation and Natural Resources, Wetumpka, AL
Scott Taylor, Nebraska Game and Parks Commission, Lincoln, NE
Fred Ward, Arkansas Game and Fish Commission, Calico Rock, AR
Mark Whitney, Georgia Department of Natural Resources, Social Circle, GA
Chris Wolkonowski, Quail Unlimited, Gruetli-Laager, TN
Bill Wyatt, UT Agricultural Extension Service, Jackson, TN

TABLE OF CONTENTS

Executive Summary i
Introduction 1
Bird Conservation Region Assessments
- Bird Conservation Region 18: Shortgrass Prairie 6
- Bird Conservation Region 19: Central Mixed Grass Prairie 9
- Bird Conservation Region 20: Edwards Plateau 12
- Bird Conservation Region 21: Oaks and Prairies 15
- Bird Conservation Region 22: Eastern Tallgrass Prairie 18
- Bird Conservation Region 24: Central Hardwoods 22
- Bird Conservation Region 25: West Gulf Coastal Plain 27
- Bird Conservation Region 26: Mississippi Alluvial Valley 31
- Bird Conservation Region 27: Southeastern Coastal Plain 34
- Bird Conservation Region 28: Appalachian Mountains 37
- Bird Conservation Region 29: Piedmont 40
- Bird Conservation Region 30: New England and Mid-Atlantic 43
- Bird Conservation Region 31: Peninsular Florida 46
- Bird Conservation Region 36: Tamaulipan Brushland 49
- Bird Conservation Region 37: Gulf Coast Prairie 52
- Summary Of Quantitative Habitat Objectives For The Bird Conservation Regions 55
- Opportunities And Needs For Plan Implementation 56

Recommended Habitat Management Practices
- Agricultural Cropland 59
- Grasslands (Pasture/Hay/Rangeland) 64
- Southern Pine Forests 73

Appendices 83
- A. Ca. 1980 Bobwhite Quail Harvests 84
- B. Ca. 1999 Bobwhite Quail Harvests 85
- C. Breeding Bird Survey Trends: 1982-1999 86
- D. 1982 National Resources Inventory Data 87
- E. 1997 National Resources Inventory Data 89
- F. How to calculate the habitat and population increases needed to achieve the 1980 bobwhite density in a BCR on the land base suitable for management in 1999 95

EXECUTIVE SUMMARY

The range of the northern bobwhite included in the Northern Bobwhite Conservation Initiative (NBCI) incorporates nearly 787 million acres. From 1980 to 1999, the autumn bobwhite population declined from 58,857,000 to 20,141,000 birds (65.8%). The Breeding Bird Survey showed a decline in bobwhite breeding numbers averaging 3.8% per year from 1982 to 1999. For some individual states and Bird Conservation Regions, the decline is sharply greater. Breeding Bird Survey and harvest statistics suggest that in some states the northern bobwhite could be approaching extirpation by the end of this decade.

The NBCI was prepared by the Southeast Quail Study Group Technical Committee at the request of the Directors of the Southeastern Association of Fish and Wildlife Agencies. The charge issued to the committee was to develop a quantitative habitat-oriented plan to restore bobwhites to the density they enjoyed during the baseline year 1980. The NBCI is organized to delineate population and habitat objectives for 15 Bird Conservation Regions that comprise that portion of the bobwhite's range incorporated in the plan. This approach was selected to facilitate coordination and cooperation with other bird management plans, e.g., Partners in Flight. The NBCI also includes three chapters detailing specific management practices to be employed on agricultural land, grasslands, and forests, and one chapter outlining the approaches to be taken to implement the plan.

Harvest records maintained by 22 individual state conservation agencies were employed to assess the change in bobwhite harvests from 1980 to 1999. These data were also used to estimate densities of bobwhites in the pre-hunt population and breeding densities at the initiation of the breeding season. The U.S. Geological Survey's Breeding Bird Survey (BBS) data from 1982-1999 were used to observe and forecast trends in the breeding population by individual states, Bird Conservation Regions, and over the species' U.S. range.

The National Resources Inventory (NRI) generated by the Natural Resources Conservation Service provides detailed land use data at 5-year intervals. Data from 1982 and 1997 were the source of information used in the NBCI.

Restoring northern bobwhites to their desired density will require the addition of 2,770,922 coveys to the current population. Achieving this population will necessitate impacting the habitat on 81.1 million acres of farm, forest, and range land. However, the recommended land management practices would change the primary land use on only 6% to 7% of this acreage.

More than 78% of the needed coveys (2,170,691 coveys) will be produced on 18.7 million acres of farm land (crops, pasture/hay, CRP). A highly significant point is that conversion of exotic cool season grasses on existing CRP acres should produce 21.2% of all coveys needed.

Altering forest management practices on 53.5 million acres of forest lands to encourage habitat favorable to bobwhites should yield 196,617 coveys (7.1% of the needed coveys). Important management practices include site preparation to encourage favorable grass and forb communities, prescribed fire, thinning to encourage light penetration, and where ecologically sound, increase acreage of longleaf pine.

Improving range management practices beneficial to bobwhites in the western and southern parts of their range should add 403,614 coveys (14.6% of the needed coveys) on 8.9 million acres of range lands. These same practices, i.e., prescribed fire, proper grazing densities, replacing exotic vegetation with native grasses and forbs, will also enhance the range productivity for livestock and improve ranch income.

Implementation of the NBCI will require the continuing cooperation of federal, state, and private wildlife organizations, and of individual landowners and managers. Much of the needed funding can be derived from existing federal and state programs, though increased appropriations will be required, and some new funding initiatives may be needed.

It is anticipated that if immediate action is taken the bobwhite's decline may be arrested in five years, and if the plan is followed to its conclusion, the restoration may be effected in 20-25 years.

THE NORTHERN BOBWHITE CONSERVATION INITIATIVE

INTRODUCTION

The northern bobwhite (*Colinus virginianus*) has endured a severe decline in its population status in the United States for at least three decades. As we enter the 21st century, the bobwhite faces a distinct and imminent threat of extirpation in significant portions of its range. The boundaries of the present range of northern bobwhites in the U.S. incorporate 786,820,800 acres (1,229,408 square miles), little changed from the land occupied during pre-Colonial times. However, the relatively stable range border does not reflect the uneven distribution within this border, nor the sharp decline in population density throughout most of its range. In 1980, the autumn population of bobwhites was estimated to be 58,857,000. By 1999, it had declined 65.8% to 20,141,000. The breeding population was estimated to be 19,619,000 in 1980, and 6,714,000 in 1999. The Breeding Bird Survey showed a decline in bobwhites averaging 3.8% per year from 1982 to 1999. Projecting this trend to 2020 indicates an additional loss of 53.9% over the next 2 decades, leaving a breeding population of only 3,095,000. Assuming a male:female ratio of 1:1, we would be faced with a maximum of 1,547,000 breeding pairs (less than 1.3 pairs per square mile). While this rate of decline is devastating, there is clear indication that in recent years the rate of decline has increased range wide. For some individual states and Bird Conservation Regions (BCRs), the decline is sharply higher. Breeding Bird Survey data suggest that in some states the northern bobwhite could be approaching extirpation by the end of this decade.

The recovery of the northern bobwhite will be made increasingly difficult by the continuing loss of the land base needed for implementing the habitat changes necessary for this recovery. Each 100,000 increase in the human population in the U.S. is accompanied by a conversion of 150,000 acres of rural land to urban uses, rendering it largely unfit for bobwhite management. The U.S. Census Bureau projects the U.S. population will grow by about 43 million by 2020. This will result in the conversion of nearly 65 million acres to urban uses nationwide. A significant portion of this will occur throughout the bobwhite's range.

Clearly, circumstances call for immediate and dramatic action. This report is a response by biologists, managers, and researchers of the Southeast Quail Study Group Technical Committee (SEQSG) to a request from the Directors of the member states of the Southeastern Association of Fish and Wildlife Agencies (SEAFWA) to prepare a plan for the recovery of the northern bobwhite.

The GOAL for this plan is to restore northern bobwhite populations range wide to an average density equivalent to that which existed on improvable acres in the baseline year of 1980. The selection of the 1980 population density as the goal for restoring northern bobwhites was endorsed by the SEAFWA directors. The following considerations influencing the choice of 1980 by the SEQSG were: 1) population densities and hunting opportunities were significantly greater in 1980 than exist today, 2) the current landscape, if properly managed, would support densities equivalent to those existing in 1980, and 3) important data bases utilized in this Initiative have comparable beginning points on or near 1980. The specific charge was to identify the types and amounts of habitats and habitat management efforts needed to achieve this goal.

HABITAT OBJECTIVES:

1. Increase the amount and enhance the quality of the agricultural lands for nesting, brood-rearing, and roosting by bobwhites and other grassland species of wildlife by adding native warm season grasses and other conservation plantings such as shrubs and forbs.

2. Enhance the management practices on pinelands and mixed pine-hardwoods by thinning, controlled burning, and site preparation in a fashion that benefits bobwhites and other wildlife, and increase acreage devoted to longleaf pine where it is ecologically feasible.

3. Preserve and enhance the quality of rangelands by utilizing vegetation management practices and grazing regimes that favor the retention and improvement of native plant communities beneficial to bobwhites and other wildlife.

In this plan, we have apportioned the responsibility for achieving these objectives to the individual states within each BCR. This apportionment was based on the decline in northern bobwhites in each state and BCR, and the amount and types of habitat improvements that would be needed to restore bobwhites to the desired density in that region.

Assumptions, Data Bases, and Methods

Projecting the habitat improvements needed to accomplish the restoration of bobwhites required developing assumptions about quail biology and demographics, delineating the current status of land use and habitat characteristics, and applying this information to develop an effective management strategy.

ASSUMPTIONS

Bobwhite Population Demographics

The following assumptions were derived from published literature, unpublished data sets, and the personal knowledge of experienced biologists:

1. Mean clutch size is 12 eggs.

2. Mean covey size in autumn is 12 bobwhites.

3. Nest success rate for all nests over the life of a nest including egg-laying and incubation = 25%

4. Nest density in good nesting habitat is 1 nest per acre over a nesting season.

5. Successful nests should occur at a rate of 1 nest per 4 acres of good nesting habitat, but some authors elected to use different assumptions. These are noted in the text.

6. Legal bobwhite harvest removes 33.3% of the autumn pre-hunt population.

7. All other mortality factors remove an additional 33.4 % of the autumn population.

8. The breeding population will be 33.3% of the preceding autumn pre-harvest population.

Habitat

1. A lack of nesting and brood-rearing cover is the major limiting factor over much of the range of the northern bobwhite. This is a result of the long-term practice of replacing native warm season grasses with exotic cool season and warm season grasses, and of completely eliminating nesting habitat in intensive cropland and dense pine forests. A lack of desirable grassland habitats not only limits bobwhites, but also limits the abundance of unexploited wildlife species as well, such as the loggerhead shrike and several other grassland and shrubland neotropical migrant bird species. The declines of bobwhites and loggerhead shrikes are strikingly similar (Figure 1). Where nesting habitat is adequate, other habitat components may be identified as requiring management efforts, e.g. winter cover, winter food, etc.

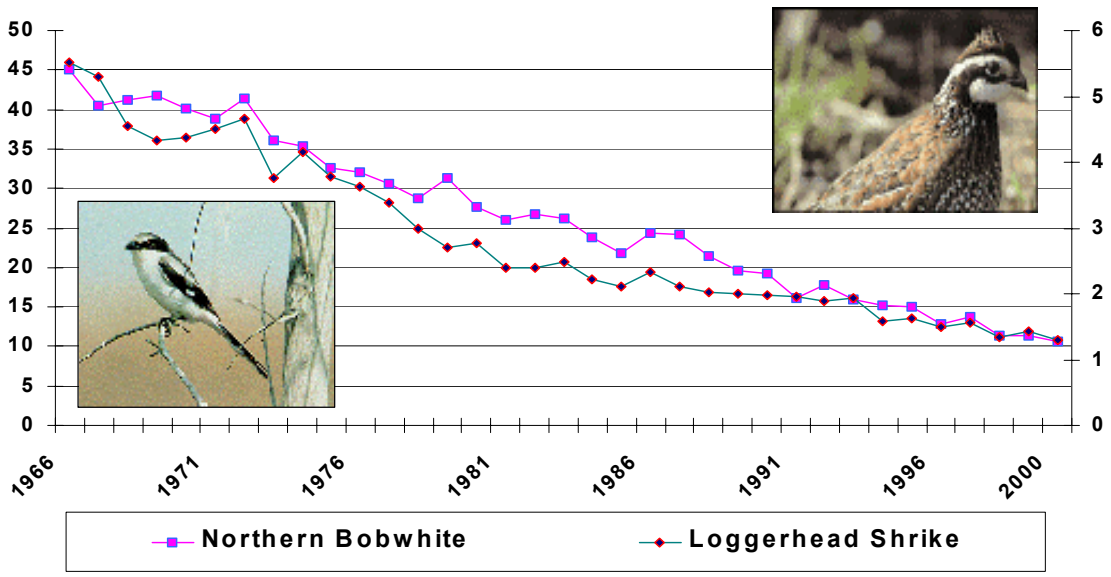


Figure 1. USFWS Region 4 BBS Indices for Northern Bobwhite and Loggerhead Shrike, 1966-2000.

2. Properly managed native warm season grasses with an adequate component of forbs provide good to excellent nesting and brood-rearing habitat.

3. Four acres of properly managed native warm season grasses/forbs should produce 1 covey of 12 bobwhites per year.

4. Southern pines, particularly longleaf, loblolly, shortleaf, and slash pines, can be enhanced by site preparation techniques that permit and/or encourage the development of bobwhite-friendly herbaceous understory during the early years of stand establishment, periodic thinning, and regular prescribed burning. Applying all or some of these techniques can add 1 to 7 or more coveys of bobwhites for each 1,000 acres properly managed.

5. Hardwood forests provide an important habitat component for winter protection for bobwhites, particularly in northern portions of its range, but these hardwoods offer little opportunity to enhance productivity (nesting, brood-rearing) in most of the Bird Conservation Regions.

6. In some portions of the bobwhite's range, hardwood savanna restoration and/or management offer opportunities for enhancing bobwhite productivity and survival.

DATA BASES

Population Density and Trends. Two sets of data were used to establish past and present population densities and trends by state and BCR. Harvest records maintained by 22 individual state conservation agencies were employed to assess the change in bobwhite harvests from 1980 to 1999 (Appendices A and B). These data were also used to estimate the densities of bobwhites in the autumn population prior to the hunting season and the breeding densities at the initiation of the breeding season. An independent data set, the Breeding Bird Survey conducted annually by the U.S. Fish and Wildlife Service from 1982-1999, was used to observe and forecast trends in the status of bobwhites by state, BCR, and over its U.S. range (Appendix C). The Breeding Bird Survey data will be used to monitor the success of the NBCI.

Land Use Acreages and Trends. The Natural Resources Conservation Service provided detailed land use data at 5-year intervals. Those data were used to evaluate the current and past status of bobwhite habitat, and to serve as a basis for developing habitat management objectives. Data from the 1982 and 1997 National Resources Inventory were the source of information for this report (Appendices D and E).

METHODS

This report is designed to provide conservation and management needs of the northern bobwhite and to facilitate integration and collaboration with other species management plans, such as Partners In Flight, the North American Waterfowl Management Plan, and others. The Bird Conservation Regions are those described in the North American Bird Conservation Initiative (NABCI).

We chose to set a goal of restoring bobwhites to 1980 regional and national population densities rather than attempting to achieve numerical parity with 1980. The rapidly shrinking land base of acres available for management would make the latter goal unachievable. The method for estimating the amount of current land suitable for management is described in detail in Appendix F.

Each chapter in this Conservation Initiative was written by a person or persons knowledgeable about the specific management techniques described, or about bobwhite management in the particular Bird Conservation Region. The general assumptions listed above were open to modification by the chapter authors as described in the individual chapters.

BIRD CONSERVATION REGIONS

The portion of the range of the northern bobwhite in the United States included in the Northern Bobwhite Conservation Initiative occupies all or part of 15 Bird Conservation Regions and 22 states (Figure 2). Some of the BCRs, e.g., Tamaulipan Brushland, Edwards Plateau, and Peninsular Florida, occupy only portions of a single state, whereas others, e.g., Southeastern Coastal Plain and Central Hardwoods, occupy parts of 2 to 10 states. An important component of this plan is identifying the number of coveys to be added in each BCR to achieve the goal of restoring bobwhites to their 1980 regional and national densities.

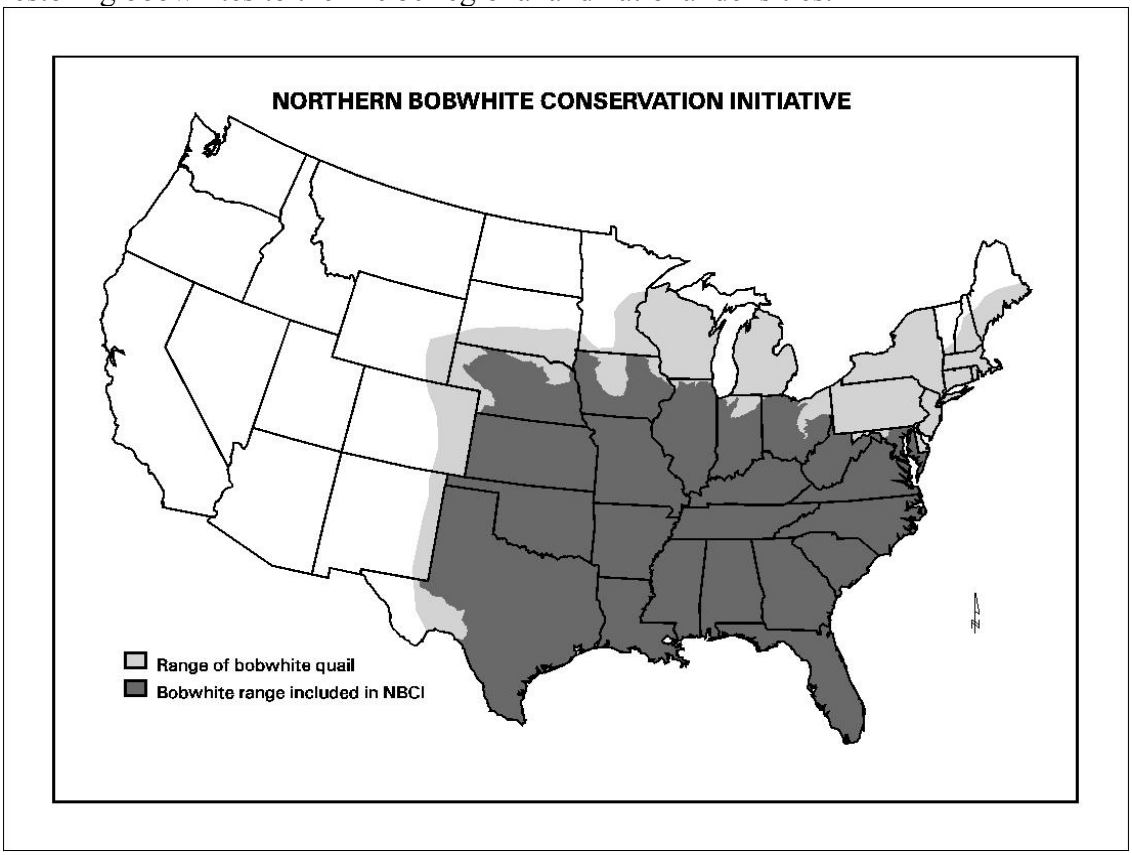
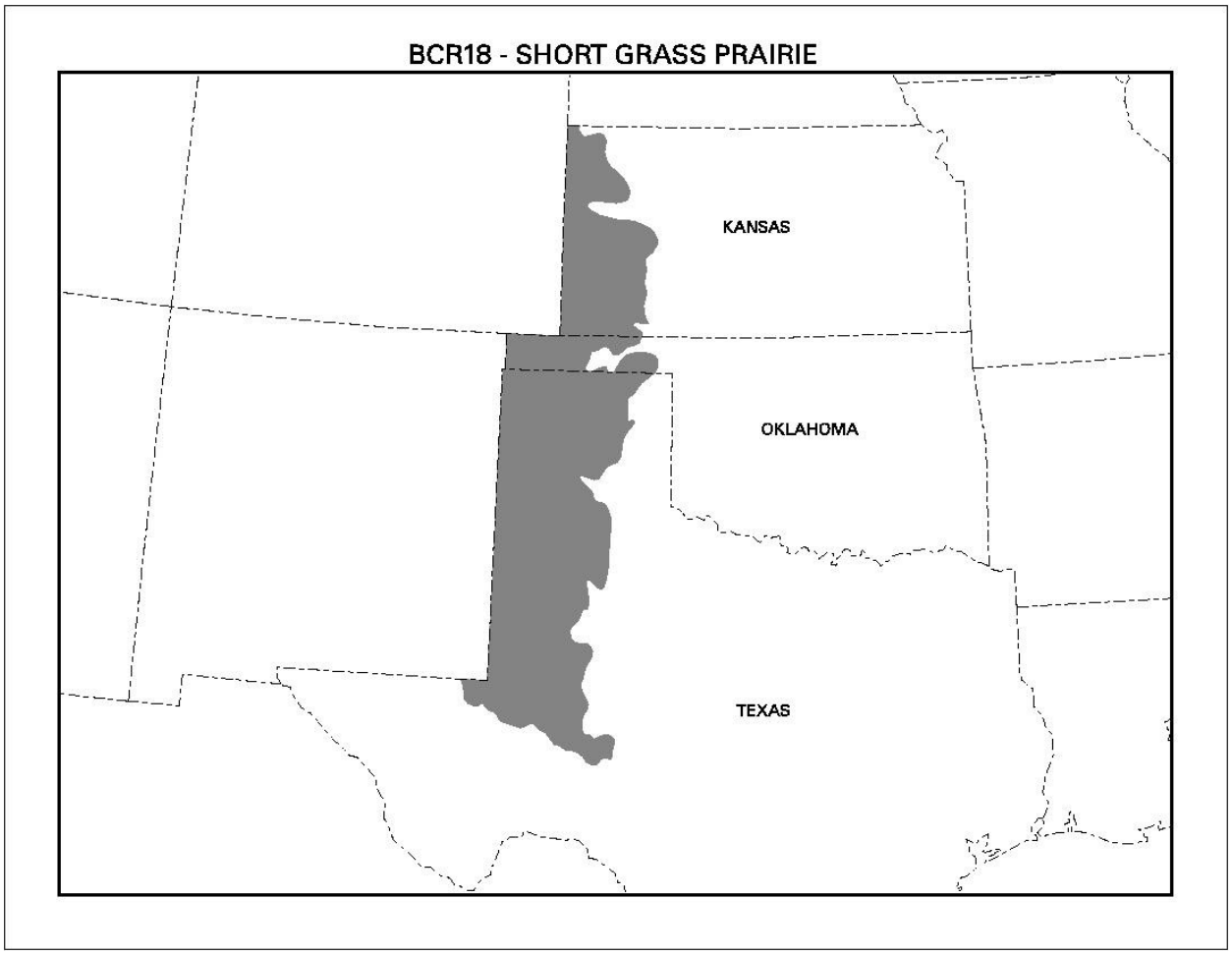


Figure 2. The range of the northern bobwhite in the U.S.

Bird Conservation Region 18: Shortgrass Prairie

Roger Wells, Quail Unlimited, Inc., 868 Road 290, Americus, KS 66835.



The Shortgrass Prairie Bird Conservation Region (BCR 18) takes in parts of 8 states, but for the purposes of the Northern Bobwhite Conservation Initiative, only those portions of the BCR in Kansas, Oklahoma, and Texas were considered. According to the 1997 National Resources Inventory, there are 25,716,900 acres of land in these 3 states within BCR 18 (Table 1). Of this, 24,418,100 acres were devoted to agricultural uses (cropland, pasture, hay, rangeland, CRP). These are categorized as "Improvable Agricultural Acres" (IAA) for this plan. The agricultural land base suitable for wildlife declined by 0.6% from 1982 to 1997. The Conservation Reserve Program (CRP), which began in 1985, accounted for 3,136,600 acres (12.8%) of the 1997 IAA, however, only 93,300 acres (2.97%) were devoted to trees or wildlife plantings. The CRP acres in Kansas were planted almost exclusively to native warm season grass (NWSG) mixtures which provided significantly improved quail habitat (R. Rodgers, KS Dept. Wildl. & Parks, pers. comm.). The CRP acres in Texas and Oklahoma were planted predominately to non-native old-world bluestems. Because of their dense growth form, they do not provide the quality wildlife habitat of the native warm season grasses as planted in Kansas (D. Swepston, TX Parks & Wildl., pers. comm.).

Bobwhite populations declined at an average annual rate of 2.5% from 1982 to 1999 based upon 44 BBS routes within BCR 18. Bobwhite harvest declined by 38% from 1980 to 1999 as reported by the 3 states within this BCR with harvests of 344,745 and 213,346, respectively. Very little decline occurred in Kansas (-1.6%) over this period of time. This is attributed primarily to improved quail habitat provided by the Conservation Reserve Program and the NWSG planted on those acres (R. Rodgers, KS Dept. Wildl. & Parks, pers. comm.). In contrast, the Oklahoma and Texas quail harvests declined 87.5% and 68.0%, respectively. The fall pre-hunt population density on improvable acres across the 3-state BCR declined from 0.042 birds/acre in 1980 to 0.027 in 1999. To restore the bobwhite population to 1980 densities on the remaining improvable acres will require the addition of 32,605 coveys.

Throughout this BCR a high percentage of the agricultural acreage is devoted to center-pivot type irrigation systems. The typical system irrigates approximately 126 acres out of each quarter section (160 acres) with about 34 acres of each circle left unirrigated. Often these unirrigated corners are left idle or are managed in a different crop rotation than the irrigated portion of the field. The unirrigated corners offer significant opportunities for quail habitat enhancement. Planting NWSG where appropriate and planting of shelterbelts and shrub rows for winter protection on these corners would improve quail habitat. On other croplands opportunities exist for planting NWSG as allowed under the Continuous Conservation Reserve Program (CCRP) such as riparian buffers, grassed terraces and cross-wind trap strips. Grassland areas (including CRP acres) can be improved for quail through strip disking and legume seeding on CRP acres and shrub planting, prescribed burning, riparian area management and food plot planting on all grasslands. Specifically, the population goals desired for quail within this BCR can be achieved through: 1) NWSG planting, shrub plot planting, soil disturbance (where needed) and winter food management on 2,522,400 acres of cropland. This should add 15,765 coveys in the BCR (48.4% of the total needed). 2) Prescribed burning, shrub planting, woody cover management, riparian area improvement and food plot plantings on 814,592 acres of range, pasture and hay land. This should produce 12,728 coveys (39.0% of the total needed). 3) Prescribed burning, legume interseeding, strip disking and shrub planting on 263,168 acres of CRP land. This should add 4,112 coveys (12.6% of the coveys needed).

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 18. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

State	Cropland	Pasture/Hay	Range	CRP	Improvable Ag Acres[1]	(%)[2]	CRP Grass	CRP Trees	CRP Wildlife
KS	3,124.6	56.6	830.6	714.3	4,726.1	19.20	712.9	1.4	0
OK	275.4	20.3	592.3	154.2	1042.2	4.58	154.2	0	0
TX	8,248.8	152.2	7,980.7	2,268.1	18,649.8	76.22	2,176.2	55.7	36.2
Totals	**11,648.8**	**229.1**	**9,403.6**	**3,136.6**	**24,418.1**	**100**	**3,043.3**	**57.1**	**36.2**

[1] Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

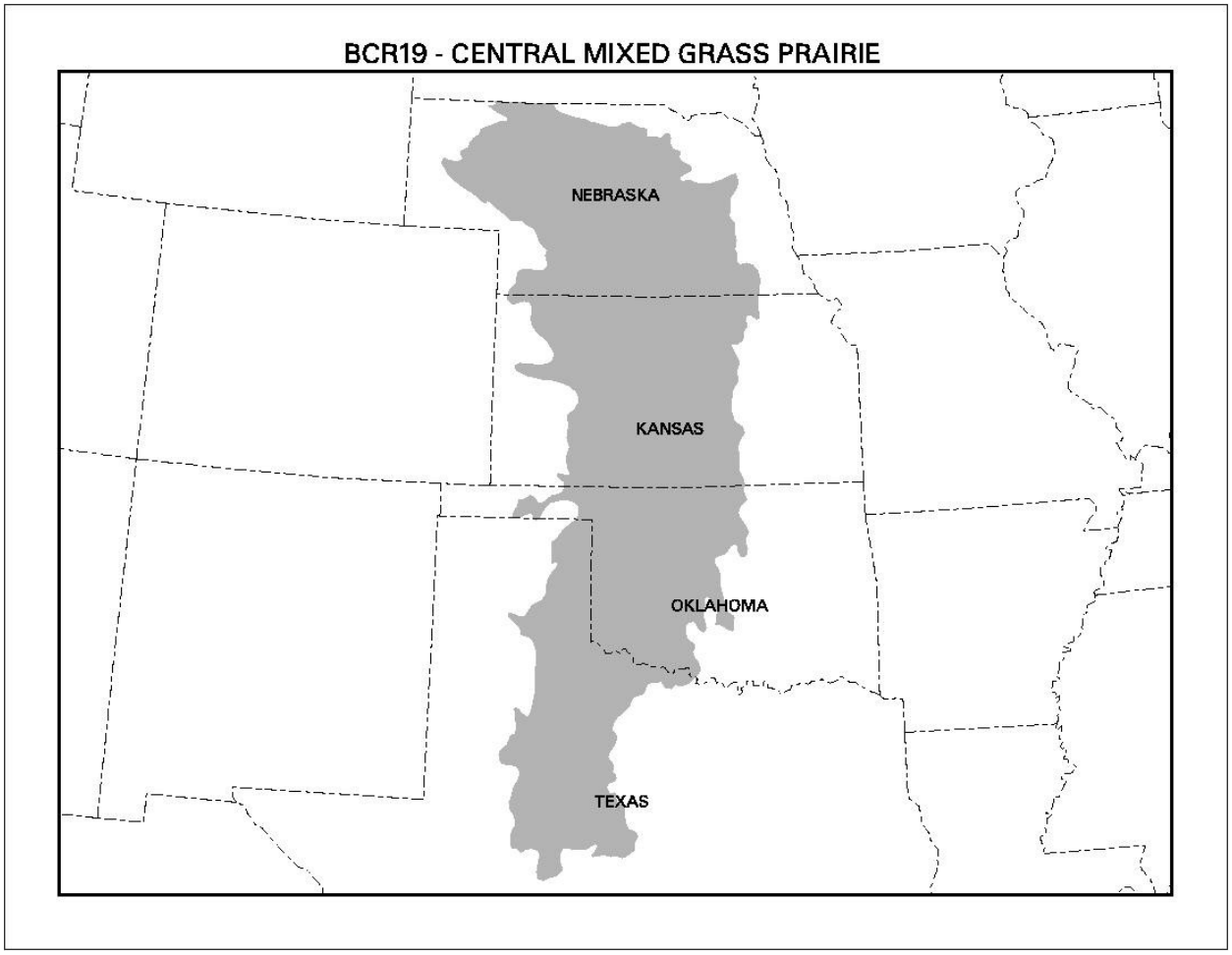
[2]% is the portion of BCR occupied by IAA for each state, and is used to determine the population goal for that state.

Table 2. Population goals (coveys to be added) and recommended management practices (acres x 1,000) by land use type for 3 states comprising BCR 18.

		Shrub planting, center-pivot corner management		**Strip disking, legume seeding, shrub planting, burning, food plots**			
State	**Pop. Goal Coveys**	Ag Land Acres	**Ag Land Coveys**	Pasture, Hay, Rangeland Acres	**Pasture, Hay, Rangeland Coveys**	CRP Acres	**CRP Coveys**
KS	**6,258**	484.2	**4,225**	156.4	**1,120**	50.5	**913**
OK	**1,494**	115.6	**378**	37.3	**802**	12.1	**314**
TX	**24,853**	1,922.6	**11,162**	620.9	**10,806**	200.6	**2,885**
Totals	**32,605**	2,522.4	**15,765**	814.6	**12,728**	263.2	**4,112**

Bird Conservation Region 19: Central Mixed Grass Prairie

Roger D. Applegate, Kansas Department of Wildlife and Parks, P.O. Box 1525, 1830 Merchant Street, Emporia, KS 66801-1525



The Central Mixed Grass Prairie Bird Conservation Region (BCR 19) includes 102,446,500 acres in portions of Kansas, Nebraska, Oklahoma and Texas. In 1997 the National Resources Inventory (NRI) recorded a total of 80,388,200 acres used for cropland, pasture/hayland, and range (Table 1). These agricultural lands comprise over 75% of the land base in the BCR. The remaining land includes urban areas and other lands that are unsuitable to wildlife. Forest lands, per se, are negligible in this BCR, and consist mainly of riparian woodlands. Unlike many BCRs, acreage of land suitable for bobwhite management decreased by only 5% between 1982 and 1997. In 1982, there was no Conservation Reserve Program (CRP) but in 1997, 4,296,700 acres were enrolled in CRP. Of these acres, only 1.2% was enrolled in a wildlife CRP practice. CRP continues to be the only true landscape-scale habitat management program in the U. S. and has the potential to impact more acres in the future.

From 1980 to 1999 bobwhite population indices derived from the Breeding Bird Survey (BBS) were nearly stable (-0.714%/year) in BCR 19 based on 80 BBS routes. This contrasts greatly

with BBS indices from other BCRs that range from –1.912% per year to –8.352% per year. In fact, the trend for BCR 19 is the only nearly stable trend in bobwhite range. BCR 19 constitutes the northern and western fringe of bobwhite range so that population densities are much lower than near the core of the range. For example, Rural Mail Carrier Survey (RMCS) indices in Kansas range from 0.11 quail/100 miles to 0.56 quail/100 miles 1980-1999 in the environs of BCR 19. Eastern Kansas RMCS indices, on the other hand are 1.17-5.19 quail/100 miles during this same period. Thus, there is a tenfold difference in relative density between eastern and western Kansas. In the four states located in BCR 19, bobwhite harvests were 38% lower in 1999 than in 1980, declining from 2.3 million to 1.5 million birds. The pre-hunting season density of bobwhites on improvable agricultural acres (IAA) in 1980 was 0.073 birds per acre and declined to 0.034 in 1999. To restore bobwhite populations to 1980 density will require the addition of 68,610 coveys to the fall pre-hunt population in BCR 19.

BCR 19 has a relatively stable population of bobwhites compared to other BCRs, however, there is room for improvement. Increases in the forb component of existing CRP and the addition of CRP acreage containing grass-forb mixtures will provide the additional coveys needed to achieve the 1980 goal (Table 2). Specifically, assuming that 10 acres of native warm season grass/forbs added to cropland will produce 1 covey of quail in this BCR, then adding 686,100 acres of CRP native warm season grass/forbs will add 68,610 coveys. Much can be gained by enrollment of IAA in buffers continuous signup CRP. Buffer strips can also be used to provide woody cover necessary for bobwhites during relatively severe winter weather. Improvement of grazing lands by reduction in cattle stocking rates and grazing seasons can also have some additional positive impacts in this BCR.

It is easy to see how a program that promotes this approach could increase the pre-harvest population of bobwhites to a level higher than the 1980 target. This should be encouraged in order to test the possibility of buffering against dramatic decreases in the population. Populations near the edge of a species range can often boom and bust due to weather fluctuations. If carrying capacity can be boosted, the increase in numbers can help to mitigate weather losses. Buffers and other practices available under CRP can also help provide larger blocks of habitat needed to permit bobwhites to maintain covey size for optimum survival.

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 19. Numbers represent acres x 1,000 in 1997[1]. Data from the 1997 National Resources Inventory.

State	Cropland	Pasture/Hay	Range	Improvable Ag Acres[1]	(%)[2]	CRP Grass	CRP Wildlife
KS	20,647.0	960.0	9,114.2	30,721.2	(38)	1,667.8	2.1
NE[3]	4,934.8	764.4	7,847.7	13,546.9	(17)	418.3	30.2
OK	7,147.2	1,296.6	6,837.3	15,281.1	(19)	938.4	0.0
TX	5,400.2	337.8	15,101.0	20,839.0	(26)	1,205.5	17.6
TOTAL	38,129.2	3,358.8	38,900.2	80,388.2	(100)	4,230.0	49.9

[1] Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2]% is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

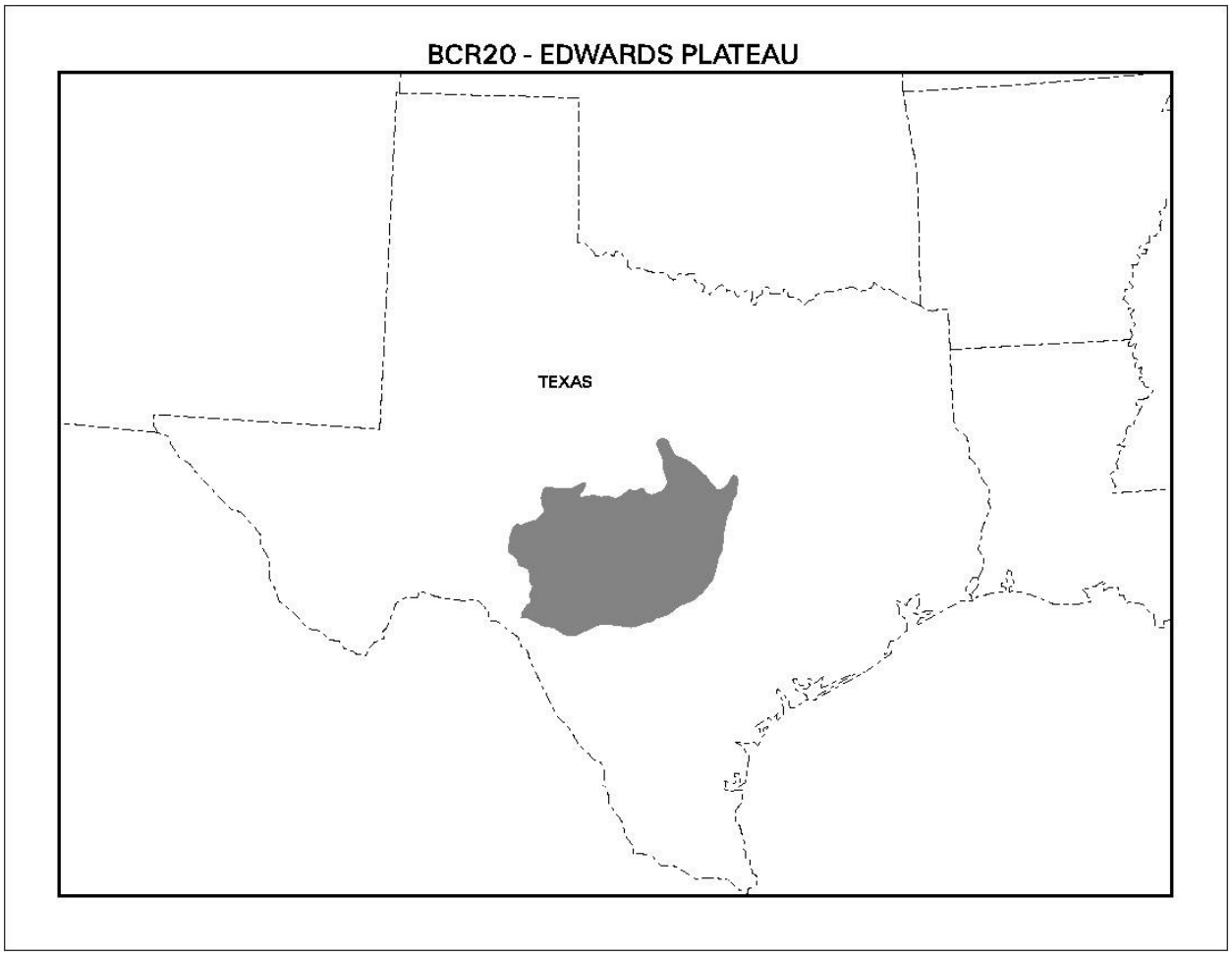
[3]Acreages for Nebraska are 40% of the total acreage/land use type. For determining population goal for Nebraska it was assumed that only 40% of the BCR was actually occupied by bobwhites.

Table 2. Population goals (coveys to be added) and recommended management practices (acres x 1,000) by land use type for 4 states comprising BCR 19.

State	**Pop. Goal Coveys**	**CRP Grass Acres**	**CRP Grass Coveys**
KS	21,200	212.0	21,200
NE	14,339	143.4	14,339
OK	25,866	258.7	25,866
TX	7,205	720.0	7,205
Total	**68,610**	**686.1**	**68,610**

Bird Conservation Region 20: Edwards Plateau

Stephen J. DeMaso, Texas Parks and Wildlife Department, 4200 Smith School Rd., Austin, TX 78744-3291



The Edwards Plateau Bird Conservation Region (BCR 20) comprises 8,553,200 acres of land in central Texas. This hilly area is clearly demarcated by the Balcones Fault escarpment to the east and south, but grades into the Chihuahuan Desert to the west and the Great Plains to the north. The plateau can be divided into four subregions. The central and western portions of the plateau are characterized by broad, relatively level uplands moderately dissected by gently sloping stream divides. The deeply dissected portion adjacent to the escarpment, the Balcones Canyonlands, is popularly known as the Texas Hill Country. This region is highly dissected by fast-moving streams through steep-sided canyons. The northeast plateau, the Lampasas Cut Plains, is characterized by broad valleys. The final subregion is the Central Mineral Valley or Llano Uplift. This area has a granitic substrate that clearly differentiates this area from surrounding areas. The Edwards Plateau was originally a grassy savanna with the most common trees being mesquite, juniper, and live oaks. Some of this community type still remains, but agricultural practices have heavily modified most of the area. The eastern and wetter end of the Plateau is characterized by diverse woodlands including hardwoods (primarily oaks) and Ashe

juniper. Periodic, naturally-occurring fire was a major ecological force in the western plateau that maintained live oak savannas and produced a mosaic of habitats across broad landscapes. Most of the acreage for bobwhite habitat improvement is in the Llano Basin and the northern, western, and southwestern fringes of the BCR.

Based on the 1997 National Resources Inventory, 8,130,800 acres were devoted to cropland, pasture/hayland, and range (Table l). These land use categories are designated "Improvable Agricultural Acres" (IAA), and treated as a single unit for assigning population densities, population goals, and acreage to be managed. This agricultural land base deemed suitable for bobwhite habitat improvement declined by 1.7% from 1982 to 1997. The Conservation Reserve Program (CRP) had not been implemented in 1982. In 1997, CRP occupied 15,200 acres, however, no lands in the Edwards Plateau were enrolled specifically as wildlife practices. CRP lands offer a significant opportunity to manage, and in some cases, convert to more wildlife friendly habitat practices over the next 2 decades. More emphasis on wildlife habitat will be placed in these programs in the future. The remaining land base in BCR 20 consists of urban areas, transportation, and miscellaneous types, none of which are suitable for bobwhite habitat enhancement.

Bobwhite populations declined from 1980 to 1999 in BCR 20. The Breeding Bird Survey (BBS) illustrated an annual decline of 9.0% in the breeding population based on 24 survey routes. Harvest statistics provided by Texas, which contains BCR 20, showed that harvest of bobwhites declined from about 190,000 in 1981 to about 60,650 in 1999 (a decline of about 68.1%). The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.23 birds/IAA. In 1999 that density had declined to 0.08 birds/IAA. To restore the bobwhite population density to 1980 levels will require the addition of 31,487 coveys to the autumn pre-hunt population in this BCR.

Assumptions made to achieve the 1980 population goals include: (1) average northern bobwhite covey size is 12.0 birds, (2) 5% of all cropland, 5% of all pasture/hay land, and 34% of the rangeland, based on the 1997 National Resources Inventory, could be improved to produce suitable bobwhite nesting and brood-rearing habitat, (3) a pre-breeding density of 0.15 birds/IAA would be needed to reach the 1980 population goal, and (4) 80 acres of new habitat is needed to produce each additional covey.

The majority of restoration for bobwhites in BCR 20 can be accomplished by increasing the acreage devoted to a mixture of native warm and cool season grasses interspersed with low growing woody cover. Bobwhite habitat restoration can be accomplished using any or a combination of cedar removal, prescribed burning, and rotational grazing systems and/or decreasing the stocking rates of exotic wildlife species, goats, sheep, and cattle on rangeland (Table 2). All of the above management practices will serve to increase plant diversity. It is important to note that this region of Texas has some of the highest deer densities in the world. Therefore, deer population management is often needed before habitat improvements are implemented to keep deer and other big game species from “camping out” on the lush, new plant growth. Additional acreage can be improved for bobwhites through the conversion of cropland and pasture/hay lands to a mixture of native warm and cool season grasses (Table 2). Specifically, population goals can be achieved through the management practices mentioned

above. Better management of native rangeland in the Edwards Plateau will improve 2,479,520 acres for bobwhites. This should produce an estimated 30,994 bobwhite coveys in the BCR (98.4% of the coveys needed to achieve the 1980 population goal) (Table 2). Conversion of cropland to a mixture of warm and cool season grasses and forbs will improve 29,440 acres for bobwhites. This should produce an estimated 368 bobwhite coveys in the BCR (1.2% of the population goal). Conversion of pasture and hay lands to a mixture of native warm and cool season grasses and forbs will improve 9,975 acres for bobwhites. This should produce an estimated 125 bobwhite coveys in the BCR (0.4% of the population goal) (Table 2).

Table 1. Land use categories suitable for enhancing northern bobwhite populations in BCR 20. BCR 20 is the Edwards Plateau region of Texas, 1982 and 1997. Data are presented as acres x 1,000 (1982 and 1997 National Resources Inventory).

Year	Cropland	Pasture/Hay	Rangeland	CRP grass
1982	637.3	175.2	7,454.6	0
1997	588.8	199.5	7,342.5	15.2
Difference[1]	-48.5	-24.3	-112.1	+15.2

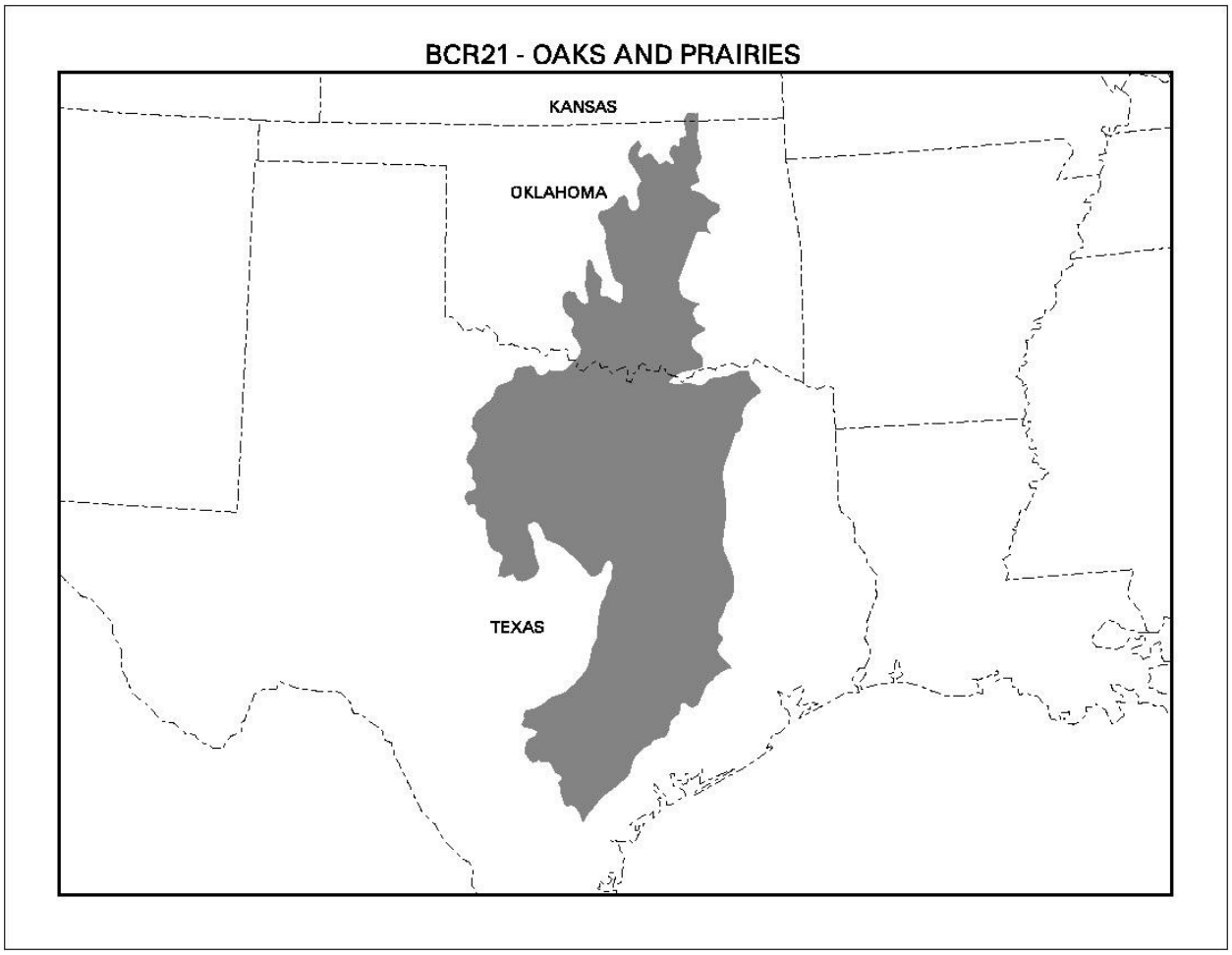
[1]Difference is the change from 1992 to 1997 in acres x 1,000.

Table 2. Acres needed to be improved for northern bobwhites and the number of coveys added through habitat improvement (i.e., establishment of a mixture of native warm and cool season grasses and forbs for nesting and brood-rearing habitat).

	Pop. Goal	Acres improvable for northern bobwhite			Northern Bobwhite coveys		
State	Coveys	Crop	Pasture/Hay	Range	Crop	Pasture/Hay	Range
Texas	31,487	29,440	9,975	2,479,520	368	125	30,994
Totals		2,518,935 Goal acres			31,487 Goal bobwhite coveys		

Bird Conservation Region 21: Oaks and Prairies

Mike Sams, Oklahoma Department of Wildlife, 1801 N. Lincoln, Oklahoma City, OK 73105



Comprising some 45,805,900 acres, the Oaks and Prairies Bird Conservation Region (BCR 21) extends from just beyond the northern border of Oklahoma south to Live Oak County, Texas. As the name implies, much of the uplands throughout the BCR are generally described as rolling savanna of tallgrass prairie and scattered oaks. This plant community is a consequence of the collective influence of fire, herbivory, and weather extremes that occurred historically. Fire suppression, grazing practices, agricultural and introduced grasses are some of the land-use changes that have altered/eliminated much of the native plant communities and thus bobwhite habitat within the Oaks and Prairies BCR. Additionally, fragmentation of native plant communities has indirectly eliminated habitat for viable bobwhite populations throughout much of the BCR.

National Resources Inventory land classifications deemed suitable for enhancement for bobwhites within the Oaks and Prairies BCR include rangelands, pastures, hay meadows, Conservation Reserve Program (CRP) grasslands, and to some extent upland hardwood forest (Table 1). Based on the 1997 National Resources Inventory, 22 million acres of BCR 21 were identified as rangeland, declining 3.7% from the 1982 inventory. Conversely, forested areas

increased 7% from 1982 to 1997. This increase of forested areas is likely due in some part to a gradual community shift of upland savannas (15% canopy closure) to mature oak overstory, consequent to the absence of recurrent fire. Some 17 million acres of BCR 21 were devoted to cropland, pasture/hayland, and CRP grassland in 1997. Other land classifications were either negligible, offering no opportunity for significant improvements (pine forest, CRP pine forest), or were not suitable to enhance for quail (urban areas, transportation, etc.).

The Breeding Bird Survey (BBS) depicts an annual decline of 3.9% in the breeding population of northern bobwhites from 1982 to 1999 in the Oaks and Prairies BCR. More dramatically, bobwhite harvest estimates for BCR 21 have declined 85.2% from 1980 (1,092,233) to 1999 (162,185). Pre-hunt population density, based solely on rangeland habitat, declined 84.7% from 1980 (0.14 quail/acre) to 1999 (0.02 quail/acre). The quail population decline, in spite of no appreciable loss in rangeland (native) habitat, is indicative of the degeneration of rangeland through the exclusion of fire and incompatible grazing practices.

To restore bobwhite population density to the 1980 pre-hunt levels will require the addition of 234,860 coveys. Restoration of bobwhite density can be accomplished by restoring native tallgrass prairie and the associated oak-prairie savanna at a ratio of 25 and 50 acres per covey, respectively. Following these requirements, bobwhite populations can be restored to 1980 levels by:

1. Facilitating restoration/recovery of 4,110,050 acres of existing rangeland through appropriate use of prescribed burning, grazing management, and brush control. This would add 164,402 coveys to the BCR, 70.0% of the total needed.

2. Converting 1,736,450 acres of cropland, pasture/hay, and CRP grassland to native warm-season grasses along with woody cover plantings and applications of appropriate burning and grazing management. Areas targeted for conversion should link existing native prairie habitat (rangeland). This would add 69,458 coveys to the BCR, 29.6% of the total needed.

3. Restoring 50,000 acres of savanna communities through thinning of upland forest along with applications of appropriate burning and grazing management. Areas targeted for conversion should link existing native prairie habitat (rangeland). This would add 1,000 coveys to the BCR, 0.4% of the total needed.

Table 1. Land classification (acres x 1,000) suitable for enhancing bobwhite populations in BCR 21 (1997 National Resources Inventory).

State	Rangeland	Cropland	Pasture/Hay	CRP Grass	Hardwood Forest[1]
OK	3,818.6	1,266.8	2,070.9	25.6	1,688.2
TX	18,286.7	7,399.9	6,573.2	145.0	67.3
Total	22,105.3	8,666.7	8,644.1	170.6	1,755.5

[1]Classification includes both upland and bottomland/riparian forest types.

Table 2. Population goals (coveys to be added) by recommended management practice and associated land classification for BCR 21, by state.

State	Pop. Goal Coveys	Prairie Restoration of Rangeland[1]		Conversion of Cropland, Pasture/Hay, & CRP Grasslands to Warm Season Grasses[2]		Savanna Restoration of Upland Forest[3]	
		Acres	Coveys	Acres	Coveys	Acres	Coveys
OK	42,879	713,850	28,554	334,080	13,363	48,083	962
TX	191,981	3,396,200	135,848	1,402,370	56,095	1,917	38
Total	234,860	4,110,050	164,402	1,736,450	69,458	50,000	1,000

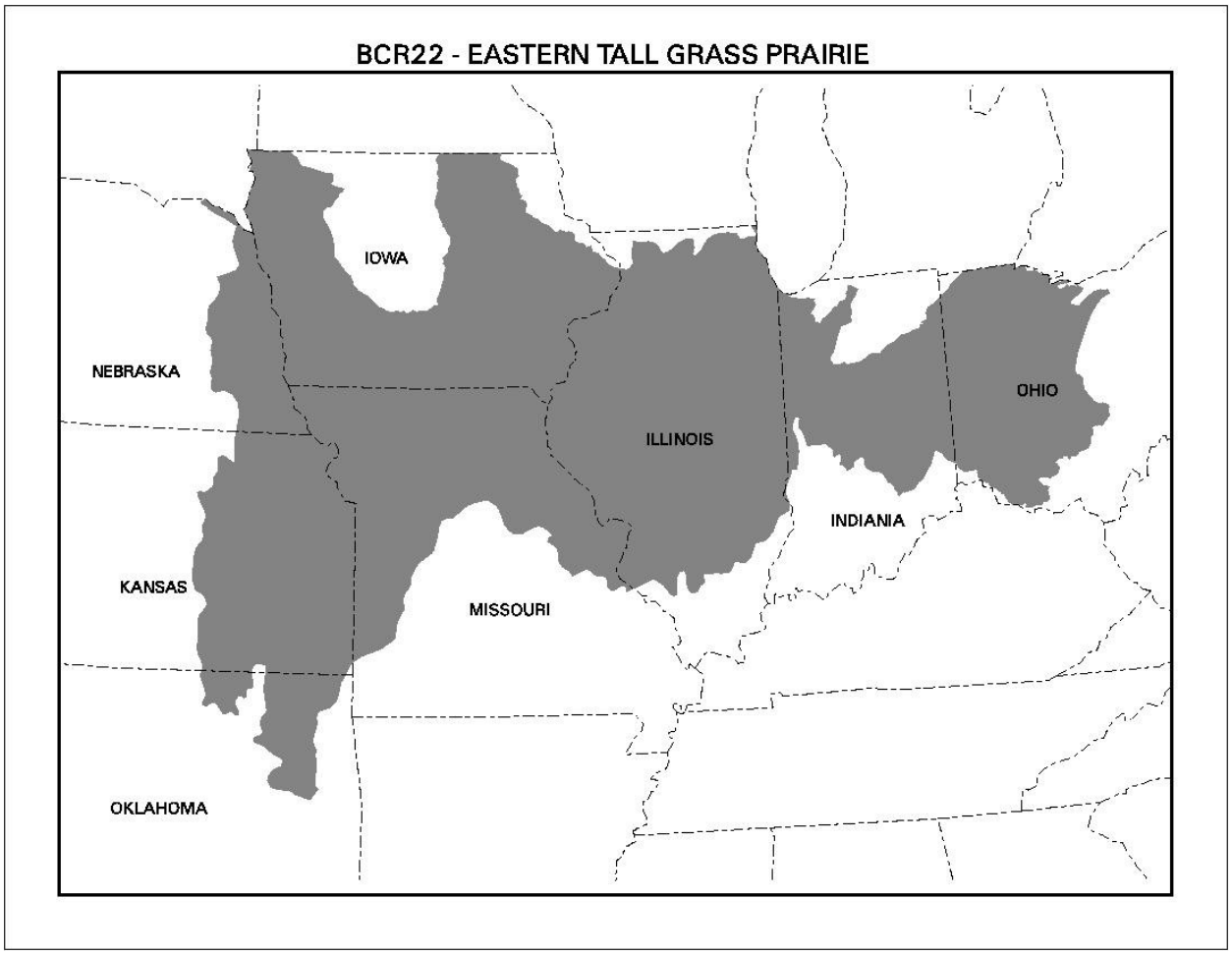
[1]Management involves prescribed burning, grazing management, and brush control.

[2]Management involves conversion to warm season grasses along with woody cover plantings followed by appropriate fire and grazing management.

[3]Management involves thinning of upland forest followed by appropriate fire and grazing management.

Bird Conservation Region 22: Eastern Tallgrass Prairie

David Howell, Quail Unlimited, Inc., 10364 S. 950 E., Stendal, IN 47585



The Eastern Tallgrass Prairie Bird Conservation Region (BCR 22) comprises 120,544,800 acres of land in 8 midwestern states. Based on the 1997 National Resources Inventory, 112,541,800 acres were devoted to cropland, pasture/hay, range, CRP, and forests (Table 1). Of that area 65.9% (79,431,000 acres/124,100 sq. mi.) is designated "Improvable Agricultural Acres" (IAA) and is treated as a single unit for assigning population densities, population goals, and acreage for maintenance and/or management. For BCR 22, IAA includes all acres in pasture/hay, range, CRP and forests, but only 54% of the cropland. Crop areas were considered on a state-by-state basis. The most highly valued, intensively cropped acres in BCR 22 offer little hope for increasing bobwhite abundance and were eliminated from consideration (Table 1).

The agricultural land base deemed suitable for bobwhite habitat improvement increased by 0.5% from 1982 to 1997. This occurred because of an increase in forests (up 9%) and the creation of the Conservation Reserve Program (CRP), which by 1997 occupied 4,254,500 acres in BCR 22. However, only 1.7% of CRP was installed specifically as wildlife habitat. The remaining land

base in BCR 22 consists of urban areas, transportation and miscellaneous types, none of which are deemed suitable for bobwhite habitat enhancement.

From 1980 to 1999, bobwhite populations in BCR 22, based on Breeding Bird Survey (BBS) information, showed the second smallest decline of 15 BCR units included in this report. The BBS data reveal an annual decline of 1.9% in the bobwhite breeding population based on 185 survey routes. Statistics provided by the eight state natural resource agencies comprising BCR 22 showed that the harvest of bobwhites went from 3.5 million birds in 1980 to slightly more than 1.6 million in 1999, a 53.1% decline, with Iowa (66%) and Nebraska (69.4%) showing the greatest decreases. In spite of this decline, BCR 22's contribution to the nationwide bobwhite harvest increased from 16.9% of the total harvest in 1980 to 23.2% in 1999.

The pre-hunt population density of bobwhites on the IAA in 1980 was .127 birds/IAA. In 1999 that density had declined to .059 birds/IAA. To restore the bobwhite population to 1980 levels will require the addition of 448,400 coveys to the autumn pre-hunt population in this BCR.

Population and Management Objectives

Increasing habitat for bobwhites on the 79,424,000 acres designated as IAA in BCR 22 will involve a variety of management and maintenance activities that focus on development of high quality nesting, brood raising, roosting and woody cover. Optimum quail abundance in BCR 22 occurs where cropland occupies from 30 to 65% of the landscape, grassland occurs on 15 to 30% of the area and more than 8,500 yards/square mile of woody edge is present (Dailey 1989, Roseberry 1998).

The current landscape-level distribution of crops, pasture/hay/range, forest and CRP will dictate what habitat management/maintenance practices are necessary to improve quail abundance. BCR 22 IAA will be treated as two areas from a management/maintenance standpoint (Table 2). One area includes all IAA in crop, pasture/hay/range and forests (75,197,440 acres). In that area 3,759,900 acres of habitat development (native vegetation, legume plantings, woody cover, field borders, etc.) are needed to increase fall quail numbers by 3.1 coveys/square mile. That adds 82% of the coveys needed (369,200) to restore bobwhites to 1980 levels.

The other area represents 4,224,000 acres of CRP in BCR 22. With a focus on wildlife friendly maintenance practices (64 acres/sq. mi./year, including disking, burning, etc.), 12 coveys/square mile (79,200 coveys) can be added to the fall population.

Some specific recommendations as they apply to major IAA land use categories in BCR 22 follow:

CROP – Grain crops are planted on 60,800 square miles (only 54% of all the crop area) in BCR 22 considered as IAA. To restore quail numbers, an average of 32 acres of high quality nesting, roosting and woody cover/square mile of IAA cropland must be developed. This could include the establishment of linear cover including field borders, filter strips, riparian buffers (shrubs, trees, grass, legumes) and hedgerows. Existing Farm Bill Programs, such as CRP, WHIP, WRP and EQIP offer excellent economic incentives for landowner participation in habitat

improvement. Additionally, state and non-government organization programs can also be a great benefit in assisting landowners with quail restoration.

PASTURE/HAY/RANGE – A variety of grassland/forb complexes comprise 40,700 square miles of pasture/hay/range in BCR 22. One principal management strategy will be to convert 32 acres of fescue/square mile to native grasses and/or other more wildlife friendly forage alternatives (orchardgrass, timothy, clovers, legumes). Emphasis on pasture/hay/range technical assistance through the Grazing Lands Initiative should be continued and increased, while better promotion of opportunities through Continuous CRP marginal pastureland eligibility are needed. Additionally, a potential grasslands reserve program could help protect native grasslands and offer quail benefits as well. These efforts should be most effective in circumstances where pasture/rangelands are juxtaposed with cropland.

FORESTS – Hardwood forests comprise 16,000 square miles of BCR 22. Opportunity for improved quail and other wildlife management is provided because forests in BCR 22 tend to be small in size and scattered throughout the landscape. Management practices in forests including regulating grazing, adding or restoring open fields, edge management, thinning, controlled burning and oak savanna restoration, are examples of activities that will benefit bobwhites.

CRP – CRP areas, primarily large field enrollment, comprise 6,600 square miles of predominately open grass/legume cover in BCR 22. Since these areas are scattered throughout the landscape, they offer potential for improving quail numbers. On an annual basis an average of 64 acres/square mile of CRP should be incorporated into a wildlife conservation maintenance plan. Unfortunately, little maintenance work is currently being done to help maximize early plant successional habitat and consequent quail numbers. The $5/acre maintenance fee paid each year to landowners should be redirected into a program that offers direct payments to landowners/contractors for maintenance work completed (controlled burning, disking, seeding). That would generate over 20 million dollars/year in BCR 22 for a wildlife friendly maintenance program that could add 79,200 coveys (12 coveys/sq. mi. of CRP acres or an increase of one covey per 53 CRP acres).

LITERATURE CITED

Dailey, T.V. 1989. Modeling bobwhite quail habitat relationships on 4 central Missouri wildlife management areas. Missouri Department of Conservation, Federal Aid in Wildlife Restoration Project W-13-R-43, Final Report.

Roseberry, J.L. 1998. Assessing the suitability of landscapes for northern bobwhite. Journal of Wildlife Management 62:895-902.

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 22. Numbers represent acres x 1,000 in 1997. Data from 1997 National Resources Inventory.

State	% BCR in State	Cropland	Pasture Hay	Range	Improvable Ag Acres[1]	(%)[2]	CRP Grass	CRP Trees	CRP Wildlife	Forest
IL	76	19,397.7	2,171.5	0.0	14,651	18.4	334	16.3	10.8	2,419.5
IN	31	5,296.3	466.5	0.0	3,691	4.7	75.8	1.8	4.7	494.1
IA	76	18,867.3	4,653.2	0.0	13,361	16.8	1,405.2	15.4	3.5	1,623.7
KS	34	6,738.3	3,270.9	5761.8	17,504	22.0	458	0.0	0.0	1,274.9
MO	38	7,977.8	5,203.1	3.0	15,417	19.4	1,306.10	2.2	37.3	2,483.2
NE	15	4,964.3	1,153.1	122.0	6,884	8.7	362.6	3.5	14.8	263.8
OH	45	7,947.9	780.1	0.0	4,116	5.2	192.7	3.1	1.1	1,152.2
OK	10	830.3	780.1	1,667.3	3,807	4.8	5.6	0.0	0.0	523.4
Totals	100	72,019.9	18,478.5	7,554.1	79,431.0	100.0	4,140.0	42.3	72.2	10,234.8

[1] Improvable Ag Acres (IAA) represents the total acres offering potential for improving quail numbers. It includes all pasture/hay/range, CRP, and forests, but only includes 54% (38,908,000 acres) of the crop acres. Because of intensive crop production and high cropland value in certain areas, the following % of each state's cropland was used to compute acres with potential for quail improvement: (IL - 50%; IN - 50%; IA - 30%; KS - 100%; MO - 80%; NE - 100%; OH - 25%; OK - 100%.

[2] % is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

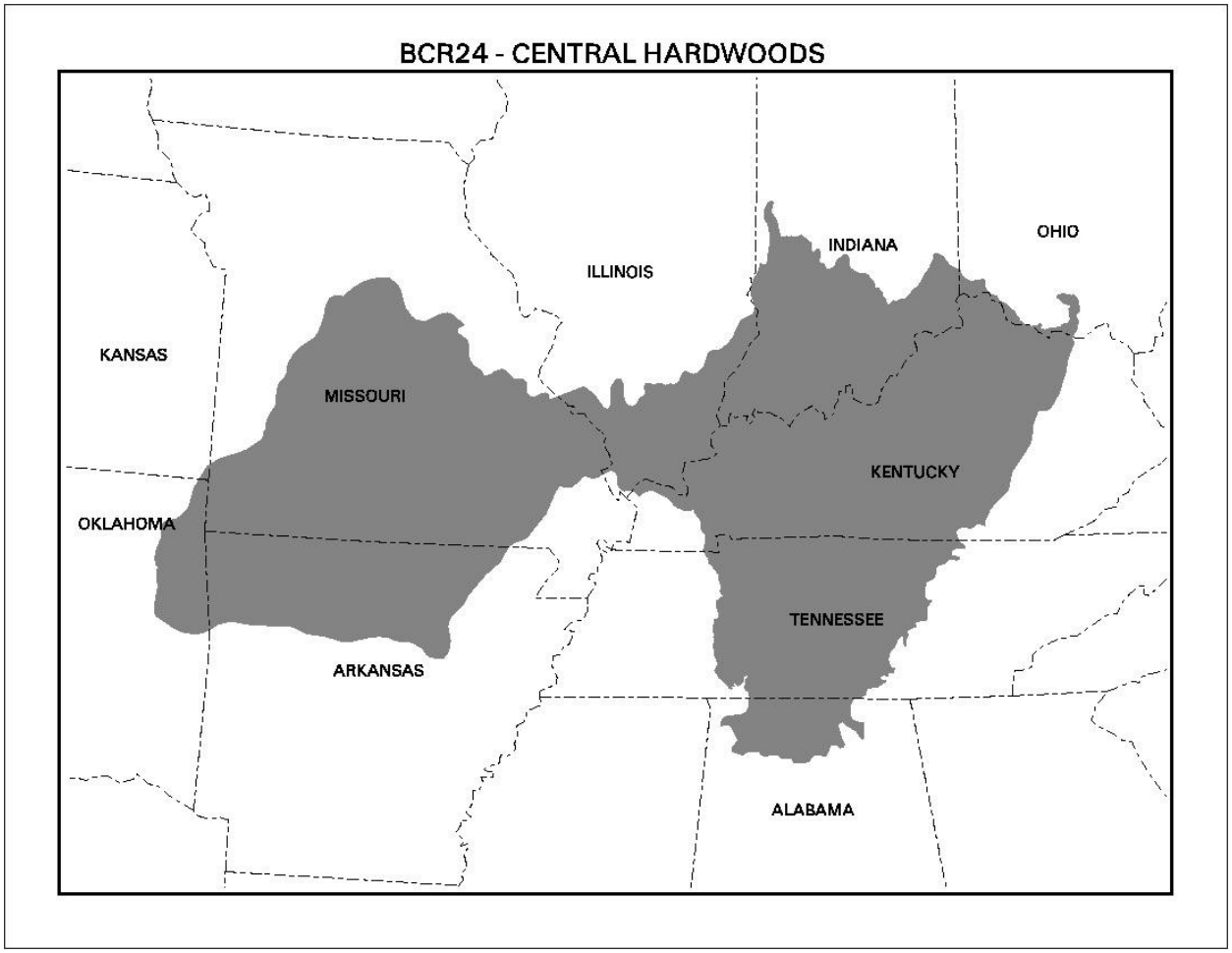
Table 2. Population goals (coveys to be added) by two major IAA areas for 8 states comprising BCR 22.

		Cropland, Pasture/Hay/Range, and Forests		CRP	
	Pop. Goal				
State	Coveys	Acres	Coveys	Acres	Coveys
IL	76,800	714,381	70,100	359,040	6,700
IN	19,200	180,475	17,700	80,256	1,500
IA	85,200	597,824	58,600	1,410,816	26,600
KS	92,200	853,498	83,700	456,192	8,500
MO	94,100	703,101	69,100	1,334,784	25,000
NE	39,100	327,111	32,000	380,160	7,100
OH	23,000	195,515	19,300	198,528	3,700
OK	18,800	187,995	18,700	4,224	100
Total[3]	448,400	3,759,900	369,200	4,224,000	79,200

Bird Conservation Region 24: Central Hardwoods

Mark J. Gudlin, Tennessee Wildlife Resources Agency, Wildlife Division, P.O. Box 40747, Nashville, TN 37204

Thomas V. Dailey, Missouri Department of Conservation, 1110 S. College Avenue, Columbia, MO 65201



The Central Hardwoods Bird Conservation Region (BCR 24) comprises 73,674,600 acres of land in 10 central and mid-south states. Based on the 1997 National Resources Inventory, 41,247,900 acres were devoted to cropland, pasture/hayland, and range (Table l). These land use categories are designated "Improvable Agricultural Acres" (IAA), and treated as a single unit for assigning population densities, population goals, and acreage to be managed. Pine forests occupied 175,100 acres. The agricultural land base deemed suitable for bobwhite habitat improvement declined by 6.1% from 1982 to 1997. Pine forests decreased by 22.4%. The Conservation Reserve Program (CRP) had not been implemented in 1982. In 1997, CRP occupied 942,200 acres, however, only 2.8% of it was installed specifically as wildlife practices. CRP lands offer a highly significant opportunity for wildlife habitat gains over the next two decades, as it is expected that program guidelines will increasingly emphasize habitat practices that result in

wildlife benefits in addition to soil erosion control and water quality improvement. Hardwood forests occupied over 25.3 million acres. The remaining land base in BCR 24 consists of urban areas, transportation and miscellaneous types, none of which are deemed suitable for bobwhite habitat enhancement.

Bobwhite populations declined precipitously from 1980 to 1999 in BCR 24. The Breeding Bird Survey (BBS) illustrated an annual decline of 4.4% in the breeding population based on 114 survey routes. Statistics provided by the 10 states comprising BCR 24 showed that harvest of bobwhites declined 67.0% from nearly 2.5 million birds in 1980 to slightly more than 800,000 in 1999 (Appendices A and B). The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.170 birds/IAA. In 1999 that density had declined to 0.060. To restore the bobwhite population density to 1980 levels will require the addition of 376,584 coveys to the autumn pre-hunt population in this BCR.

Restoration of bobwhites in BCR 24 can be accomplished by significantly increasing the acreage devoted to native warm season grasses (NWSG)/forbs (or in some cases, diversified stands of certain cool season grass/legume/forb mixtures), increasing the use of CRP grassland management practices, and to improving management practices applied to existing and future pine forests (Table 2). Specifically the population goal can be achieved by doing the following:

1. **Convert 462,830 acres of exotic cool season grasses currently in the Conservation Reserve Program to native warm season grasses/forbs. This would produce an estimated 115,707 coveys of bobwhites in the BCR (30.7% of the total needed).** Roughly half (52.6%) of existing CRP grassland acres are currently in dense monocultures of exotic cool season grasses and could be converted to native grasses or significantly improved by maintenance practices. CRP grasslands, primarily large field enrollment, comprise 1,374 square miles of predominately open grass/legume cover in BCR24.

2. **Apply appropriate site preparation techniques, burning and/or thinning to the 7,000 acres of CRP pines. This would add 77 coveys to the region (<1% of total BCR 24 goal).**

3. **Apply appropriate site preparation techniques, burning and thinning to 172,500 acres of the pinelands in BCR 24. This should add about 518 coveys to the bobwhite population (<1% of total BCR 24 goal).**

4. **Add to the improvable acres of the agricultural land base 1,041,128 acres of native warm season grasses/forbs**, **which should add 260,282 coveys to the BCR (69.1% of the total needed).** This can be achieved through replacement of row crop acreage to NWSG/forbs (or in some cases, diversified stands of certain cool season grass/legume/forb mixtures), and by conversion of cool-season hay and/or pasture to NWSG. This addition of 16.2 acres of NWSG/forbs per square mile of improvable ag acres will change the habitat on 2.5% of the improvable agricultural land base.

Cropland

A main emphasis in BCR 24 will likely be on establishing 30' wide filter strips and field borders in native grasses, legumes and forbs. In order to be effective in this effort, more emphasis and information is needed on the economics of field borders in crop management and the establishment and maintenance of these borders. Should the national cap on CRP acreage be increased to allow an influx of new CRP ground to be enrolled, efforts should be made to ensure as much of this land as possible is revegetated in NWSG/forbs. Successful integration of other potential new programs in the 2002 Farm Bill, such as a "flex fallow" type of short term set-aside program and/or Grassland Reserve Program, would likely play a significant role in helping achieve BCR 24 objectives.

Pasture/Hay/Range

There is generally a lack of plant diversity in BCR 24 pasture/hay acreage. Generally, KY31 fescue dominates the hay and pastureland, and still comprises a significant amount of CRP grassland in these Mid-South states. The rangeland in Arkansas, Kansas, Missouri, and Oklahoma is somewhat more diverse, typified by some fescue and smooth brome, but also includes a more diverse mixture of native grasses and weeds that are periodically hayed or grazed. The principal management strategy will be to convert a portion of the exotic grass pasture/hay/rangeland to NWSG/forbs. The remaining rangeland would greatly improve with reduced stocking rates, periodic strategically timed burns or other compatible grazing management. This should be most effective in circumstances where pasture/rangelands are juxtaposed with cropland.

Pinelands

The degree of habitat quality for quail in pinelands is quite variable, depending upon the stocking rate and intensity of management practices applied, including site preparation, prescribed burning, thinning, and incorporation of openings. For BCR 24, we premised that the typical scenario was heavily stocked pine stands (usually loblolly) with no thinning and little to no burning, that included some even-aged regeneration over large areas. This scenario is estimated to support a quail density of 1 covey per 1,000 acres. The best BCR 24 pineland scenario was optimally managed CRP pine stands (loblolly, shortleaf) that are planted at lighter stocking rates (or thinned if re-enrolled in CRP), with 15-20% openings in grassy vegetation, with planned prescribed burns. This habitat could support approximately 12 coveys per 1,000 acres.

Thus, applying one management practice (site preparation, thinning, or burning) to an average pine stand could result in an increase of 3 coveys per 1,000 acres. This management goal is projected mainly for the privately owned non-CRP pinelands (including commercial tracts). CRP pine stands re-enrolled after 1995 with optimal management conditions (if CRP guidelines are enforced) would be expected to result in an increase of 11 coveys per 1,000 acres. These assumptions were used to calculate the habitat and quail population goals in Table 2.

Hardwood Forests

Hardwood forests are a significant habitat type in BCR 24, occupying some 39,564 square miles. Small woodlots and perimeters of larger hardwood forests, where adjacent to agricultural row crop, grasslands and pineland habitats, provide an important source of protective cover and food for bobwhites. Generally, practices common to hardwood forest management have provided benefits that are hard to quantify within the contexts of management of the forested acres themselves. Private lands technical assistance programs (e.g. Forest Stewardship, state forest/woodlot management programs) that incorporate recommendations and practices that promote development of "soft edges" on woodlot perimeters could contribute to quail population increases.

There is a small but growing move to revert some hardwood tracts to their historical oak-savanna condition, typified by widely spaced trees and shrubs with a significant understory of native grasses and forbs. Today, savannas are one of the rarest plant communities in North America, with about 2% of the original 11 million pre-settlement hectares in the Midwest remaining (Nuzzo 1986). Savannas are perpetuated by fire, and consequently, species such as quail that thrive in the early successional habitats created by fire, could benefit from savanna restoration. The amount of pre-settlement savanna varies widely among states, with tremendous potential for positive change for bobwhites in some cases. For example, Missouri's original savannas covered about one-third of the state, or some 5,261,000 hectares (roughly 12.6 million acres). Should such management of hardwood forests become more common, even managing a relatively small portion of this habitat type in BCR 24 could result in some significant gains towards the BCR quail population goal. The current red oak decline in Arkansas and Missouri may provide some great opportunities for restoration of savannas (both oak and native shortleaf pine) in BCR 24. Public lands will likely be the site of most savanna restorations in the near future.

More knowledge is needed regarding quantifying quail responses from various hardwood management practices. Since hardwoods comprise such a large portion of BCR 24, potential quail increases could be significant if beneficial practices are implemented on even a small portion of this acreage. For example, an increase in the population of bobwhites as nominal as 1 covey/square mile of forest would yield approximately a 39,560 covey gain in this BCR. Such gains could relieve some of the pressure on and compliment production from agricultural lands management. However, due to the current undependability of these types of habitat improvements and lack of more quantifiable data on quail responses to hardwood management, we did not include these potential gains in our specific goals.

LITERATURE CITED

Nuzzo, V.A. 1985. Extent and status of midwest oak savanna: pre-settlement and 1985. The Natural Areas Journal 6:6-36.

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 24. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

State	Cropland	Pasture/Hay	Range	Improvable Ag Acres[1]	(%)[2]	CRP Grass	CRP Trees	CRP Wildlife	Pines
AL	153.2	92.9	0.0	246.1	(0.6)	0.0[3]	0.0[3]	0.0[3]	5.7
AR	26.4	1,927.3	26.4	1,980.1	(4.8)	0.0[3]	0.0[3]	0.0[3]	17.4
IL	3,327.2	886.7	0.0	4,213.9	(10.3)	276.1	25.2	4.2	1.3
IN	4,617.3	1,788.9	0.0	6,406.2	(15.6)	100.9	1.6	0.0	12.1
KS	198.1	96.4	21.3	315.8	(0.8)	0.4	0.0	2.2	0.0
KY	4,124.2	5,782.2	0.0	9,906.4	(24.1)	202.7	3.2	7.3	32.4
MO	3,434.8	8,651.0	84.5	12,170.3	(29.7)	210.4	1.0	11.0	47.7
OH	455.0	174.0	0.0	629.0	(1.5)	36.0	1.0	0.0	0.0
OK	181.1	1,022.5	253.8	1,457.4	(3.6)	3.7	0.0	0.0	0.0
TN	1,121.1	2,595.3	0.0	3,716.4	(9.0)	48.9	5.0	1.4	58.5
Totals	17,638.4	23,017.2	386.0	41,041.6	(100.0)	879.1	37.0	26.1	175.1

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2] % is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

[3]The apparent total lack of CRP land in AL and AR appears to be a factor of the way the 1997 NRI data was analyzed, and BCR 24 CRP acreage in these 2 states are likely included in this plan in adjacent BCRs.

Table 2. Population goals (coveys to be added) and recommended management practices by land use type for 10 states comprising BCR 24. Acreages are actual acres.

Convert to Native Warm Season Grass **Site Prep, Burn, Thin**

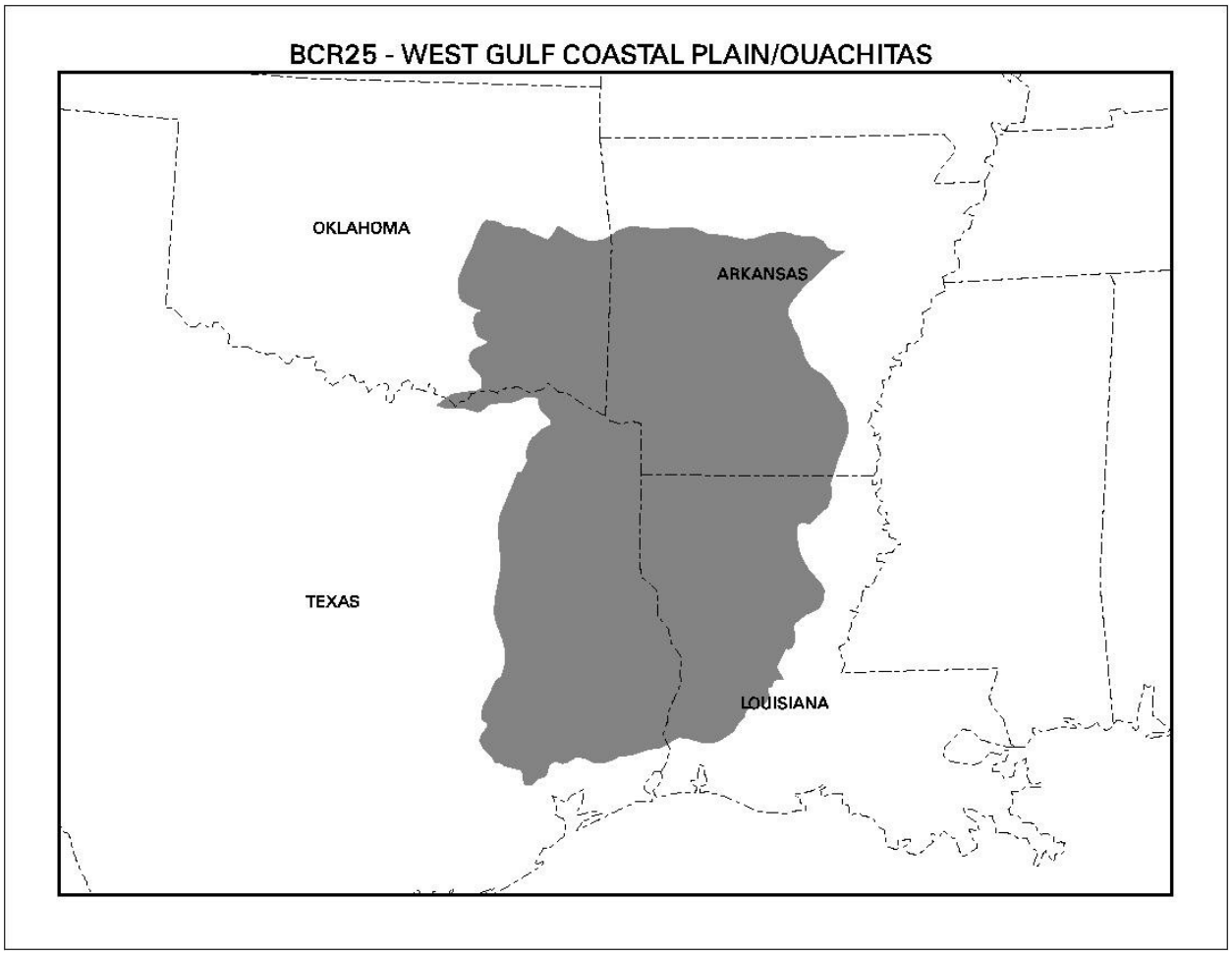
State	Pop. Goal Coveys	CRP Grass		Improvable Ag Land		CRP Pines		Southern Pine	
		Acres	Coveys	Acres[1]	Coveys	Acres	Coveys	Acres	Coveys
AL	**1,541**	0[2]	**0**	6,104	**1,526**	0[2]	**0**	5,000	**15**
AR	**12,303**	0[2]	**0**	49,008	**12,252**	0[2]	**0**	17,000	**51**
IL	**47,071**	82,830	**20,707**	105,400	**26,350**	1,000	**11**	1,000	**3**
IN	**59,940**	80,000	**20,000**	159,616	**39,904**	0	**0**	12,000	**36**
KS	**2,048**	0	**0**	8,192	**2,048**	0	**0**	0	**0**
KY	**99,217**	150,000	**37,500**	246,396	**61,599**	2,000	**22**	32,000	**96**
MO	**101,063**	100,000	**25,000**	303,688	**75,922**	0	**0**	47,000	**141**
OH	**10,839**	9,000	**2,250**	34,356	**8,589**	0	**0**	0	**0**
OK	**9,464**	1,000	**250**	36,856	**9,214**	0	**0**	0	**0**
TN	**33,098**	40,000	**10,000**	91,512	**22,878**	4,000	**44**	58,500	**176**
Total	**376,584**	462,830	**115,707**	1,041,128	**260,282**	7,000	**77**	172,500	**518**

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2]The apparent total lack of CRP land in AL and AR appears to be a factor of the way the 1997 NRI data was analyzed, and BCR 24 CRP acreage in these 2 states are likely included in this plan in adjacent BCRs.

Bird Conservation Region 25: West Gulf Coastal Plain

Don McKenzie, Wildlife Management Institute, 2396 Cocklebur, Rd Ward, AR 72176



The West Gulf Coastal Plain Bird Conservation Region (BCR 25) comprises about 55,262,300 acres (86,347.3 square miles) of land in four southeastern states--Arkansas, Louisiana, Oklahoma, and Texas. This BCR is comprised of two distinct regions, the Gulf Coastal Plain in the southern two-thirds and the Ouachita Mountains to the north. The coastal plain portion of the region is similar to the Southeastern Coastal Plain, having been separated from it by the Mississippi River and its alluvial valley. This area exhibits rolling to relatively flat topography, with deep, typically well-drained soils. A portion of the BCR, covering part of Louisiana and Texas, is within the historic range of longleaf pine, which dominated a savannah ecosystem largely compatible with bobwhites. The Ouachita Mountains of Arkansas and Oklahoma are a series of east-west oriented ridges dominated by sandstone and shale, and separated by narrow valleys, exhibiting distinctly different microclimates on the north- versus south-facing slopes. The ridges typically are forested--primarily in mixed pine/hardwood--and the valleys have been converted mostly to pasture and hay. Much of the forested uplands are owned and managed by the U.S. Forest Service. BCR 25 is bounded on the east by the Mississippi Alluvial Valley, on

the north by the Arkansas River Valley and the Ozark Mountains, on the south by the Gulf Coastal Prairie and on the west by the Oaks and Prairies BCR.

Based on the 1997 Natural Resources Inventory, 2,572,000 acres (4.7%) were devoted to cropland, 13,374,000 acres (24.2%) to pasture/hayland, 1,662,300 acres (3.0%) to rangeland and 28,721,400 acres (52.0%) were forested (Table l). Of the forested land, pine forests occupied about 12,184,500 acres (42% of forested acreage), while mixed pine/hardwood forests occupy about 10,279,000 acres (35.8% of forested land). The Conservation Reserve Program did not exist in 1982, but by 1997 about 135,800 acres (0.2% of BCR area) were enrolled throughout the region. About 76,100 acres of CRP is in grass (almost exclusively tame species of poor habitat quality), 31,000 acres in wildlife plantings and 28,700 acres in trees (primarily dense loblolly plantations). These six land use categories--cropland, pasture/hay, range, pine forests, mixed pine/hardwood forests, and CRP--are designated "Improvable Acres", and form the basis for calculating population densities and goals, and for allocating target acreages to be managed.

From 1982 through 1997, the West Gulf Coastal Plain became less agricultural and more forested. The cropland base in the region declined 26%, from 3,465,000 to 2,572,000 acres. Likewise, the pasture/hay land use base declined 9.2%, from 14,736,000 acres in 1982 to 13,374,000 acres in 1997. The range acreage declined 6.8% between 1982 and 1997, from 1,783,700 acres to 1,662,300 acres. The total area of open agricultural land uses (cropland, hay, pasture and range) with bobwhite habitat potential declined 2,376,400 acres (12%) from 1982 to 1997. In contrast, the total acreage of forests increased 1,237,900 million acres (4.5%), from 27,483,500 acres in 1982 to 28,721,400 acres in 1997.

The total “improvable acreage” for bobwhite habitat in BCR 25 was about 42,448,200 acres in 1982, but had declined 5.3% by 1997 to about 40,207,600 acres. The current estimated improvable acreage is about 73% of the total area of the BCR. The remaining land base in BCR 25 consists of bottomland and other hardwood forests, urban areas, transportation and miscellaneous types, none of which are deemed suitable for bobwhite habitat enhancement.

Bobwhite populations declined precipitously from 1980 to 1999 in BCR 25. The Breeding Bird Survey (BBS) illustrated an annual decline of 8.24% (Appendix C) in the breeding population based on 65 survey routes, among the highest rates of decline anywhere in the bobwhite’s range. Statistics provided by the four states comprising BCR 25 showed that harvest of bobwhites in the region declined 70%, from about 807,096 birds in 1980 to only 239,814 in 1999 (Appendices A and B).

The pre-hunt population density of bobwhites on the improvable acres (IA) of agricultural lands in 1980 was 0.057 birds/IA. In 1999 that density had declined to 0.018 birds/IA. To restore the bobwhite population density on remaining improvable acres to 1980 levels will require the addition of 131,033 coveys to the 1999 autumn pre-hunt population in this BCR.

Restoration of bobwhites in BCR 25 can be accomplished. Because the dominant cover type of the region is pine and mixed pine/hardwood forests, high priority will necessarily be accorded them. Encouraging success in this endeavor already has been demonstrated by the U.S. Forest Service’s ambitious effort to restore the historic shortleaf pine/bluestem savannahs on about

125,000 acres of the Ouachita National Forest. Bobwhites have responded positively to the 40,000 acres of savannah restoration that has been achieved thus far. Assuming the decline in agricultural open land continues, the relative importance of managing forests for bobwhites and other grassland birds in this region will increase. Nevertheless, management of open ground--especially pasture and hayland--remains vital to the restoration effort. An insignificant percentage of land in BCR 25 is enrolled in CRP; nonetheless, its lands offer a significant opportunity to contribute to the population goal.

Specifically the population goal can be achieved by doing the following:

1. Convert all 76,100 acres of CRP tame grasses to native warm-season grasses/forb mixtures. This would produce an estimated 19,025 coveys of bobwhites in the BCR (14.5% of the total needed).

2. Establish 64,300 acres of field borders and filter strips (at least 30 feet wide) of native vegetation on cropland, up to a total of 2.5% of the 2,572,000 acres of cropland in the region. This objective would add 16,075 coveys to the bobwhite population of the region (12.3% of total needed).

3. Convert 2.0% (267,480 acres) of the pasture and hayland from tame grass monocultures to native, warm-season grasses and forbs. This level of conversion equates to an average of only 3.1 acres of NWSG per square mile across the BCR, though it should not be spread so thinly. This objective should add 66,870 coveys to the bobwhite population (51.0% of total needed).

4. On 4,151,857 acres of pine and mixed pine/hardwood forests, *convert* to longleaf pines (on appropriate sites within its historic range), *apply* wildlife-friendly site preparation techniques, *conduct* heavy thinnings (to expose 40 to 60% of the forest floor to sunlight at noon) and/or *prescribe* frequent burning (2- to 3-year rotation), sufficient to provide herbaceous nesting cover that will produce seven new coveys per 1,000 acres. This scope of habitat improvement will require improving the conversion and/or management of about 18.5% of the pine and mixed pine/hardwood forest in the region. This achievement should add 29,063 coveys to the bobwhite population (22.2% of total needed).

The habitat objectives described here for each major land use type are only an example of how the challenge of and need for management actions could be allocated among land use types and land ownerships. Wildlife and other natural resource managers on the ground in the BCR have unlimited flexibility to adjust the habitat objectives among the land use types as opportunities and obstacles arise.

It is worth noting that it may be feasible in this BCR eventually to *exceed* the bobwhite restoration goal. That is, so much improvable acreage is present in the West Gulf Coastal Plain that bobwhite populations could potentially be restored higher than the 1980 goal set by this plan. For example, to meet the established goal the following tables suggest managing only 2.5% of the cropland and 2.0% of the pasture and hayland. Further, no management objectives

at all have been suggested here for improving rangeland acres, which have good bobwhite habitat potential.

Table 1. Total area of BCR 25, land use categories suitable for improving bobwhite habitat, and percent of total improvable acres in 1997 (acres in thousands). Data from 1997 USDA National Resources Inventory.

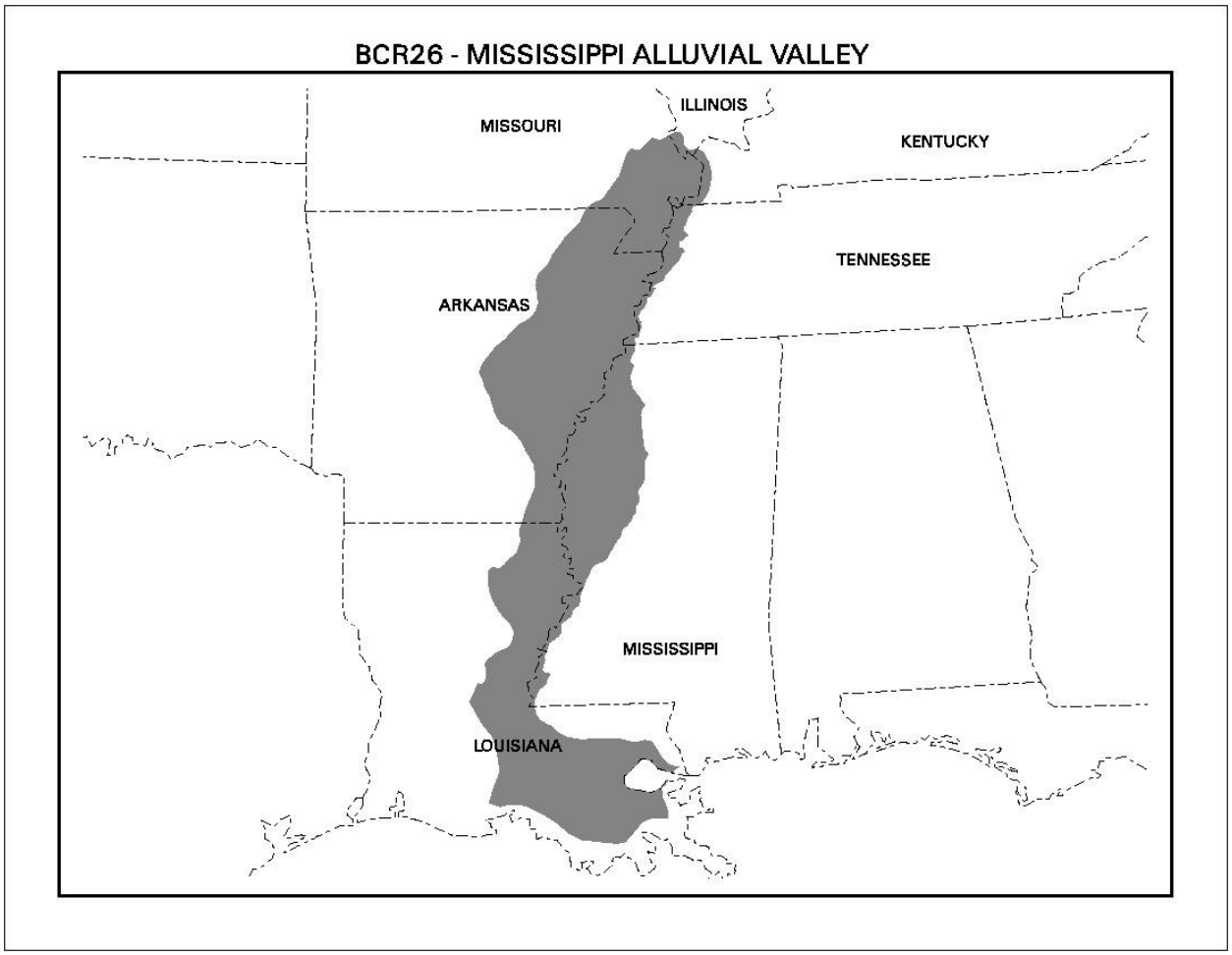
State	Total Area	Crop-land	Pasture & Hay	Range	Pine Forest	Pine/ Hdwd	CRP Grass	CRP Trees	CRP Wldl	Impr. Acres	% of I.A.
AR	15521.4	607.0	2603.2	11.5	3286.2	3792.9	27.8	16.8	2.2	10347.6	25.7
LA	8770.4	524.5	993.5	0.0	4407.5	770.4	0.0	10.6	9.8	6716.3	16.7
OK	9813.1	498.6	3352.6	863.5	562.6	1613.0	9.4	0.0	0.8	6900.5	17.2
TX	21157.4	941.9	6424.7	787.3	3928.2	4102.7	38.9	1.3	18.2	16243.2	40.4
Total	55262.3	2572.0	13374.0	1662.3	12184.5	10279.0	76.1	28.7	31.0	40207.6	100.0

Table 2. Population goals (new coveys to add) and suggested estimated acres for each major land-use category needing to be managed in each state to improve bobwhite nesting and brood-rearing habitat.

State	Pop. Goals (new Coveys)	CRP Grass Acres	CRP Grass Coveys	2.5% of Cropland Acres	Cropland Coveys	2.0% of Pasture/ Hay Acres	Pasture/ Hay Coveys	Forest Acres	Forest Coveys
AR	33,675	27,800	6,950	15,175	3,794	52,064	13,016	1,416,429	9,915
LA	21,883	0	0	13,117	3,279	19,872	4,968	1,948,000	13,636
OK	22,538	9,400	2,350	12,474	3,119	67,052	16,763	43,714	306
TX	52,937	38,900	9,725	23,534	5,883	128,492	32,123	743,714	5,206
Total	131,033	76,100	19,025	64,300	16,075	267,480	66,870	4,151,857	29,063

Bird Conservation Region 26: Mississippi Alluvial Valley

Timothy O. White, Tennessee Wildlife Resources Agency, Wildlife Division, P.O. Box 40747, Nashville TN 37204.



The Mississippi Alluvial Valley Bird Conservation Region (BCR 26) comprises 29,848,000 acres of land in 6 southeastern states. Based on the 1997 National Resources Inventory, 21,861,800 acres were devoted to cropland, pasture/hay land/rangeland, pines, and Conservation Reserve Program (CRP) lands (Table l). These land use categories are designated "Improvable Agricultural Acres"(IAA), and treated as a single unit for assigning population densities, population goals, and acreage to be managed. Pine forests occupied about 1.6 million acres, and approximately 180,000 acres were designated in the CRP. The agricultural land base deemed suitable for bobwhite habitat improvement declined by approximately 3% from 1982 to 1997. The CRP had not yet been implemented in 1982. In 1997, CRP occupied 352,900 acres, however, only 3.6% of it was installed specifically as wildlife practices. CRP lands offer a highly significant opportunity for conversion to wildlife friendly habitat practices over the next 2 decades, as the emphasis on these areas is expected to shift toward environmentally sensitive treatment. The remaining land base in BCR 26 consists of hardwood forests, urban areas,

transportation and miscellaneous types, none of which are deemed suitable for bobwhite habitat enhancement.

Bobwhite populations declined precipitously from 1980 to 1999 in BCR 26. The Breeding Bird Survey (BBS) illustrated an annual decline of 6% in the breeding population based on 32 survey routes. Statistics provided by the 6 states comprising BCR 26 showed that harvest of bobwhites declined from more than 280,000 birds in 1980 to slightly more than 40,000 in 1999 (86%). In Mississippi and Louisiana, the bobwhite harvest declined more than 90%. The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.050 birds/IAA. In 1999 that density had declined to 0.010. To restore the bobwhite population density to 1980 levels will require the addition of 66,554 coveys to the autumn pre-hunt population in this BCR.

Restoration of bobwhites in BCR 26 can be accomplished by increasing significantly the acreage devoted to native warm season grasses and to improving management practices applied to existing and future pine forests (Table 2). Specifically the population can be achieved by doing the following:

1. Convert 60,084 acres of the total 81,600 acres of non-native and cool season grasses currently in the CRP to native warm-season grasses. This would produce an estimated 15,021 coveys of bobwhites in the BCR (22.5% of the total needed).

2. Apply appropriate site preparation techniques, burning and/or thinning to 57,400 acres of the total 114,900 acres of pines in CRP trees. This would add about 632 coveys to the region (1%).

3. Apply appropriate site preparation techniques, burning and thinning to 841,100 of the 1,679,900 acres of pinelands in BCR 26. This should add 2,524 coveys to the bobwhite population (3.8%).

4. Add 193,508 acres of native warm season grasses to the 18,334,500 improvable acres of the agricultural land base. This can be achieved through replacement of row crop acreage, and by conversion of cool season hay and/or pasture. This addition of 6.75 acres of native warm season grass/forbs per square mile will change the habitat on 1.1% of the improvable agricultural land base, and should add 48,377 coveys to the BCR (73% of the total needed).

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 26. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

State	Crop-land	Pasture/ Hay	Range	Improvable Ag Acres	(%)[2]	CRP Grass	CRP non-native grass	CRP Trees	CRP Pines	Pines
AR	7,117.3	1,088.6	0.0	8,205.9	(44.8)	53.7	49.7	129.9	110.4	837.7
IL	144.6	27.6	0.0	172.2	(0.94)	6.2	3.7	0.3	0.02	0.0
LA	3,480.4	547.2	6.8	4,027.6	(22.0)	64.5	1.7	33.1	3.3	840.9
MS	2,749.6	47.5	0.0	2,797.1	(15.3)	6.1	5.5	20.7	1.0	0.0
MO	2,509.9	538.5	0.0	3,048.4	(16.6)	34.5	20.7	3.6	0.2	1.3
TN	82.8	0.5	0.0	83.3	(0.5)	0.3	0.27	0.0	0.0	0.0
Totals	16,084.6	2,256.7	6.8	18,334.5	(100.0)	165.3	81.6	187.6	114.9	1,679.9

[1] Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2]% is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

Table 2. Population goals (coveys to be added) and recommended management practices by land use type for 6 states comprising BCR 26. Acreages are actual acres.

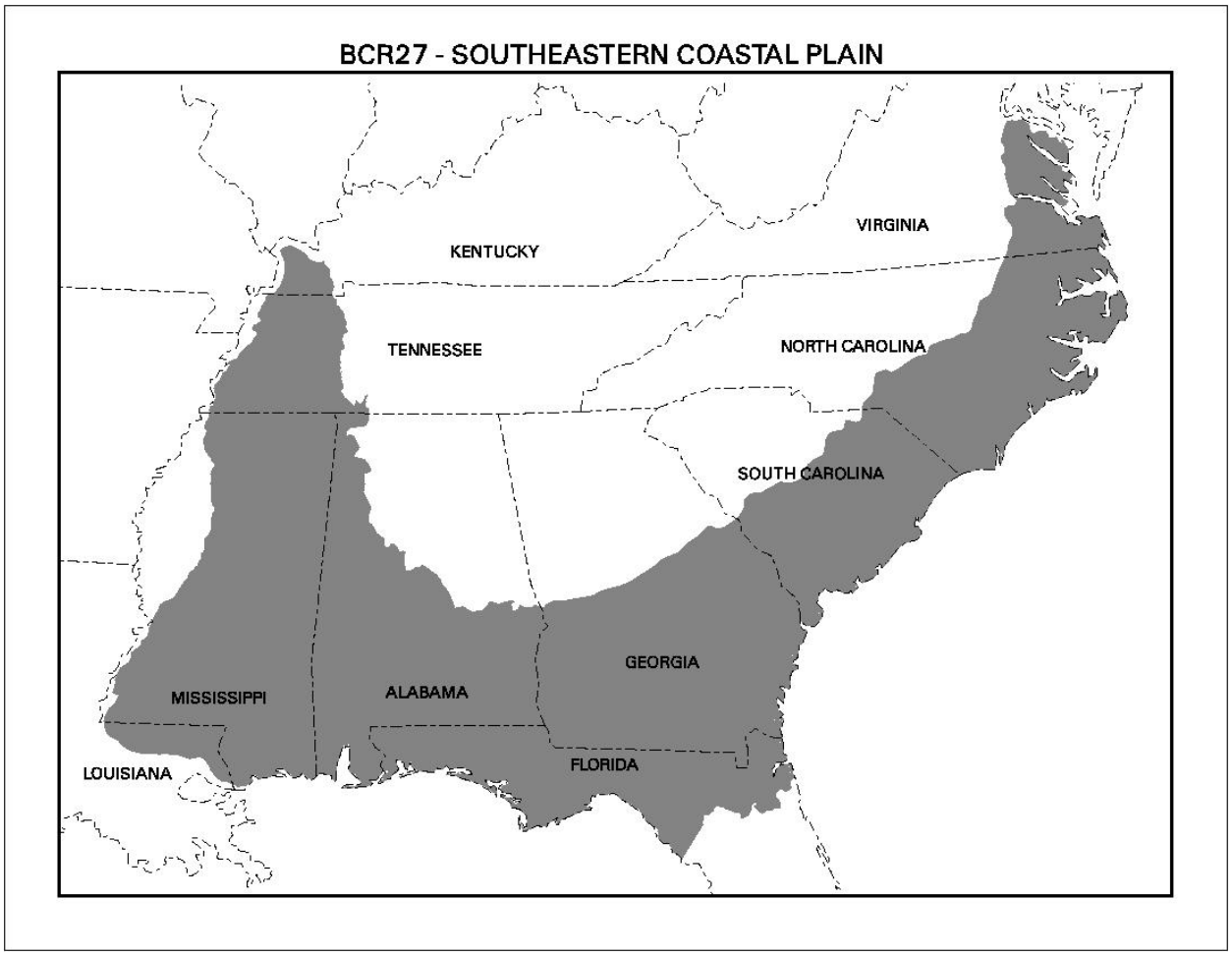
Convert to Native Warm Season Grass **Site Prep, Burn, Thin**

State	Pop. Goal Coveys	CRP Grass		Improvable Ag Land		CRP Pines		Southern Pine	
		Acres	Coveys	Acres[1]	Coveys	Acres	Coveys	Acres	Coveys
AR	**29,830**	26,880	**6,720**	86,792	**21,698**	25,700	**283**	376,300	**1,129**
IL	**597**	564	**141**	1,704	**426**	540	**6**	7,900	**24**
LA	**14,584**	13,200	**3,300**	42,364	**10,591**	12,600	**139**	184,800	**554**
MS	**9,943**	9,180	**2,295**	28,660	**7,165**	8,800	**97**	128,500	**386**
MO	**11,269**	9,960	**2,490**	33,028	**8,257**	9,500	**104**	139,400	**418**
TN	**331**	300	**75**	960	**240**	290	**3**	4,200	**13**
Total	**66,554**	60,084	**15,021**	193,508	**48,377**	57,400	**632**	841,100	**2,524**

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

Bird Conservation Region 27: Southeastern Coastal Plain

Ralph W. Dimmick, Department of Forestry, Wildlife and Fisheries, University of Tennessee, 274 Ellington Plant Sciences Building, Knoxville, TN 37901



The Southeastern Coastal Plain Bird Conservation Region (BCR 27) comprises 119,576,100 acres of land in10 southeastern states. Based on the 1997 National Resources Inventory, 32,706,000 acres were devoted to cropland, pasture/hayland, and range (Table l). These land use categories are designated "Improvable Agricultural Acres" (IAA), and treated as a single unit for assigning population densities, population goals, and acreage to be managed. Pine forests occupied nearly 30 million acres, and nearly 2.6 million acres were designated in the Conservation Reserve Program (CRP). The agricultural land base deemed suitable for bobwhite habitat improvement declined by 16.5% from 1982 to 1997. Pine forests increased by about 4%. The CRP had not been implemented in 1982. In 1997, CRP occupied 2,592,900 acres, however, only 3.6% of it was installed specifically as wildlife practices. CRP lands offer a highly significant opportunity for conversion to wildlife friendly habitat practices over the next 2 decades, as the emphasis on these areas is expected to shift toward environmentally sensitive treatment. The remaining land base in BCR 27 consists of hardwood forests, urban areas,

transportation and miscellaneous types, none of which are deemed suitable for bobwhite habitat enhancement.

Bobwhite populations declined precipitously from 1980 to 1999 in BCR 27. The Breeding Bird Survey (BBS) illustrated an annual decline of 5.8% in the breeding population based on 227 survey routes. Statistics provided by the 10 states comprising BCR 27 showed that harvest of bobwhites declined from nearly 6 million birds in 1980 to slightly more than 1.5 million in 1999 (73.7%). In Louisiana, Mississippi, and South Carolina, the bobwhite harvest declined more than 90%. The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.460 birds/IAA. In 1999 that density had declined to 0.145. To restore the bobwhite population density to 1980 levels will require the addition of 859,378 coveys to the autumn pre-hunt population in this BCR.

Restoration of bobwhites in BCR 27 can be accomplished by increasing significantly the acreage devoted to native warm season grasses/forbs and to improving management practices applied to existing and future pine forests (Table 2). Specifically the population can be achieved by doing the following:

1. Convert 941,000 acres of cool-season grasses currently in the CRP to native warm season grasses/forbs. This would produce an estimated 235,253 coveys of bobwhites in the BCR (27.4% of the total needed).

2. Apply appropriate site preparation techniques, burning and/or thinning to the 1,534,300 acres of pines in CRP trees. This would add about 4,602 coveys to the region (0.5%).

3. Apply appropriate site preparation techniques, burning and thinning to the 29,613,000 acres of pinelands in BCR 27. This should add 88,839 coveys to the bobwhite population (10.3%). In those portions of the Southeastern Coastal Plain where longleaf pine is native or adaptive, this species should be favored for planting on CRP lands, and wherever else new or replacement plantings of pine are established.

4. Add to the improvable acres of the agricultural land base 2,122,736 acres of native warm season grasses. This can be achieved through replacement of row crop acreage, and by conversion of cool season hay and/or pasture. This addition of 41.5 acres of native warm season grasses per square mile will change the habitat on 6.5% of the improvable agricultural land base, and should add 530,684 coveys to the BCR (61.8% of the total needed).

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 27. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

State	Cropland	Pasture/ Hay	Range	Improv. Ag Acres[1]	(%)[2]	CRP Grass	CRP Trees	CRP Wildlife	Pines
AL	2,369.3	1,913.7	73.6	4,356.6	(13.4)	190.6	288.4	0.0	5,231.9
FL	876.0	796.5	12.8	1,685.3	(5.2)	5.1	114.8	0.0	4,354.3
GA	5,657.7	1,217.4	0.0	6,875.1	(21.0)	18.0	482.3	39.3	7,010.9
KY	650.9	241.6	0.0	892.5	(2.7)	117.6	0.0	1.4	12.9
LA	200.0	459.0	2.1	661.1	(2.0)	6.1	6.8	1.9	709.9
MS	3,138.7	4,030.2	0.0	7,168.9	(21.9)	294.6	441.7	32.5	5,856.3
NC	3,656.6	361.1	0.0	4,017.7	(12.3)	4.8	13.0	0.0	3,391.2
SC	2,368.3	302.4	0.0	2,670.7	(8.2)	37.7	152.0	14.8	2,445.7
TN	2,603.3	1,170.8	0.0	3,774.1	(11.5)	282.8	27.1	2.9	213.7
VA	543.5	60.5	0.0	604.0	(1.8)	8.5	8.2	0.0	499.1
Totals	22,064.3	10,553.2	88.5	32,706.0	(100.0)	965.8	1,534.3	92.8	29,625.9

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2]% is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

Table 2. Population goals (coveys to be added) and recommended management practices (acres x 1,000) by land use type for 10 states comprising BCR 27.

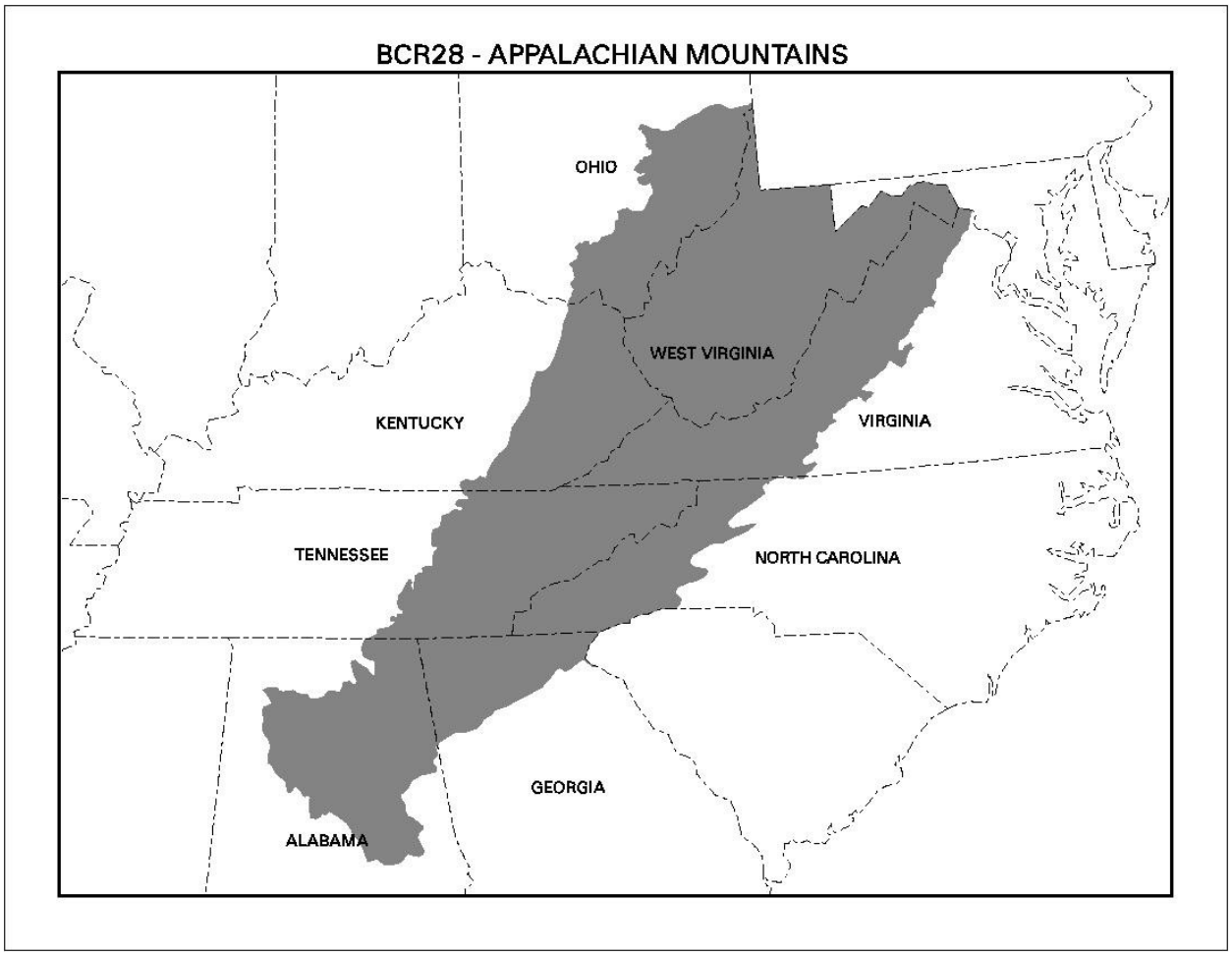
Convert to Native Warm Season Grass **Site Prep, Burn, Thin**

State	Pop. Goal Coveys	CRP Grass		Improvable Ag Land		CRP Pines		Southern Pines	
		Acres	**Coveys**	Acres[1]	**Coveys**	Acres	**Coveys**	Acres	**Coveys**
AL	**115,157**	190.6	**47,650**	203,788	**50,947**	288.4	**864**	5,231.9	**15,696**
FL	**44,688**	5.1	**1,275**	120,024	**30,006**	114.8	**345**	4,354.3	**13,062**
GA	**180,469**	18.0	**4,500**	613,960	**153,490**	482.3	**1,446**	7,010.9	**21,033**
KY	**23,203**	92.8	**23,203**	0	**0**	0	**0**	0	**0**
LA	**17,188**	6.1	**1,525**	54,048	**13,512**	6.8	**21**	709.9	**2,130**
MS	**188,204**	294.6	**73,650**	382,640	**95,660**	441.7	**1,326**	5,856.3	**17,568**
NC	**105,703**	4.8	**1,200**	378,364	**94,591**	13.0	**39**	3,291.2	**9,873**
SC	**70,469**	37.7	**9,425**	213,000	**53,250**	152.0	**456**	2,445.7	**7,338**
TN	**98,828**	282.8	**70,700**	109,620	**27,405**	27.1	**81**	213.7	**642**
VA	**15,469**	8.5	**2,125**	47,292	**11,823**	8.2	**24**	499.1	**1,497**
Total	**859,378**	941.0	**235,253**	2,122,736	**530,684**	1534.3	**4,602**	29,613.0	**88,839**

[1]Numbers of acres for Improvable Ag Lands are actual figures.

Bird Conservation Region 28: Appalachian Mountains

Marc Puckett, Virginia Department of Game and Inland Fisheries, HC 6 Box 46, Farmville, VA 23901



For the purposes of the Northern Bobwhite Conservation Initiative, the Appalachian Mountains Bird Conservation Region (BCR 28) includes portions of the following southeastern and mid-western states: Alabama, Georgia, Kentucky, North Carolina, Ohio, Tennessee, Virginia and West Virginia. There may be small portions of the Appalachian Mountains in other states, however, the amount of land and quail harvests in these areas is considered insignificant for the purposes of this plan.

There are 74,692,000 acres in BCR 28. This encompasses 33.9% of the above named states total land area. Of these, 6,765,500 acres are cropland and 13,571,900 are pasture/hayland. Combining these categories yields 20,337,400 acres deemed "Improvable Agricultural Acres" (IAA) for the purposes of this plan (Table 1). There are also 90,000 acres of Conservation Reserve Program lands planted to grasses or trees deemed "improvable CRP acres". In addition, there are 3,272,100 acres in either loblolly, longleaf, shortleaf or slash pine forests. These acres will be considered "improvable pine forest acres" for the purposes of this plan. There are

23,699,500 acres deemed potentially improvable for bobwhite quail in BCR 28. The total improvable acres represent 32% of BCR 28.

While other land use categories such as hardwood and mixed pine/hardwood make up a substantial portion of BCR 28, these categories are not considered "improvable" for bobwhite quail and are excluded. It is important to note, however, that some acres now considered mixed pine/hardwood could be converted to pure pine forests in the future. These acres could subsequently be thinned, burned and improved for bobwhite. This may increase the improvable acres for bobwhite in BCR 28.

The bobwhite population in BCR 28 dropped dramatically from 1980 to 1999. Based on 135 Breeding Bird Survey (BBS) routes, the population declined annually by 7.7%. Using harvest statistics provided by the 8 states in BCR 28, 697,220 quail were harvested in 1980 compared to only 187,545 in 1999. This represents a harvest decline of 73%. The autumn pre-hunt quail density on total improvable acres in BCR 28 in 1980 was 0.094 quail/acre. In 1999, the density of bobwhite on BCR 28 total improvable acres dropped to 0.027 quail/acre. Restoring the quail density in BCR 28 on improvable acres to 1980 levels will require the production of 116,866 new coveys.

Restoration of bobwhite on BCR 28 improvable acres may be accomplished by increasing quail habitat in agricultural areas. More specifically, native warm season grasslands must be increased. Native warm season grasslands may be added by converting cool season pasture or hayland, allowing idle cropland to revert to native grasses such as broomsedge or by adding native vegetation field borders around crop fields. Typically, high quality native warm season grasslands for quail contain ample amounts of native annual weeds or forbs in addition to grasses. Native warm season grasslands do NOT include Caucasian bluestem or coastal bermudagrass, which are exotic (non-native) species.

The following recommendations outline one way to achieve the objectives identified for BCR 28.

1. Convert 398,636 acres of cool season grass pasture/hayland and agricultural cropland to native warm season grass/forbs to produce 99,659 coveys (85.3% of goal).

2. Convert 55,600 acres of CRP cool season grasses to native warm season grass/forbs to produce 13,900 coveys (8.3% of goal).

3. Site prep, burn, and/or thin 34,400 acres of CRP pines to produce 35 coveys (<1% of goal).

4. Site prep, burn and/or thin 3,272,100 acres of non-CRP pines to produce 3,272 coveys (2.8% of goal).

The land area needed to achieve the population goal for this BCR is 3,760,636 acres, or 5% of the total land area. Though not as productive as other regions, the Appalachian Mountain region can contribute substantially to the bobwhite's recovery.

Table 1. Land use categories suitable for improving bobwhite quail populations in BCR 28. Numbers represent acres x 1,000 in 1997[1].

State	Cropland	Pasture/ hay	Improv. Ag Acres[1]	(%)[2]	CRP Grass	CRP Pines	Southern Pines
AL	1,143.6	1,589.9	2,733.5	13.4	10.3	32.7	2,326.8
GA	110.1	382.6	492.7	2.4	0.0	0.0	46.3
KY	413.3	1,684.8	2,098.1	10.3	0.0	0.0	6.3
NC	141.4	475.2	616.6	3.0	0.0	0.0	18.6
OH	2,411.6	2,497.1	4,908.7	24.2	39.8	1.7	51.4
TN	965.1	2,745.7	3,710.8	18.3	5.5	0.0	532.7
VA	660.3	1,972.2	2,632.5	12.9	0.0	0.0	1.5
WV	919.9	2,224.4	3,144.3	15.5	0.0	0.0	288.5
Total	6,765.3	13,571.9	20,337.2	100	55.6	34.4	3,272.1

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2]% is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

Table 2. Population goals (coveys to be added) and acres (actual acres) required to achieve the goals by state in BCR 28.

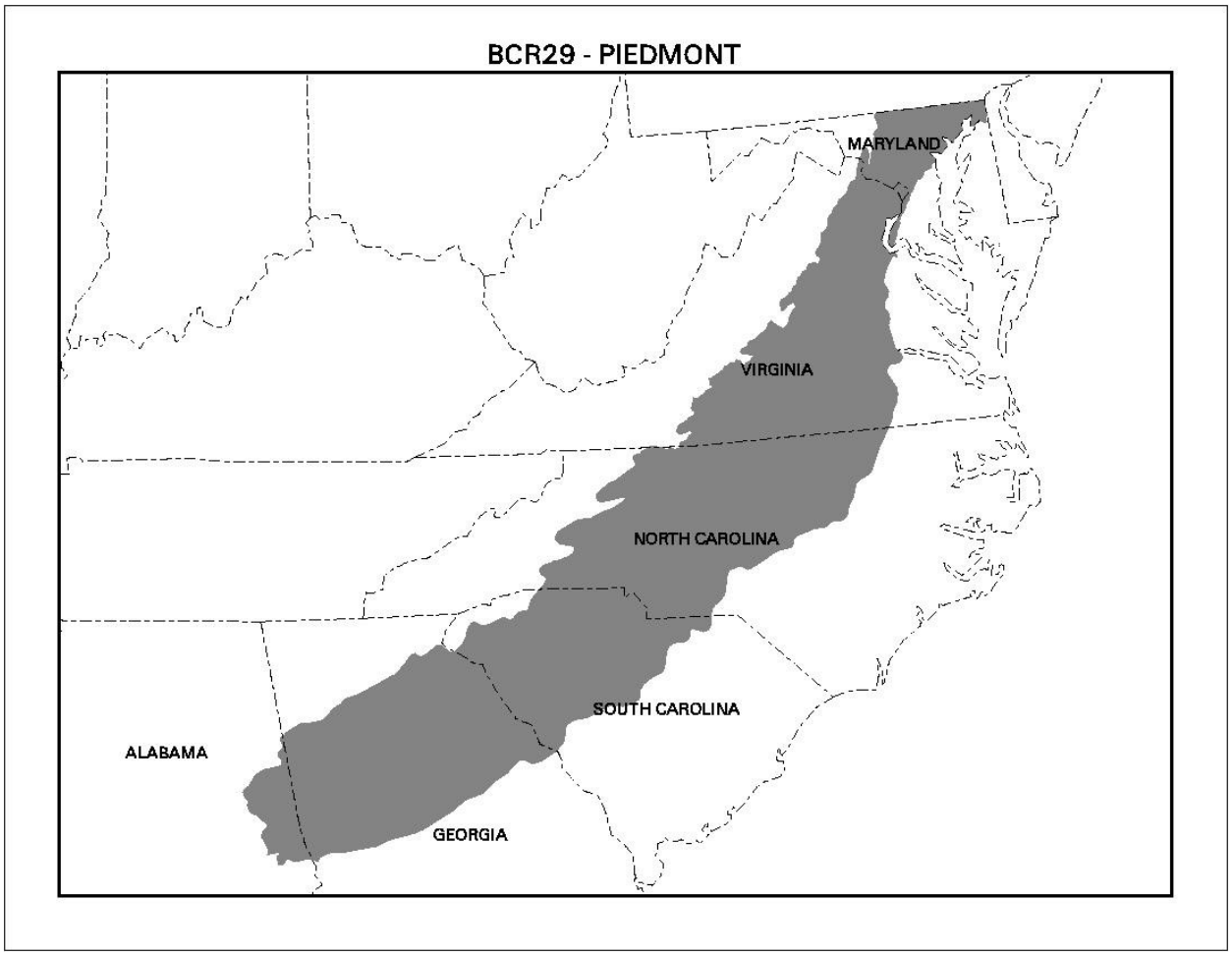
State	Pop. Goal Coveys	Improvable Ag Land		CRP Grass		CRP Pines		Southern Pines[2]	
		Acres[1]	**Coveys**	Acres	**Coveys**	Acres	**Coveys**	Acres	**Coveys**
AL	**15,660**	42,900	**10,725**	10,300	**2,575**	32,700	**33**	2,326,800	**2,327**
GA	**2,805**	11,036	**2,759**	0.0	**0**	0.0	**0**	46,300	**46**
KY	**12,037**	48,124	**12,031**	0.0	**0**	0.0	**0**	6,300	**6**
NC	**3,506**	13,948	**3,487**	0.0	**0**	0.0	**0**	18,600	**19**
OH	**28,282**	73,116	**18,279**	39,800	**9,950**	1,700	**2**	51,400	**51**
TN	**21,386**	77,912	**19,478**	5,500	**1,375**	0.0	**0**	532,700	**533**
VA	**15,076**	60,300	**15,075**	0.0	**0**	0.0	**0**	1,500	**1**
WV	**18,114**	71,300	**17,825**	0.0	**0**	0.0	**0**	288,500	**289**
Total	**116,866**	398,636	**99,659**	55,600	**13,900**	34,400	**35**	3,272,100	**3,272**

[1]Improvable Ag Acres represents the total for cropland, pasture/hayland.

[2]Pines represents acres of loblolly, longleaf, shortleaf, or slash pine in more or less pure stands.

Bird Conservation Region 29: Piedmont

Terry Sharpe, North Carolina Wildlife Resources Commission, Sandhills Wildlife Depot, P.O. Box 149, Hamlet, NC 28347



The Piedmont Bird Conservation Region (BCR 29) encompasses 51,214,500 acres of 6 southeastern states. Based on the 1997 National Resources Inventory, 12,044,000 Piedmont acres (23.5 %) were devoted to cropland and pasture/hayland (Table l). These land use categories, which provide excellent opportunities for bobwhite habitat improvements, are designated "Improvable Agricultural Acres" (IAA) and treated as a single unit for assigning population densities, population goals, and acreage to be managed. The agricultural land base in the Piedmont declined by 11 % between 1982 and 1997. Cropland decreased by 28% and pastureland decreased by 4%. However, hayland increased by 57% during the 15-year period. Pine forests, which occupy about 10 million acres can provide bobwhite habitat but must be actively and aggressively managed. Land management beneficial to bobwhites meshes well with the goals of the Conservation Reserve Program (CRP) and almost 260,000 Piedmont acres were enrolled in 1997 (the CRP had not been implemented in 1982). However, few CRP acres provide suitable habitat conditions for bobwhites as most were established in dense loblolly pine plantations and exotic grasses. CRP lands offer a highly significant opportunity for conversion to

wildlife friendly habitat practices over the next 2 decades, as the emphasis on these areas is expected to shift toward ecologically sensitive treatment. The remaining land base in BCR 29 consists of hardwood forests, urban areas, transportation and miscellaneous types, none of which are deemed suitable for bobwhite habitat enhancement.

The Piedmont BCR experienced the steepest bobwhite population decline in the range of the species between 1980 and 1999. Breeding Bird Survey (BBS) data recorded an annual decline of 8.35% per year based on 98 routes. Bobwhite harvests in the region declined from 1.15 million birds to slightly over 300 thousand birds (72.8%) in the 19 years between 1980 and 1999. The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.256 birds/acre. In 1999 that density had declined more than 69% to 0.079. Restoring the Piedmont bobwhite population density to 1980 levels on remaining agricultural lands will require the addition of 178,014 coveys to the autumn pre-hunt population.

Restoration of bobwhites in BCR 29 can be accomplished by increasing the acreage devoted to volunteer early succession vegetation (VESV) and native warm season grasses (NWSG) and by improving management practices applied to existing and future pine forests (Table 2). Specifically the population can be achieved by doing the following:

l. Convert 94,200 acres of cool-season exotic grasses currently in the CRP to VESV and NWSG. This would produce an estimated 23,550 coveys of bobwhites in the BCR (13.2% of the total needed).

2. Apply appropriate site preparation techniques, burning and/or thinning to the 161,700 acres of pines in CRP. This would add about 161 coveys to the region (0.1%).

3. Apply appropriate site preparation techniques, burning and thinning to the 9,662,200 acres of pinelands in BCR 29. This should add 9,662 coveys to the bobwhite population (5.4%).

4. On the IAA, develop 578,564 acres of VESV and NWSG. This can be achieved through replacement of row crop acreage, and by conversion of exotic hay and/or pasture grasses. This addition of 30.7 acres of VESV and NWSG per square mile will change the habitat on 4.8% of the IAA, and should add 144,641 coveys to the BCR (81.3% of the total needed).

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 29. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

State	Cropland	Pasture/ Hay	Improvable Ag Acres[1]	(%)[2]	CRP Grass	CRP Trees	CRP Wildlife	Pines
AL	41.4	244.0	285.4	(2.4%)	0.0	0.0	0.0	771.2
GA	384.9	1,593.5	1,978.4	(16.4%)	11.3	39.2	4.4	3,064.4
MD	280.8	193.0	473.8	(3.9%)	0.0	3.1	0.0	2.1
NC	2,161.8		3,977.3	(33.0%)	40.7	60.3	12.6	2,176.2
SC	506.7	1,127.5	1,634.2	(13.6%)	21.1	34.7	2.2	2,169.6
VA	1,484.5	2,210.4	3,694.9	(30.7%)	21.1	24.4	0.0	1,478.7
Total	4,860.1	7,183.9	12,044.0	(100.0%)	94.2	161.7	19.2	9,662.2

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, and range.

[2] % is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

Table 2. Population goals (coveys to be added) and recommended management practices (acres x 1,000) by land use type for states comprising BCR 29.

Convert to VESV and NWSG[1] **Site prep, burn, thin**

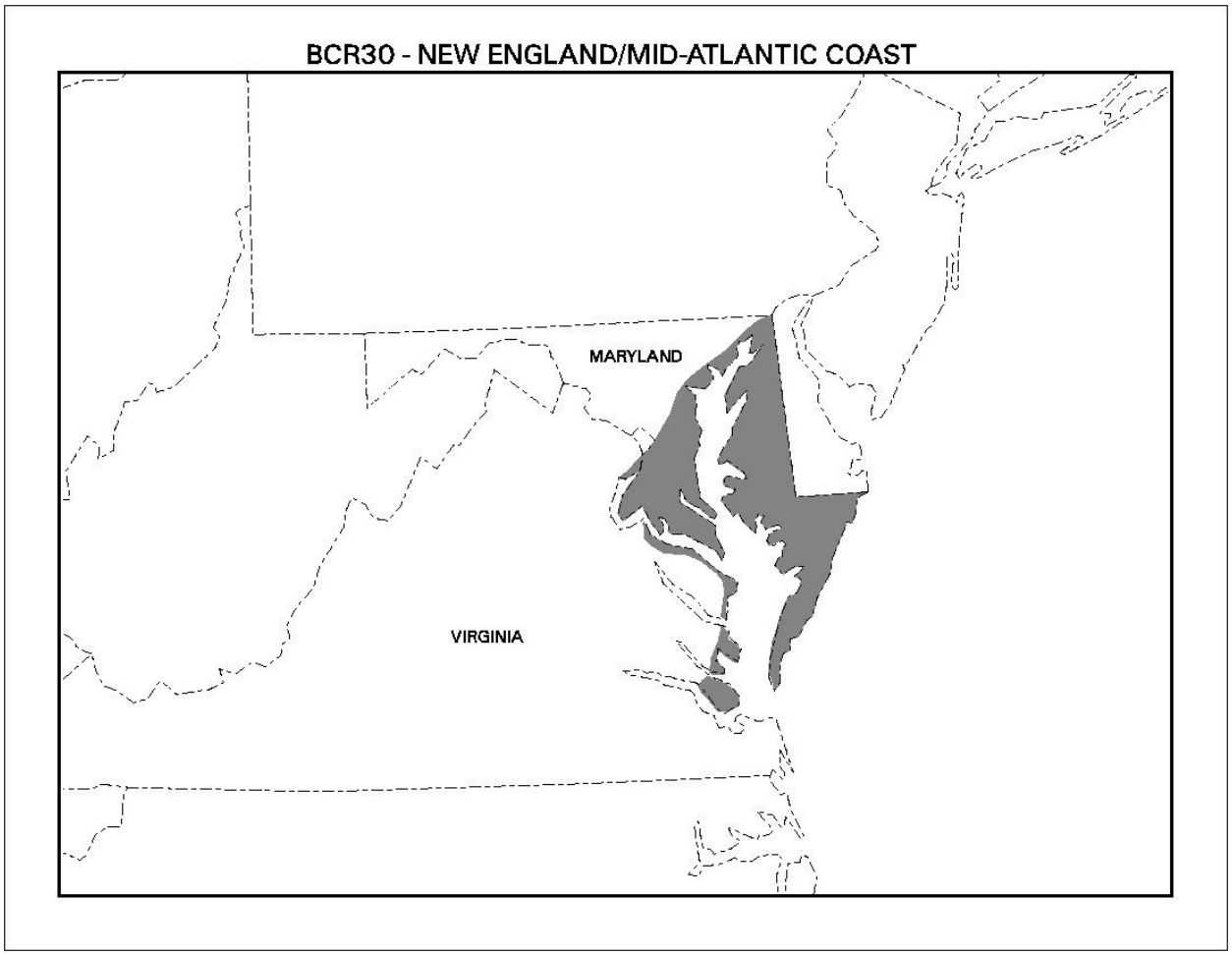
State	Pop. Goal coveys	CRP Grass		Improvable Ag Land		CRP Pines		Southern Pines	
		Acres	**coveys**	Acres[2]	**coveys**	Acres	**coveys**	Acres	**coveys**
AL	**4,272**	0.0	**0**	14,004	**3,501**	0.0	**0**	771.2	**771**
GA	**29,194**	11.3	**2,825**	93,064	**23,266**	39.2	**39**	3,064.4	**3,064**
MD	**6,943**	0.0	**0**	27,752	**6,938**	3.1	**3**	2.1	**2**
NC	**58,745**	40.7	**10,175**	185,336	**46,334**	60.3	**60**	2,176.2	**2,176**
SC	**24,210**	21.1	**5,275**	66,920	**16,730**	34.7	**35**	2,169.6	**2,170**
VA	**54,650**	21.1	**5,275**	191,488	**47,872**	24.4	**24**	1,478.7	**1,479**
Total	**178,014**	94.2	**23,550**	578,564	**144,641**	161.7	**161**	9,662.2	**9,662**

[1] Volunteer Early Succession Vegetation and Native Warm Season Grass.

[2] Numbers of acres for Improvable Ag Lands are actual figures.

Bird Conservation Region 30: New England and Mid-Atlantic

Stephen Capel, Virginia Department of Game and Inland Fisheries, 4792 Anderson Highway, Powhatan, VA 23139



The New England and Mid-Atlantic Bird Conservation Region (BCR 30) covers 12 states in the Mid-Atlantic region and stretches NE along the coast to Maine (Figure 1). A substantial portion of this BCR (54.1%) (north of Maryland) is not bobwhite quail range. Coastal Plain harvest data from Virginia has been divided between BCR 27 (Southeastern Coastal Plain) and BCR 30 based on comparative acreage. Thus BCR 30, for bobwhite quail, includes the Maryland and north Tidewater Virginia Coastal Plain, which comprises 9,381,900 acres. Of this, 1,692,300 acres are cropland or pasture/hay (Table 1). These are considered the "Improvable Agricultural Acres" (IAA) and treated as a single unit for assigning population densities, population goals and acreage to be managed. Pines make up 404,500 acres of BCR 30. CRP acreage in BCR 30 comprises 23,400 acres (0.2% of the BCR), of which 21,500 acres are in tall fescue.

BCR 30 is predominantly hardwood and pine-hardwood forest (50.2% of the BCR). Crops represent 17.1%, pasture/hay 4.1% and pine forests 4.3%. Other land (mostly urban, and transportation uses) occupies 24.2%. Crops, pasture/hay, pines and CRP comprise only 25.7% of

the land area, but must support all of the quail and any restoration efforts to meet 1980 population restoration goals.

Population history, current status and objectives

Bobwhite populations declined precipitously from 1980 to 1999 in BCR 30. The Breeding Bird Survey (BBS) illustrated a decline of 7.4%/year. The harvest declined 81% from 1979 to 1999 (187,140 quail killed in 1980 to 36,154 birds in 1999). The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.092 birds/IAA. In 1999 that density had declined to 0.021 birds/IAA. To restore quail to 1980 levels will require adding 9,931 coveys to the autumn pre-hunt population in BCR 30.

Restoration of bobwhites in BCR 30 can be accomplished by significantly increasing the acres of native grasses and idle land and improving pine management (Table 2). The 1980 population levels could be reached with the following actions:

1. Convert 96,775 acres of bermudagrass and tall fescue and other cool season grass (CSG) pastures and hay meadows to native warm season grasses (NWSG). This would approximate the 25% ratio of NWSG to CSG that Cooperative Extension Services are recommending. Assuming that 25 new acres of NWSG would produce and support an additional covey, this would add 3,853 coveys to BCR 30 (3,562 in MD and 291 in VA).

2. Apply appropriate site preparation techniques, thin to appropriate levels (175 TPA) and initiate prescribed burning management to control understory hardwoods on 404,500 acres of pine plantations (194,300 acres in MD and 210,200 acres in VA). This would add 1,616 coveys (1 covey/250 acres) to BCR 30.

3. Add to the cropland base 17,848 acres (14,044 acres in MD and 3,804 acres in VA) of NWSG/forbs, natural vegetative succession, and other quail-friendly herbaceous covers as filter strips, field borders, buffers, and similar "idle land" to add 4,462 coveys (3,511 coveys in MD and 951 coveys in VA).

The aggregate of these recommendations should produce 9,931 new coveys, and reach the restoration goals for the Mid-Atlantic Coastal Plain BCR. While the goal for conversion of cool season grasses to native warm season grass/forbs might be a difficult goal to reach, the amount of cropland acres converted to quail-friendly cover types appears to be a reachable goal. Obviously there will be an ability to add quail habitat in the easiest manner possible, and not feel constrained to work proportionately toward all goals.

By far the greatest potential contribution to new coveys in BCR 30 could come from some form of set aside program with a 3 to 5 year wildlife-friendly cover. The Conservation Reserve Enhancement Program (CREP) offers one such approach that is successfully adding filter strips and buffers to agricultural acres in this BCR. Prescribed burning is not being adopted at a rate that will achieve these goals; however thinning is being practiced at an increasing rate. Absent from these discussions are the efforts of a handful of landowners who are managing at a much

more intensive rate, utilizing discing soil disturbance, planting food plots and shrub travel lanes, cut back edges and other proven quail management techniques.

Table 1. Land use categories suitable for bobwhite populations in BCR 30 in Maryland and Virginia. Numbers represent acres x 1,000 based on 1982 & 1997 NRI data.

State	Year	Total Acres	Cropland	Pasture/ Hay	Improv. Ag.Acres	% IAA in BCR land base	Pines
MD	1982	6,159.2	1,319.0	289.5	1,608.5	26.1	206.7
MD	1997	6,159.2	1,264.4	356.2	1,320.6	21.4	194.3
VA	1982	3,222.7	387.7	42.7	430.4	13.4	232.8
VA	1997	3,222.7	342.6	29.1	371.7	11.5	210.2
Totals	1982	9,381.9	1,706.7	332.2	2,038.9	21.7	439.5
Totals	1997	9,381.9	1,607.0	385.3	1,692.3	18.0	404.5

Table 2. Population goals (coveys to be added) and recommended management practices by land use type for Maryland and Virginia portion of BCR 30.

State	**Pop. Goal Coveys**	Convert to NWSG				Site Prep, Thin, Burn[3]	
		Pasture/Hay[1]		Cropland[2]			
		Acres	**Coveys**	Acres	**Coveys**	Acres	**Coveys**
Maryland	**7,849**	89,500	**3,562**	14,044	**3,511**	194,300	**776**
Virginia	**2,082**	7,275	**291**	3,804	**951**	210,200	**840**
Totals	**9,931**	96,775	**3,853**	17,848	**4,462**	404,500	**1,616**

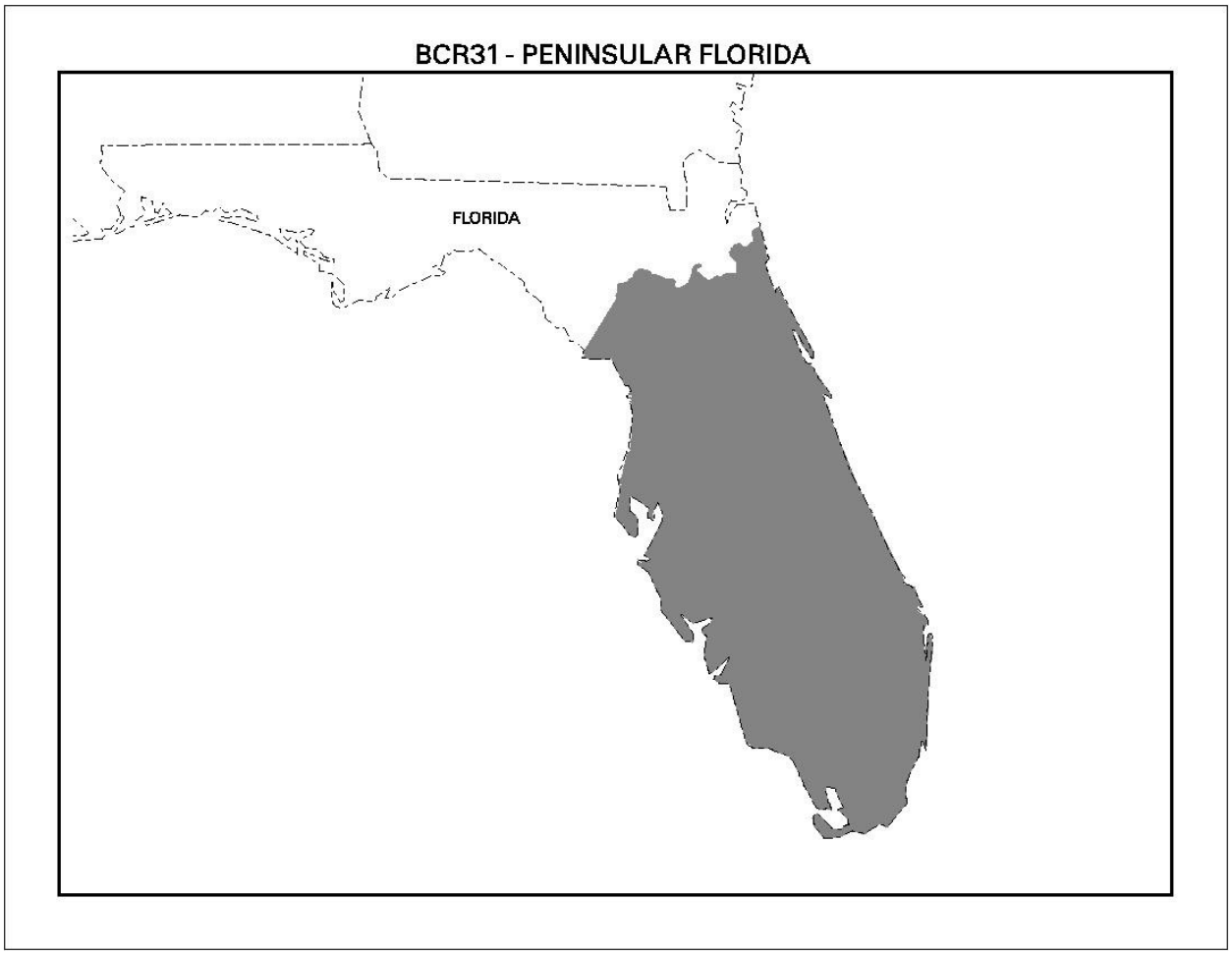
[1] 25 % conversion of tall fescue pasture (CES Recommendation) would add one (1) covey/100 Acres of pasture.

[2] 4 Ac NWSG (or natural vegetative succession from cropland) as filter strips, field borders, buffers, etc. will add one (1) covey.

[3] Pines managed with quail-friendly thinning and understory burning will produce a minimum of 1 covey/250 acres.

Bird Conservation Region 31: Peninsular Florida

Bill Palmer, Tall Timbers Research Station, 13093 Henry Beadel Drive, Tallahassee, FL 32312



The Peninsular Florida Bird Conservation Region (BCR 31) comprises 24,969,100 acres of land. Based on the 1997 National Resources Inventory 7.8 million acres were devoted to cropland, pasture, and range. A total of 3.2 million acres were forested in pine forests and pine-hardwood forests. The remaining land base in BCR 31 consists of hardwood forests, urban areas, transportation and miscellaneous habitat types, none of which are deemed suitable for bobwhite habitat enhancement.

There are 3 primary opportunities in Peninsular Florida for improving quail habitat; these include 1) pasture/rangeland, 2) pine forests, and 3) field crop acreage, primarily corn, soybeans, cotton and peanuts. The agricultural land base deemed suitable for bobwhite habitat improvement declined by 9% from 1982 to 1997; however, actual declines were greater as agricultural producers shifted from field crops to vegetable, fruit, and other crop production. Today, only a small percentage of cropland is in field crops suitable to bobwhite management (<10% based on Florida Agricultural Statistics Service). Therefore, land use categories designated "Improvable Agricultural Acres" (IAA) excluded most crop acreage in BCR 31.

Rangeland accounted for 3.2 million acres in 1997, and had declined by 30% from 1982 levels. Conversion of unimproved rangelands to improved pasture through establishment of exotic grasses has reduced the value of a large portion of these habitats. According to the 1997 National Resources Inventory, approximately 63% of forested acreage in BCR 31 is in pine habitats. Pine forests in BCR 31 include industrial forests, upland pine/scrub, and upland and lowland pine savannas. Existing Conservation Reserve Program (CRP) acreage in BCR 31 is minimal with no acres existing in the 1997 National Resources Inventory. Today, CRP in BCR 31 offers only a minor opportunity for conversion to wildlife friendly habitat practices.

Bobwhite populations declined precipitously from 1980 to 1999 in BCR 31. The Breeding Bird Survey (BBS) illustrated an annual decline of 4.3% in the breeding population. Harvest rates of bobwhites in BCR 31 declined from 507,682 birds in 1980 to only 98,255 birds in 1999, an 81% decline. The pre-hunt population density of bobwhites on the improvable acres of agricultural and pine forested lands in 1980 was 0.106 birds/IAA. In 1999 that density had declined to 0.024. To restore the bobwhite population density to 1980 levels on 1997 improvable agricultural and pine acreage (Table 1) will require the addition of 66,853 coveys to the autumn pre-hunt population in this BCR.

Restoration of bobwhites in BCR 31 can be accomplished by increasing significantly the acreage devoted to native warm season grasses on pasture and rangelands, increasing use of prescribed fire on rangelands and pastures, and improving management practices applied to existing and future pine forests. Specifically the population can be achieved by doing the following:

1. Apply appropriate prescribed burning, site preparation and thinning to 3,132,000 acres of pine forests in BCR 31. Longer rotations, including saw timber rotations, would also increase acreage of suitable habitat. Assuming each 250 acres of properly managed pine forests would add 1 new covey of bobwhites, this would produce an estimated 12,528 coveys of bobwhites (18.7% of the total needed).

2. Add to the improvable acres of the pasture and rangeland base 196,300 acres of native warm season grass pasture and/or rangelands. This can be achieved through replacement of improved pasture acreage with native warm season plant communities and/or increasing the use of prescribed burning of native rangelands. This habitat enhancement should add 49,075 coveys to BCR 31 (73.4% of the total needed).

3. Convert approximately 21,000 of the 420,000 acres of improvable cropland to field borders or other native vegetation practices. This would add 5,250 coveys (7.9% of the total needed).

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 31, Peninsular Florida. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

Crop Acres	Pasture/ hay	Range Acres	Improv. Ag. Acres	Longleaf/ Slash Acres	Loblolly/ shortleaf acres	Mixed Pine/Hwd	Pine Forest Acres
420.1	3,563.3	3,215.7	7,199.1	1,953.5	6.9	1,171.6	3,132.0

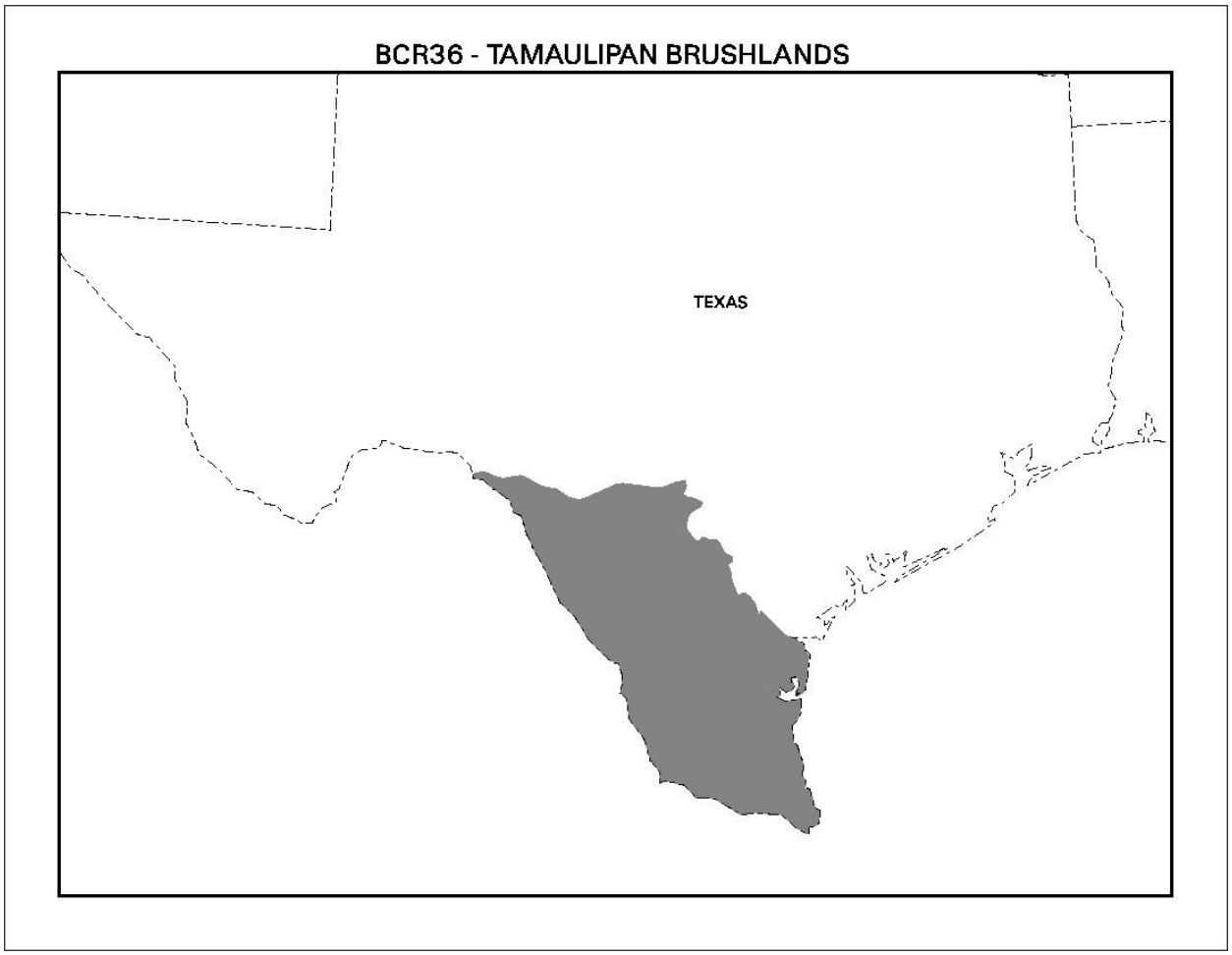
[1] Improvable Ag Acres represents the total for 10% of cropland and all pasture, hay, and range. Ten % of cropland acreage represents the approximate proportion in cotton, corn, soybeans and peanuts based on FL Agricultural Statistics Service. Vegetable, fruit, cane and other production was not considered as improvable acreage**.**

Table 2. Population goals (coveys to be added) and recommended management practices by land use type for BCR 31.

State	**Pop. Goal Coveys**	Convert to NWSG				Site Prep, Thin, Burn Pine Forests	
		Pasture/Hay		Cropland			
		Acres	**Coveys**	Acres	**Coveys**	Acres	**Coveys**
Florida	**66,853**	196,300	**49,075**	21,000	**5,250**	3,132,000	**12,528**

Bird Conservation Region 36: Tamaulipan Brushland

Robert M. Perez, Wildlife Division, Texas Parks and Wildlife Department, P.O. Box 1081, La Vernia, TX 78121



The Tamaulipan Brushland Bird Conservation Region (BCR 36) comprises 18,991,100 acres of land in southern Texas. This area, commonly referred to as the brush county, is part of the Tamaulipan biotic province that extends into Mexico. The area is dominated by chaparral, or brushland habitat, and fairly recent agricultural fields. However, the region also includes fairly extensive grasslands, oak forests, and some tall riparian forests. In the brushlands, much of the area was originally covered by mesquite-acacia savanna, and areas of semi-open thorn scrub generally less than 3 meters tall alternating with grassy areas. The relative coverage of grassy areas is questionable, and may have varied during wet-dry cycles. Forested areas included live oak mottes and taller riparian zone forests along the Rio Grande, Nueces and other rivers. Cenizo, or purple sage, covered some of the area as well, mainly on caliche capped ridges along the Rio Grande and Bordas escarpment. Coastal acreage, relatively small in this physiographic area, was once dominated by a complex of coastal marsh, upland grasslands, and floodplain forest. Today, much of the acreage in BCR 36 is used for livestock and commercial /

recreational wildlife operations. Quail and quail hunting are particularly important in this region. Revenues are especially important for many economically strapped rural communities.

Based on the 1997 National Resources Inventory, 18,689,300 acres were devoted to cropland, pasture/hayland, and range (Table l). These land use categories are designated "Improvable Agricultural Acres" (IAA), and treated as a single unit for assigning population densities, population goals, and acreage to be managed. This agricultural land base deemed suitable for bobwhite habitat improvement declined by 3.0% from 1982 to 1997. The Conservation Reserve Program (CRP) had not been implemented in 1982. In 1997, CRP occupied 124,500 acres, however, no lands in the Tamaulipan Brushland were enrolled specifically as wildlife practices. CRP lands offer a significant opportunity to increase the amount of available wildlife habitat over the next 2 decades. The remaining land base in BCR 36 consists of urban areas, transportation, and miscellaneous types, none of which are suitable for bobwhite habitat enhancement.

Bobwhite populations declined from 1980 to 1999 in BCR 36. The Breeding Bird Survey (BBS) illustrated an annual decline of 6.7% in the breeding population based on 21 survey routes. Harvest statistics provided by Texas showed that the harvest of bobwhites in BCR 36 declined from 719,672 in 1980 to 195,726 in 1999 (a decline of 72.8%). The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.42 birds/IAA. In 1999 that density had declined to 0.11 birds/IAA. To restore the bobwhite population density to 1980 levels will require the addition of 135,065 coveys to the autumn pre-hunt population in this BCR.

Assumptions made to achieve the 1980 population goals include: (1) average northern bobwhite covey size is 12.0 birds, (2) 5% of all cropland, 5% of all pasture/hay land, 33% of the rangeland, and 50% of CRP grassland, based on the 1997 National Resources Inventory, could be improved to produce suitable bobwhite nesting and brood-rearing habitat, and (3) four acres of warm season grasses will add enough nesting and brood rearing habitat for 1 covey.

The majority of restoration for bobwhites in BCR 36 can be accomplished by increasing the acreage devoted to a mixture of native warm and cool season grasses interspersed with low growing woody cover. Bobwhite habitat restoration can be accomplished using any or a combination of brush control (doze, aerate, chop, chain, shred, or spray), prescribed burning, and rotational grazing systems and/or decreasing the stocking rates of, goats, sheep, and cattle on rangeland (Table 2). All of the above management practices will serve to increase plant diversity. Additional acreage can be improved for bobwhites through the conversion of cropland and pasture/hay lands to a mixture of native warm and cool season grasses (Table 2).

Specifically, population goals can be achieved through the management practices mentioned above on the following acreages:

(1) Better management of native rangeland in the Tamaulipan Brushland to improve 519,732 acres for bobwhites should produce an estimated 129,933 bobwhite coveys in the BCR (96.2% of the coveys needed to achieve the 1980 population goal) (Table 2).

(2) Conversion of 10,804 acres of cropland to a mixture of native warm and cool season grasses and forbs should produce an estimated 2,701 bobwhite coveys in the BCR (2.0% of the population goal).

(3) Conversion of 3,240 acres of pasture and hay lands to a mixture of native warm and cool season grasses and forbs should produce an estimated 810 bobwhite coveys in the BCR (0.6% of the population goal).

(4) Conversion of 6,484 acres of CRP grassland to a mixture of native warm season grasses and forbs should produce an estimated 1,621 bobwhite coveys in the BCR (1.2% of the population goal)(Table 2).

Table 1. Land use categories suitable for enhancing northern bobwhite populations in BCR 36. BCR 36 is the Tamaulipan Brushland Region of Texas, 1982 and 1997. Data are presented as acres x 1,000 (1982 and 1997 National Resources Inventory).

	Land Use (Acres x 1,000)			
Year	Cropland	Pasture/Hay	Rangeland	CRP grass
1982	2550.9	755.3	15,383.1	0
1997	2114.0	642.4	15,367.0	124.5
Difference	-436.9	-112.9	-16.1	+124.5

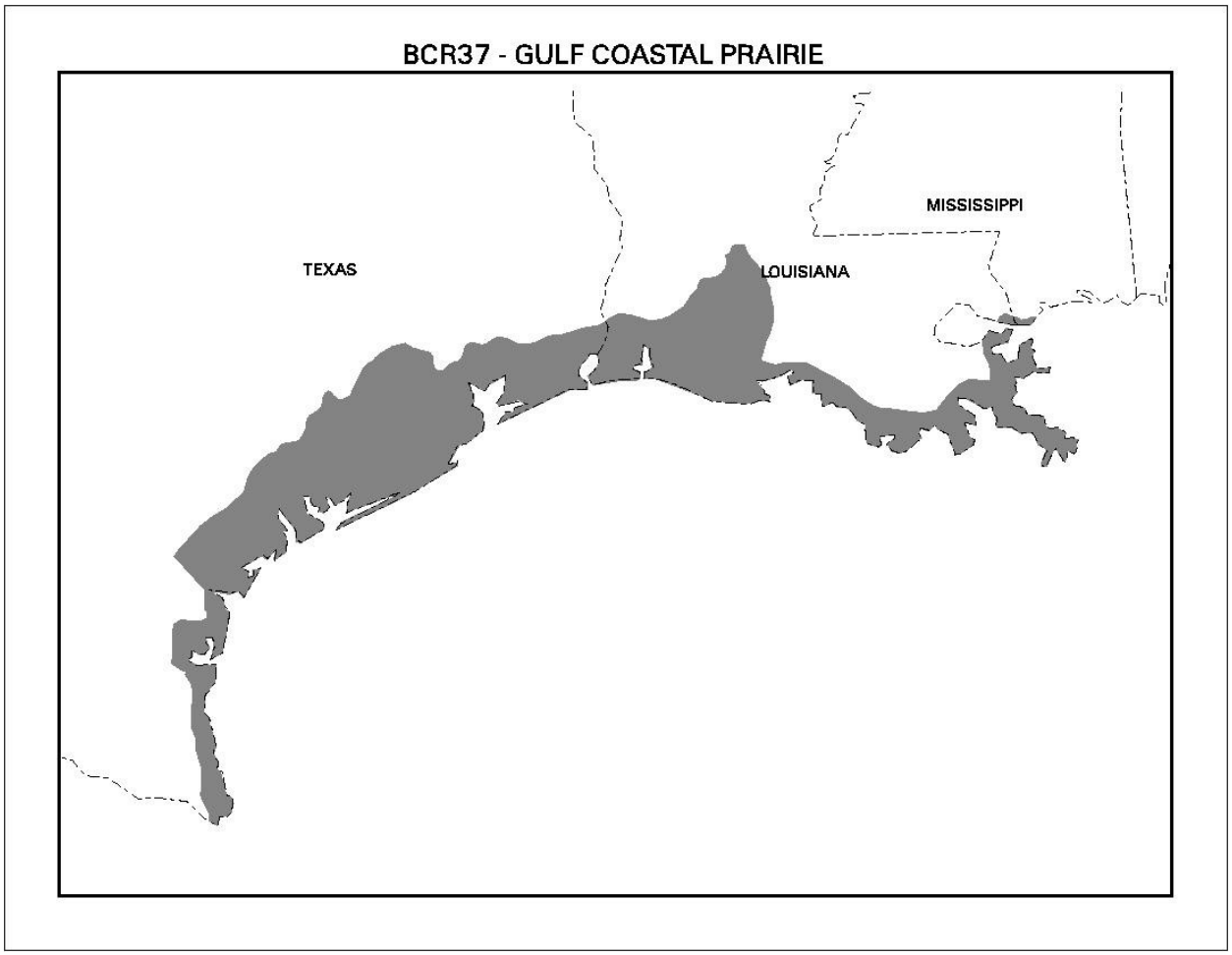
Table 2. Acres to be improved for northern bobwhites and number of coveys to be added through habitat improvement[1] to meet population goal for BCR 36, Tamaulipan Brushland.

	Pop. Goal	Acres improvable for northern bobwhite				Northern bobwhite coveys			
State	Coveys	Crop	Pasture/Hay	Range	CRP grass	Crop	Pasture/Hay	Range	CRP grass
Texas	135,065	10,804	3,240	519,732	6,484	2,701	810	129,933	1,621
Totals		540,262 Goal Acres				135,065 Goal bobwhite coveys			

[1] Establishment of a mixture of native warm and cool season grasses and forbs for nesting and brood-rearing habitat; and brush control (doze, aerate, chop, chain, shred, or spray), prescribed burning, rotational grazing systems, and/or decreasing the stocking rates on rangeland.

Bird Conservation Region 37: Gulf Coastal Prairie

Robert M. Perez, Wildlife Division, Texas Parks and Wildlife Department, P.O. Box 1081, La Vernia, TX 78121



The Gulf Coastal Prairie Bird Conservation Region (BCR 37) comprises 29,010,400 acres of land in 3 states. This region contains a complex of marshes and upland grassland and a small amount of forested habitat. Marsh vegetation is determined largely by the salt content of the water, with community types ranging from salt marsh to brackish to fresh water marsh. Nearly all grassland habitats have been converted to agricultural use, primarily pasture lands and rice farms. Forested areas occur primarily along major riverine systems and on coastal cheniers (ancient beachfront ridges), mottes and salt domes, and man-made levees and spoil banks. Bottomland hardwood forests along the major river systems that drain the Gulf Coastal Prairies range in composition from cypress-tupelo to hackberry-ash-elm to water oak-willow oak dominated forests. Most of the natural communities of BCR 37 have experienced tremendous alteration. Marsh habitats have been lost or changed because of saltwater intrusion caused by oil and gas development, dredging, channelization, impoundments, land subsidence, and other factors. As much as 99% of the original prairies and grasslands have been converted to agriculture. Cattle are commonly grazed in marsh, grassland and wooded habitats, further

degrading bird habitat. Invasion by non-native plants, such as Chinese tallow, has changed diverse natural habitats to monotypic stands covering hundreds of hectares. Continuing human development of higher ground is likely as human population pressures increase.

Based on the 1997 National Resources Inventory, 16,977,700 acres were devoted to cropland, pasture/hayland, and range (Table l). These land use categories are designated "Improvable Agricultural Acres" (IAA), and treated as a single unit for assigning population densities, population goals, and acreage to be managed. This agricultural land base deemed suitable for bobwhite habitat improvement increased by 0.8% from 1982 to 1997, although most of the increase is cropland and probably reflects an increase in rice production in the region. The Conservation Reserve Program (CRP) had not been implemented in 1982. In 1997, CRP occupied 28,700 acres, including 3,200 acres enrolled specifically as wildlife practices in the Gulf Coastal Prairie. CRP lands offer a significant opportunity to increase the amount of available wildlife habitat over the next 2 decades. The remaining land base in BCR 36 consists of urban areas, transportation, and miscellaneous types, none of which are suitable for bobwhite habitat enhancement.

Bobwhite populations declined from 1980 to 1999 in BCR 37. The Breeding Bird Survey (BBS) illustrated an annual decline of 4.5% in the breeding population based on 22 survey routes. Harvest statistics provided by Texas and Louisiana, showed that harvest of bobwhites declined from 98,495 in 1980 to 30,567 in 1999 (a decline of 70.0%). The pre-hunt population density of bobwhites on the improvable acres of agricultural lands in 1980 was 0.11 birds/IAA. In 1999 that density had declined to 0.04 birds/IAA. To restore the bobwhite population density to 1980 levels will require the addition of 14,682 coveys to the autumn pre-hunt population in this BCR.

Assumptions made to achieve the 1980 population goals include: (1) average northern bobwhite covey size is 12.0 birds, (2) 5% of all cropland, 5% of all pasture/hay land, 33% of the rangeland, and 50% of CRP grassland, based on the 1997 National Resources Inventory, could be improved to produce suitable bobwhite nesting and brood-rearing habitat, and (3) ten acres of warm season grasses will add enough nesting and brood rearing habitat for 1 covey.

The majority of restoration for bobwhites in BCR 37 can be accomplished by increasing the acreage devoted to a mixture of native warm and cool season grasses interspersed with low growing woody cover. Native prairie restoration is a key element to any bobwhite habitat restoration plan and can be accomplished using a combination of prescribed burning, rotational grazing systems, decreased stocking rates, and reduction of introduced grasses (e.g. Bermuda) on rangeland (Table 2). All of the above management practices will serve to increase plant diversity. Additional acreage can be improved for bobwhites through the conversion of cropland and pasture/hay lands to a mixture of native warm and cool season grasses (Table 2).

Specifically, these management practices should be applied on the following acreages:

(1) Better management of 114,087 acres of native rangeland in the Gulf Coastal Prairie should produce an estimated 11,409 bobwhite coveys in the BCR (77.7% of the coveys needed to achieve the 1980 population goal) (Table 2).

(2) Conversion of 24,080 acres of cropland to a mixture of native warm and cool season grasses and forbs should produce an estimated 2,408 bobwhite coveys in the BCR (16.4% of the population goal).

(3) Conversion of 8,076 acres of pasture and hay lands to a mixture of native warm and cool season grasses and forbs should produce an estimated 807 bobwhite coveys in the BCR (5.5% of the population goal).

(4) Conversion of 587 acres of CRP grassland to a mixture of native warm season grasses and forbs should produce an estimated 58 bobwhite coveys in the BCR (0.4% of the population goal). (Table 2).

Table 1. Land use categories suitable for enhancing bobwhite populations in BCR 37. Numbers represent acres x 1,000 in 1997[1]. Data from 1997 National Resources Inventory.

State	Cropland	Pasture/Hay	Range	CRP Grass	Improvable Ag Acres	(%)[2]	CRP Trees	CRP Wildlife	Pines
LA	3,250.8	609.3	268.3	0.8	4,129.2	24.3	3.4	1.3	678.3
MS	8.3	34.9	0.0	0.0	43.2	0.3	0.4	1.9	93.0
TX	5,009.9	2,125.9	5,670.3	20.9	12,827.0	75.5	0.0	0.0	197.1
Totals	8,269.0	2,770.1	5,938.6	21.7	16,999.4	100.0	3.8	3.2	968.4

[1]Improvable Ag Acres represents the total for cropland, pasture/hay, range, and CRP grass.

[2] % is the proportion of the BCR occupied by IAA for each state, and is used to determine the population goal for that state.

Table 2. Acres to be improved for northern bobwhites and number of coveys to be added through habitat improvement[1] to meet population goal for BCR 37.

State	Population Goal Coveys	Acres improvable for northern bobwhite				Northern Bobwhite coveys			
		Crop	Pasture/Hay	Range	CRP grass	Crop	Pasture/Hay	Range	CRP grass
LA	3,553	5,828	1,954	27,609	142	583	195	2,761	14
MS	43	72	24	342	2	7	2	34	0
TX	11,086	18,180	6,098	86,136	443	1,818	610	8,614	44
Totals	14,682	24,080	8,076	114,087	587	2,408	807	11,409	58

[1] Establishment of a mixture of native warm and cool season grasses and forbs for nesting and brood-rearing habitat; and prescribed burning, rotational grazing systems, and/or decreasing the stocking rates on rangeland.

SUMMARY OF QUANTITATIVE HABITAT OBJECTIVES FOR THE BIRD CONSERVATION REGIONS

Restoring northern bobwhites to the range wide density that existed in 1980 on the land base suitable for management in 1999 will require the addition of 2,770,922 coveys. Achieving this density will necessitate impacting the habitat on more than 81.1 million acres of farm, forest, and rangelands. However, the recommended land management practices would change the primary use of the land on only 6% to 7% of this 81.1 million acres.

More than 78% of the needed coveys (2,170,691 coveys) will be produced on 18.7 million acres of farm lands, including croplands, pasture and haylands, and acres currently enrolled in the Conservation Reserve Program (CRP) that are not now in wildlife-friendly practices. Recommended practices include the addition of native warm season grasses to the cropland component in the form of field borders and buffer strips, and the conversion of exotic cool and warm season grasses in CRP lands and in pasture and haylands to NWSG. A highly significant feature of this approach is that conversion of CRP exotic grasses to NWSG would produce 21.2% of all coveys needed to meet the rangewide goal.

Applying wildlife friendly forest management practices on 53.5 million acres of forest lands, principally loblolly, shortleaf, slash, and longleaf pines, will add 196,617 coveys (7.1% of the needed coveys) to the landscape. Important management practices include site preparation treatments that favor the establishment of native grasses and forbs on the plantations, thinning to densities that will encourage ground cover, periodic burning, and where ecologically sound, increase the acreage devoted to long rotation longleaf pine. The land base planted to forests is increasing in contrast to the shrinking land base in agriculture. Thus forest management may become a more significant resource for bobwhites in the future. One emerging forest management practice that holds much promise for bobwhites and many other species of early successional wildlife is the conversion of hardwood forests to savanna. This Conservation Initiative calls for the conversion of 50,000 acres of hardwoods, but there are millions of acres where this practice would yield significant benefits to wildlife.

In the western portion and parts of the southern portions of the bobwhite's range, range management is the most effective practice for increasing bobwhites. The very practices that benefit bobwhites also benefit livestock, and consequently, ranch income. Implementing practices such as prescribed fire, conversion of exotic range vegetation to native warm and cool season grasses, and regulating grazing densities would add 403,614 coveys (14.6% of the needed coveys) on 8.9 million acres of rangeland. It is notable that bobwhite numbers have declined least in areas where healthy native grasslands are the product of enlightened range management.

Although the trend in numbers is indeed grim for the northern bobwhite, this Conservation Initiative is offered with a strong sense of optimism. The necessary land base is yet adequate to achieve our Conservation Initiative goal. Indeed, in some parts of the range, it is more than adequate. And the personnel, the mechanisms, and the knowledge for implementing the plan are in place or in reach.

OPPORTUNITIES AND NEEDS FOR PLAN IMPLEMENTATION

Many years, or even decades, will be required to implement this ambitious plan sufficiently to stabilize and recover bobwhite populations across their range. More than nine-tenths of the needed management actions are on private lands that are being cropped, grazed or managed for timber. Achieving the habitat objectives will depend on the collective efforts of thousands of individual landowners--including farmers and ranchers, non-industrial and industrial forest owners, and recreational landowners--in cooperation with state wildlife agency biologists; federal land management agency personnel; USDA personnel at the county, area, state, regional and national levels; non-government organizations; and sportsmen's clubs. That is, bobwhite restoration will require nothing less than a virtual populist movement across much of the country.

Seize Immediate Major Opportunities

Such an immense task certainly will need substantial money. However, the amount of new, dedicated money needed for bobwhites, above and beyond that already available and potentially applicable to bobwhite habitat restoration, is less than initially apparent. It is possible that the majority of money and programmatic authority needed to restore bobwhite habitat could originate outside traditional state and federal wildlife agency revenue sources, such as USDA farm bill conservation programs. The most immediate, meaningful gains in bobwhite habitat likely will be achieved by (1) tweaking implementation of ongoing federal private land conservation programs; (2) increasing appropriations to current federal programs that have sound authority but are under funded; and (3) creating new and improved authorities that place higher consideration upon early successional wildlife habitat opportunities.

Refine and Adapt Existing Authorities

Many of the habitat restorations and improvements needed are possible to achieve merely by making *refinements to current programs* or *updating existing technical assistance*. For example, the ongoing whole-field enrollments in the Farm Service Agency's (FSA) **Conservation Reserve Program** can be much more beneficial to bobwhites simply by continuing the emphasis on planting suitable cover types, while establishing and enforcing required management practices for which annual maintenance fees already are paid. The partial-field practices of the **Continuous CRP** could provide excellent bobwhite habitat by allowing wildlife field borders and requiring wildlife-friendly cover plantings on all enrollments. Ongoing Cooperative Extension Service and Natural Resources Conservation Service (NRCS) technical assistance activities could be updated to provide more effective guidance to landowners interested in quail management. Water quality efforts such as the **NRCS Buffer Initiative** and the **Environmental Quality Incentives Program** could perform dual functions by consistently using wildlife-friendly plantings to filter and slow runoff. Finally, FSA's **Pasture Recovery Program** could benefit grassland wildlife and livestock producers by establishing drought-impacted pastures to drought-tolerant native warm season grasses instead of replanting more of the same cool season exotic grasses such as fescue.

Increase Appropriations for Existing Authorities

In other cases, existing federal conservation programs can provide many habitat needs with only *increased appropriations*. The **Wildlife Habitat Incentives Program** of the 1996 Farm Bill, if reauthorized and adequately funded by the 2002 Farm Bill, can be directly applied to promote quail habitat. Likewise, the USDA Forest Service's (USFS) State and Private Forestry programs--especially the **Forest Stewardship Program** and **Stewardship Incentive Program**--need only enhanced appropriations to be up to the bobwhite restoration task on a significant scale. On national forests, increased appropriations are needed for the USFS's prescribed burning activities, and for pine savanna and oak woodland ecosystem restoration projects.

Pursue Grants

The NBCI provides a sound basis for bobwhite grant proposals of unprecedented scope and magnitude, even on multi-state, regional scales. Substantial, and continually growing, grant monies from federal, state and private agencies and foundations are available currently that could be applied to bobwhite restoration immediately. The **National Fish and Wildlife Foundation** likely would be interested and receptive to major grant applications for restoring habitat for bobwhites and other early successional species. Funds available through **Title VIII** of the federal "CARA Light" legislation passed in the year 2000, and assorted other pots of federal money that pop up occasionally, are prime for bobwhite habitat proposals.

Create New or Improved Authorities

Improve Authorities

In still other cases, substantially *new or redirected federal and state authorities* will be needed. With the simple addition of wildlife habitat as a purpose, the USFS's **Forestry Incentives Program** (or a substitute that could result from the ongoing 2002 Farm Bill) could provide meaningful benefits for early successional wildlife. Similarly, state wildlife agency programs that long have promoted inefficient quail habitat practices such as food plots could be re-directed to more beneficial management actions. The 1996 Farm Bill's **Conservation on Private Grazing Lands** (CPGL) program is the only federal program designed specifically to address conservation needs on pasture, rangeland and hay land. Although wildlife habitat is a major purpose of CPGL, only education and technical assistance currently are authorized. With the possible addition in the 2002 Farm Bill of significant cost-share and incentive components, CPGL could be a potent program to help restore grasslands to native, warm-season grasses and forbs suitable to bobwhites.

Create New Money

Certainly, however, some new money ultimately will be needed, for example to hire additional biological staff among agencies, to fund specific projects and educational campaigns, and to provide incentives not adequately covered by existing government programs. Entirely new federal or state funds might eventually be secured, similar to the North American Wetland Conservation Act's primary purpose of funding implementation of the North American Waterfowl Management Plan. Alternatively, new funds may be dedicated for a larger set of

habitat conservation plans that could include bobwhites along with migratory birds and other species. Such potential new sources as the long-sought federal Conservation and Reinvestment Act, which would provide major new funding to state wildlife agencies, Georgia's state legislature-funded quail initiative, and other as-yet-unthought-of new state and federal initiatives will have to be explored, pursued and capitalized upon eventually.

Establish Working Partnerships

It is likely that much of the habitat restoration that benefits bobwhites will be conducted on behalf of other species that share its habitats. Partners in Flight (PIF) is an international alliance of federal, state, local and non-government groups that cooperates in planning and implementing projects to benefit migratory landbirds. Because numerous migratory landbird species that share the bobwhite's habitats also are declining and are PIF priorities, myriad fruitful opportunities are present for bobwhite and PIF advocates to combine efforts for mutual benefit.

The Southeast Quail Study Group anticipates that this recovery plan will provide the foundation, the unity of purpose, the catalyst and the motivation to quail advocates across the country to seize the numerous opportunities already before us, to secure major new funding, and to establish working partnerships that can turn these dreams into reality.

HABITAT MANAGEMENT PRACTICES

AGRICULTURAL CROPLAND

Terry Sharpe, North Carolina Wildlife Resources Commission, Sandhills Wildlife Depot, P.O. Box 149, Hamlet, NC 28347

David Howell, Quail Unlimited, 10364 South 950 E., Stendal, IN 47585

Mark J. Gudlin, Tennessee Wildlife Resource Agency, PO Box 40747, Nashville, TN 37204

Ecology and Status

Inefficient row crop agriculture, characterized by small weedy crop fields interspersed with fallow fields and frequently disturbed open canopy woodlands, once created an environment productive of bobwhites and early succession wildlife across the region. Technological advances during the 20th century increased productivity and yields of farm commodities, but the value of cropland to wildlife has steadily decreased. Farming intensity continues to increase, with double cropping becoming more prevalent, and at the regional level land use for agricultural crops has been consolidated on the more productive soils. Field consolidation, surface and subsurface drainage, and hedgerow removal have reduced habitat interspersion and complexity at the field level. On an even smaller scale, plant community structure and plant and insect diversity, have been reduced by chemical pesticides, faster growing crops, and increased efficiency of harvest equipment. In contrast to the interspersion of complex plant communities characteristic of early agriculture, today's crop fields are for the most part true monocultures. Bobwhites persist, but at lower densities, in landscapes dominated by cropland.

Cropland Types

Cropland is devoted to the annual planting and harvesting of grains and other commodities. In certain instances, an annual rotation of different crops occurs on the same acreage, but continuous cropping of the same plant (e.g. corn) may take place for several successive years. One positive development is increased use of minimal till and no-till planting for certain crops in recent years. Major crops of concern are corn, soybeans, cotton, peanuts, rice, sorghum, tobacco and small grain (wheat, rye, barley, etc.).

Agriculture has shifted geographically. Smaller fields and those on less fertile soils, characteristic of the Piedmont and Mountain regions, have been abandoned to forestry and cropland has been consolidated on more fertile soils of the Coastal Plains and Mississippi Alluvial Valley. The shift has been accelerated by federal farm policy, that provided landowners an opportunity to retire smaller and less fertile fields.

Cropland as Bobwhite Habitat

Resources provided by commercial commodity crops sometimes provide important life requisites for bobwhites (Table 1). However, natural early succession habitat associated with field edges and fallow areas are essential habitat.

Table 1. Value of current commercial commodity crops as bobwhite habitat.

CROP	NESTING HABITAT	BROOD HABITAT	WINTER COVER[1]	WINTER FOOD[1]
No-till Soybeans	Fair	Good	Poor	Good
No-till Sorghum	Fair	Fair	Good	Good
Conventional tilled Soybeans	Poor	Fair	Poor	Good
Small grain (wheat, rye, barley,etc.)	Good[2]	Good	Poor	Fair
Conventional tilled Sorghum	Poor	Poor	Good	Good
No-till Corn	Fair	Fair	Fair	Poor
Conventional tilled Corn	Poor	Poor	Poor	Poor
Peanuts	Poor	Poor	Poor	Poor
No-till Cotton	Fair	Fair	Poor	Poor
Conventional Tilled Cotton	Poor	Poor	Poor	Poor
Tobacco	Poor	Poor	Poor	Poor
Sugarcane	Poor	Fair	Poor	Poor
Rice	Poor	Poor	Poor	Poor

[1] Where crop residue remains over winter.

[2] Good structure. Harvest may disrupt nests.

Problems Identified

- The trend toward larger field size through farm consolidation has decreased the value of cropland as quail habitat. Larger and more intensively cropped landscapes have contributed to lower densities of bobwhites in intensively cropped areas because of reduced nesting and brood rearing cover.

- Cropland areas help maintain an open quality to the landscape that appears to be an important element in maintaining the suitability of an area for quail. Where cropland occupies from 30 to 65% in a landscape, that area offers the best opportunity for implementing landscape level habitat quail management practices (Dailey 1989, Roseberry and Sudkamp 1998). Where less than 30% or more than 65% of a landscape is

in crops, the upside potential for quail density and abundance of many other early succession species diminishes.

- The quality of nesting cover adjacent to or in association with cropped fields has declined drastically in recent years. The widespread use of introduced, aggressive grasses (e.g. fescue, bahia, and Bermuda grass) that form dominant monocultures, frequent mowing, and forestry practices that result in closed canopy stands has aggravated this situation.

- Brood habitat quality in cropland and remaining field borders has declined because of greater use of herbicides, changes in annual set-aside programs and changing crop rotation patterns. However, use of no-till and in some instances, double cropping (e.g. soybeans planted into grain stubble) has resulted in improved conditions for quail broods (Palmer, 1996).

- Loss of cropland to long-term land retirement (CRP) that is not maintained in early succession habitat, especially conversion to loblolly pine plantations has dramatically reduced quail habitat at the landscape level in several physiographic areas. However, recent increases in the promotion and acceptance of native warm season grass in mid-South States (Kentucky, North Carolina, Virginia and Tennessee) and conversion of CRP fields from fescue to native warm season grass may be improving the quality of this habitat for bobwhite.

- Consolidation of cropland by species, farmland leasing, social stigma against brushy field borders, excessive maintenance mowing, and double cropping have lowered habitat quality and quantity.

Cropland Implementation Recommendations and Opportunities

While the quality of quail habitat provided by cropland acres has changed dramatically in the past, cropland's role as quail habitat can and will continue to be important in attempts to manage and maintain quail numbers. Following are recommendations that benefit bobwhite quail and early successional wildlife in farm landscapes where cropland acres occur.

- Identify Opportunities – Develop state and physiographic region data on percent of cropland acres that offer good, moderate or little potential for improvement (Roseberry and Sudkamp 1998). In some parts of the Southeast this will show dramatic declines in cropland because of conversion to pine, grass monocultures and other uses. This information will guide selection of focus areas for habitat improvements.

- Promote No-Till Farming – Work with the Natural Resources Conservation Service to promote no-till farming practices which are currently recognized for their water quality benefits and economic advantages. No-till offers young broods critical food and cover resources not afforded by conventional cultivation. Farming systems comprised of no-till fields with field borders of native grasses or natural vegetation provide optimum bobwhite nesting and brood habitat.

- Establish Conservation Buffers - A major initiative, launched in the late 1990's, included cooperative efforts of state, federal and NGO natural resource organizations, business and industry and private landowners. Various programs and incentives (Continuous CRP, CREP, standard CRP) involving both federal, state and private monies have been used to take cropland out of production and establish cover along streams and field drainage systems. These practices should reduce soil erosion and improve water quality and wildlife habitat. By September 2001, almost 4,000,000 acres of conservation buffers (waterways, filter strips, riparian buffers, field margins) had been established nationwide. Unfortunately much of this acreage is either outside the bobwhite range or is allowed to develop into late succession vegetation communities that do not provide habitat conducive to early succession wildlife. More work is needed in this effort to maximize the benefits for quail and other early successional wildlife.

- Encourage Edge Management

    1. Wildlife Field Borders – Field borders of volunteer natural or planted vegetation can offer multiple benefits including improved water quality, habitat for a variety of wildlife, and in some cases economic benefits to landowners. Characteristics of field borders productive of bobwhite include sufficient width to conceal nests (usually over 15 feet and optimally 30 feet), and vegetation of sufficient height and density to provide screening from aerial and ground predators, but open enough at the ground to allow bobwhites to travel through it. Field borders require periodic disturbance to control trees, which shade out groundcover, remove the litter from the soil surface, and manage vegetation density.

    2. Fencerows/Hedgerows – One currently overlooked area is the edge where cropland meets timber and/or fencerows. In many instances a current "soft" edge is lacking, either because of an over mature woods edge or fencerow/hedgerow being too large, with not enough brushy cover at ground level. A program to promote fencerow and field edge thinning and management to maintain early succession plant communities would be beneficial.

        - Establish a Set-aside (flex fallow) Program - Habitat availability on cropland is dynamic. Usable space-time (Guthrey 1997) grows as crops reach sufficient size to promote overhead cover and shrinks as fields are harvested and prepared for the next crop. The exception to this rule is when no-till crops are planted into standing small grain stubble. A strategy to provide a significant acreage of fallow lands across landscapes dominated by cropland would provide refuges allowing birds to more efficiently exploit cropfields as they become available. Retiring cropland acreage for a two or three year period will provide quality nest and brood habitat. Cover could be a light seeding of oats, wheat, lespedeza or natural revegetation which remains undisturbed from one to three years.

        - Designate Focus Areas - Bobwhites are one of numerous bird species to exhibit "area sensitivity". Resources provided by isolated habitat patches in a landscape dominated by expanses of low quality or non-habitat are seldom

available to bobwhites (e.g. isolated crop fields in a landscape dominated by closed canopy forestland). Focus areas should be prioritized and efforts concentrated in those regions offering the best opportunity for increasing habitat on a significant scale. Factors considered in selection of priority areas should include focus area size, cropland acres, crop types, field sizes, farmer/landowner interest, and opportunities for networking. Guthrey (2000) speculates that a minimum of 2,000 to 4,000 acres of useable habitat is required to maintain a viable bobwhite population based on models which include weather and harvest variables. Focus areas should be implemented with an adaptive resource management perspective to allow refinement of acreage, habitat, and population goals.

- Discourage Summer Mowing – Implement a media campaign to encourage alternatives (e.g. spot herbicide treatments, late winter mowing, etc.) to summer maintenance mowing during the critical nesting and brooding season.

- Increase Interaction with the Farm Community – To be successful in making significant changes in farming practices (e.g. No-till, summer mowing, and field borders) we must work closely with farmers, landowners, farm agencies, and lawmakers at the local, state, and national level. Developing an effective working relationship with all these groups will be critical to success of the plan.

Evaluation of Assumptions

Develop remote sensing capability to identify coarse habitat changes over time.

LITERATURE CITED

Dailey, T.V. 1989. Modeling bobwhite quail habitat relationships on 4 central Missouri wildlife management areas. Missouri Department of Conservation, Federal Aid in Wildlife Restoration Project W-13-R-43, Final Report.

Guthrey, F.S. 2000. Viability of northern bobwhite populations. J. Wildl. Manage. 64(3): 646-662.

Guthrey, F.S. 1997. A philosophy of habitat management for northern bobwhites. J. Wildl. Manage. 61:291-301.

Palmer, W.E., J.R. Anderson Jr., P. T. Bromley, and K. M. Puckett. 1996. Crop production impacts to bobwhite quail. 1996. American Society of Agronomy - Crop Science Society of America Annual Meeting, Indianapolis.

Roseberry, J.L., and S.D. Sudkamp. 1988. Assessing the suitability of landscapes for northern bobwhite. J. Wildl. Manage. 62(3):895-902.

GRASSLANDS (PASTURE/HAYLAND/RANGELAND)

Stephen Capel, Virginia Department of Game and Inland Fisheries, 4792 Anderson Highway, Powhatan, VA 23139

Roger D. Applegate, Kansas Department of Wildlife and Parks, P.O. Box 1525, 1830 Merchant Street, Emporia, KS 66801-1525

Stephen J. DeMaso, Texas Parks and Wildlife Department, 4200 Smith School Rd, Austin, TX 78744-3291

William C. Hunter, U.S. Fish and Wildlife Service, 1875 Century Blvd., Atlanta, GA 30345

Ecology and Status

History

Grasslands were important habitat for bobwhites across their range in pre-settlement times. In the East, the grasslands were primarily savannas, and in the Midwest and Great Plains, the vast native prairies sustained quail populations ranging from fair to excellent. Over the past 300 years, 4 factors teamed up to reduce the quality and quantity of these grassland habitats: 1) continuous grazing livestock operations of the new European settlers, 2) tallgrass prairie conversion to cropland, 3) fire suppression permitting woody invasion and 4) the introduction of exotic grass species.

Native grasslands evolved with intermittent grazing by bison and elk. Those grasslands further west were also grazed by pronghorn. Native Americans periodically burned the grasslands, especially those in the east. The European settlers brought a different approach to husbandry that confined the livestock and introduced continuous grazing. This pattern reduced the vigor and shifted species composition to increasers and invaders. The end result was a stand that was less desirable bobwhite habitat.

Savannas throughout the East were quite important to bobwhites, offering an excellent interspersion of woody and grassy cover. Fire suppression permitted a denser, invasive growth of fire-intolerant hardwoods while lessening the competitive advantage of such fire-tolerant species as longleaf pine and oak. Thus with fire suppression, the savannas gave way to dense hardwood and mixed pine-hardwood stands with little herbaceous understory. Further west on the Great Plains, fire suppression permitted a deterioration of the grasslands with shrub and cool season grass invasion. At first, the addition of shrubs to the prairies increased quail numbers. However, over time, intensive grazing combined with fire suppression to bring about a decline in quail populations as brush and exotic cool season grasses increased; thus the grasslands deteriorated as quail habitat.

In the East and especially in the Midwest, prairie soils held outstanding crop production potential, and the vast majority of the tallgrass prairies (*Andropogon, Panicum, Sorghastrum* dominated) were put into agricultural production, reducing quail habitat dramatically in the "corn belt." With the exception of a few tallgrass prairies that existed over very shallow rock strata and isolated relicts, the tallgrass prairies of old now produce the country's corn, milo and soybeans, not quail and other grassland birds. Similar, but less extensive conversion has occurred in midgrass prairies (*Schizachyrium, Boulteloua)* except where center-pivot irrigation has been developed. Other prairie and oak-tallgrass savanna sites met similar fates in more localized situations like the Shenandoah Valley of Virginia, the Blackland area of Mississippi and Alabama, scattered islands in Tennessee, Grand Prairie in Arkansas and the Pennyrile region of Kentucky. These smaller prairie islands supported some of the largest bobwhite populations of presettlement times in those states.

Another change in the grasslands of bobwhite range that has had a marked impact on quail populations is the tremendous acreage of cropland and degraded grassland that has been reseeded to exotic forages, such as tall fescue (*Festuca arundinacea*), bermudagrass (*Cynodon dactylon*), Caucasian bluestem (*Bothriochloa bladhii*), weeping lovegrass (*Eragrostis curvula*) and a host of other exotic forages. These are mostly dense sod-formers that produce habitat inhospitable to quail. The switchover from crop fields and native pastures and hay meadows to the exotic grasses accelerated dramatically in the 1940s as tenant farmers moved to the cities, and landowners in many cases seeded the numerous small fields to tall fescue.

The season-long grazing that Europeans introduced to North American grasslands created an increased propensity to overgraze a parcel. Whereas bison moved through an area, often utilizing forage completely and moving on, fencing and continuous grazing more often than not left livestock confined to limited forage areas with long-term overutilization occurring. This weakened stands and opened prairies to invasion, encouraged increaser (less desirable) forages and certainly reduced the value of these grasslands to bobwhites.

Native grasslands vary dramatically across the bobwhite's range and are found from Florida to west Texas, and north up to Nebraska. As a consequence, this group will be broken down into several sections to address the widely different issues. Figure 1 illustrates the various physiographic regions that are typically represented by unique species of vegetation in the various prairies.

Tame pastures vary from tall fescue, bermudagrass, smooth brome (*Bromus inermis*) and Caucasian bluestem, with many other species in the Deep South also included. They all have one thing in common--they are planted in basically dense, monoculture stands, with little diversity to meet wildlife habitat needs.

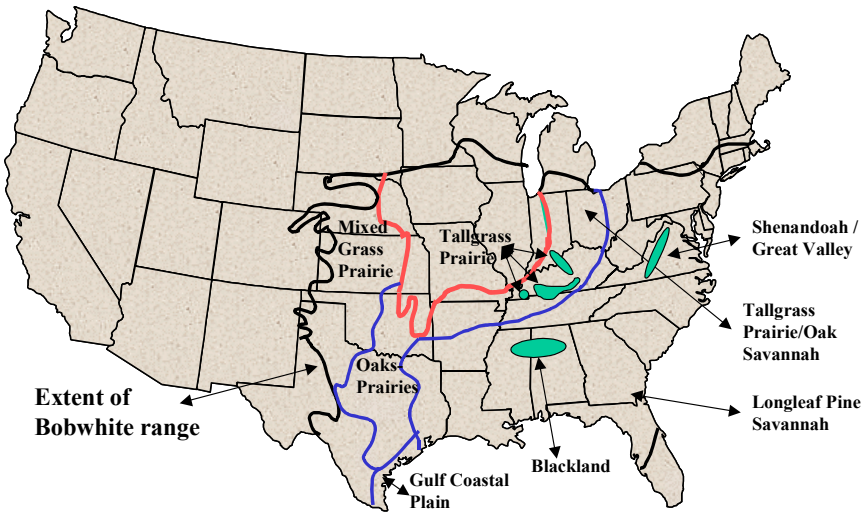


Figure 1. Northern bobwhite range and grassland regions.

GRASSLANDS AS BOBWHITE HABITAT

Broomsedge Meadows—perhaps the premier quail nesting cover over the years

Grasslands in the southeastern portion of bobwhite range in the first half of the 20th century were mostly broomsedge (*Andropogon virginicus*) meadow horse and dairy pastures and hay meadows. These were the primary bobwhite nesting and brood-rearing habitats. Quail hens had quality nesting habitat any direction they turned.

During the last half of the century the majority of broomsedge meadows were converted to loblolly pine plantations, were plowed and added to adjacent cropland acres or were converted to or invaded by exotic forages.

Where they still exist, broomsedge hay meadows *can* still be fine quail habitat. However, a high percentage of broomsedge pastures and meadows have been invaded by tall fescue, which has filled in the bare ground between broomsedge plants. This has rendered these formerly high quality habitats almost useless to quail. Quail have difficulty moving through this dense vegetation. Leading chicks to good brood habitat takes a toll as young chicks struggle through this dense vegetation. As a consequence, hens typically select alternate nesting habitats, resulting in reduced nest success.

Peninsular Florida Grasslands

Although pine flatwoods often are recognized as among the most important natural habitats supporting bobwhites in Florida, it is the dry prairies and savannas found historically through much of Peninsular Florida, mostly between the Ocala National Forest and Lake Okeechobee, that likely supported important bobwhite habitat, where trees were naturally sparse. In fact, dry prairies are essentially flatwoods in terms of grassy and herbaceous species dominating the ground cover, but with trees essentially absent (Abrahamson and Hartnett 1990). Among the most important grass species are wiregrass (*Aristida stricta*), bottlebrush three-awn, arrowfeather (*Aristida purpurascens*), broomsedge, and lovegrasses (*Eragrostis* spp.). These grasslands are often mixed with saw palmettos (*Serenoa repens*) and scattered patches of low shrubs including fetterbush (*Leucothoe racemosa*), blueberry (*Vaccinium* spp.), and wax myrtle (*Myrica cerifera*). The density of shrubs is dependent on the frequency of fires, which historically were ignited mostly by lightning during the growing season.

Florida dry prairies are characterized by low and flat topography, and relatively poorly drained, acidic, and sandy soils. These habitats outside of some large patches managed as public lands have been mostly lost through disruption of fire regimes, heavy grazing pressure, and conversion to other land uses including cool-season "improved" pastures, agriculture, and development. Therefore, in addition to being important bobwhite habitat, a number of endemic species associated with dry prairies are now imperiled. In fact, dry prairies in Florida are among the least adequately protected of natural communities in Florida, a state that is relatively progressive in protecting natural ecosystems.

Tallgrass Prairies

In the more eastern oak-tallgrass mosaic prairie, woodland peninsulas frequently dissect the prairies, placing the entire mix of quail habitat needs in close proximity. As the prairies become more extensive to the west, the distance between woody draws increases, and quail populations are proportionately somewhat lower on a per acre density.

Native grasslands in the majority of bobwhite range today are found west of the Mississippi River. In the higher rainfall regions, these are tallgrass prairies characterized by big (*Andropogon* gerardi) and little bluestem, indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and eastern gamagrass (*Tripsacum dactyloides*) with a rich array of complimentary forbs, including perennial sunflowers (*Helianthus* spp.), coneflowers (*Ratibida* spp.), gayfeathers (*Liatris* spp.), *Aster* spp, *Silphium* spp., prairieclovers (*Petalostemum* spp.) and other forbs. Tallgrass prairie offers quail excellent nesting and brood-rearing cover with overhead protective cover, while remaining open at ground level. Broods can readily move through this cover and capture the abundant insects supported by the diverse plant community. Loafing and escape cover was usually confined to the shrubby and woody draws, thus confining quail to the grasslands close to these coverts.

Specific Problems

- The plow has been the greatest enemy of tallgrass prairies. The rich, black soils of Ohio, Indiana and Illinois producing bumper crops of corn and beans attest to that--almost all of these crops are grown on former tallgrass prairie sites. Intensive efforts to protect remaining prairies in these regions will definitely benefit bobwhites.

- The removal of fire from the landscape has been a major factor in the declining health of tallgrass prairies, especially in eastern prairie "islands" and remnants, where succession progresses rapidly in the absence of fire. Brush and cool season grasses have invaded these once luxurious prairies. The larger expanses of tallgrass prairie that remain today in overall good shape (Flint Hills and Osage Prairie) are areas where the tradition of annual spring burning has been continued by local ranchers through the years. However, in the last decade in the Flint Hills and Osage Prairie there has been a shift toward annually burning extensive areas of prairie resulting in the elimination of residual nesting cover.

- Fencing that permitted more intensive, year around grazing has dramatically reduced the condition of these pastures as increaser and invader species have replaced the typical tallgrass plant community. Bluegrass (*Poa* spp.), three-awn, dropseed (*Sporobolis* spp.), ironweed (*Vernonia* spp.), goldenrod (*Solidago* spp.), and numerous other increaser species now dominate expanses of grasslands that were formerly tallgrass prairie. The vigorous tall grasses that characterized these prairies are gone or depressed, and their quality as quail habitat is equally depressed.

- Tall fescue came on the scene in the 1940s, and became the "cure-all" for many farmers. Rough, eroding cropland was seeded to fescue. Broomsedge horse pastures were converted to tall fescue. Tall fescue was relied on by conservation agencies as the cure-all reseeding species. Unfortunately, tall fescue forms a dense sod, and quail, especially newly hatched chicks, find it difficult to travel through. It also supports low insect numbers which chicks rely on. Tall fescue also has an invasive habit that reduces the quality of many remaining grasslands, especially old broomsedge fields. Fescue tends to fill in the bare ground between broomsedge clumps. In the Flint Hills, and especially the Osage Prairie, tall fescue was interseeded into native bluestem prairie. In these areas the fescue dominates the pasture because it is less preferred forage than bluestems. Other exotic forages such as bermudagrass, bahia (*Paspalum notatum*) and Caucasian bluestem exhibit the same characteristics as tall fescue.

- Prescribed burning that once maintained extensive savanna sites in the Coastal Plain has been vastly curtailed. As a consequence, timber stand densities in the woodlands today are much higher, reducing sunlight reaching the forest floor. This has virtually eliminated the herbaceous layer from existing Coastal Plain forests, changing savannas to densely stocked woodlands uninhabited by quail. It also permitted the trees to invade the grassy openings.

- In recent years, concerns for smoke management have reduced the use of prescribed burning.

- Restrictive burning laws make use of prescribed burning to maintain grasslands needlessly difficult.

- Haying dates for tame forages such as tall fescue, orchardgrass (*Dactylis glomerata*), smooth brome and others fall in May and early June. First nesting attempts in these cover types are almost universally destroyed during the haying operations. Native prairies are advantageous because they are typically hayed in July, after the peak of hatch, allowing a much greater chance of successful hatch and chick survival.

- Grassland restoration is hampered by a lack of native grass planting equipment. In many states, the only such equipment is housed at experiment stations or research facilities. Native grass/forb seed is often expensive and short in supply. Harvesting equipment for seed is also expensive and difficult to obtain. These create difficulties with obtaining sufficient appropriate native seed to meet the demands for CRP, grassed terraces, field/riparian borders, etc.

- Native grass restoration in the East has been hampered by a lack of reliable techniques. This has tended to give native grasses a poor reputation among farmers and conservationists in the Southeast.

- There is so little original native range or savanna remaining in the southeast that knowledge of proper management is lacking in the land management community. Remaining native grasslands in Missouri, Kansas, Nebraska, and Oklahoma are becoming scarce and highly fragmented. East of the Mississippi River there is a lack of appreciation for the quality of forage and the place of native forages in livestock operations and appropriate stocking rates or rotations that enhance quail cover.

- Federal farm programs have typically and traditionally mandated clipping/mowing during the height of the nesting season for weed control. This has the identical impact on quail nesting as does haying tame grasses--a guaranteed disruption in the nesting effort.

- Brush control operations tend to reduce the value of the grasslands to quail by placing escape cover at excessive distances. Studies in Kansas have shown that brush or old field type cover is crucial to enhancing winter survival of quail. Brush control in Texas has had mixed impacts on bobwhites, depending on the approach taken.

Grassland Recommendations and Opportunities

Grasslands were once a bastion of quail populations, either as extensive prairies or as understory savannas. European land management techniques did not fit well with the ecology of North American grasslands, and grasslands have been declining in condition and acreage ever since settlement. The pendulum has now swung too far, and there is now an over-reliance on tame forages. This presents an opportunity to promote native forages and educate landowners in their management. Adding native forages back into the mix presents an economically viable approach. There is an opportunity to make inroads in pasture and range management, especially

in the mid-South (Kentucky, North Carolina, Tennessee, and Virginia) using native grasses to improve summer grazing performance.

Burning

1. Encourage state legislatures to adopt "right-to-burn" and Certified Prescribed Burn Manager laws.
2. Education is a major factor in regaining the ground lost due to recent mishaps in prescribed burning in the West. Smoky the Bear is as dominant now as in the past, yet some areas of the Great Plains are experiencing overuse of prescribed burning.
3. Some selective herbicides have come on the market in recent years that offer viable alternatives to the use of prescribed burning *for some applications*. For example, Plateau® and Roundup® can remove tall fescue from broomsedge meadows. Careful evaluation of new herbicides and their impact may point to alternatives to fire in some situations.
4. Prescribed burning of grasslands generally does not produce the volume of smoke that other prescribed burning does, e.g. site prep burns (Southern Forestry Smoke Management Guidebook. 1976. USFS General Tech. Report SE-10). This fact needs to be emphasized in any discussions of smoke management and smoke problems.
5. Prescribed burning old fields in the upper South often reveals latent prairie that responds dramatically to the fire. This is just one example of the use of fire in quail habitat restoration.
6. In the ideal world, all tall and midgrass prairies would be burned at least once every three years. In areas, such as the Flint Hills, where extensive annual burning is eliminating nesting cover, alternate burning/grazing systems need to be developed and tested.
7. Fire frequency needs to be better understood. Excessive (annual) fire frequency can be as bad as infrequent fire or elimination of fire. The best nesting cover is residual grass, which is eliminated by annual burning. Nesting cover is reduced or eliminated as fire frequency increases.

Native Warm Season Grass Planting

1. Specialized equipment needs to be readily available to landowners if native forages are to be planted widely. Since an individual landowner may only plant these species once or very occasionally, public entities are probably the best way to assure that such equipment is available to them. Partnerships between federal, state and local agencies, private conservation groups such as Quail Unlimited, Ducks Unlimited, National Wild Turkey Federation, and others can spread the cost of these expensive drills over a broader constituency.
2. In order to increase the percentage of livestock operators utilizing native grasses in their operation, a major educational effort should be conducted. This should demonstrate their value in drought-proofing an operation, and increasing productivity and palatability. The Southeast is not immune to drought. USDA has repeatedly provided drought emergency funding for Southeast livestock producers when USDA could have achieved the same result by encouraging the adoption of native grasses in the pasture “mix.” This includes providing a 2 year “rent” while the native grasses are being established.

3. Conservation agencies should be encouraged to utilize native grasses in place of exotics in conservation programs and their practices such as CRP, Wetlands Reserve Program, filter strips, field borders, riparian buffers, circle irrigation corners, etc.
4. Recent research and advances in developing more selective herbicides has improved native grass establishment success. Use of Plateau® or Roundup® followed by a prescribed burn to remove competition and provide a suitable seedbed has greatly improved stand establishment.
5. Provide incentives (cost-share) for conversion of cool season pastures and hay meadows to native warm season grasses. Especially support such provisions in the federal farm programs. Landowners still lose one to two years of grazing while the conversion takes place. The loss in something that most can not endure.
6. Encourage use of native grass mixtures in the establishment of new or renovation of existing hay meadows. Most native grass haying dates are in July, after first nesting efforts have been completed. The forage quality of native grass mixtures is equal to or exceeds that of exotics as well and should be emphasized.
7. Availability of native seed stocks needs improvement. If necessary, state/federal/private partnerships could invest in harvesting equipment for supplying additional seed at-cost.
8. Promote incentives in the 2002 Farm Bill that will allow landowners to convert fescue to native grass pastures using the technique studied at Kansas State University (unpublished data) that calls for withdrawal of fertilizer and grazing, followed by spring burning, and return of light-moderate cattle stocking. This eliminates the need to purchase herbicides and native plant seeds in this particular setting. This technique is applicable where the fescue pastures were established by overseeding weakened native range (tallgrass prairie-woodland interface).

Grassland Conversion

1. Discourage the conversion of existing grasslands/rangelands to cropland and non-agricultural uses.
2. Encourage regulations for participation in such programs as CRP that do NOT create an incentive to bring native range into production only long enough to establish a cropping history or base.
3. Support the Grassland Reserve Program as proposed for inclusion in the Farm Bill legislation. Pursue a CRP program change to eliminate or modify the "51% rule" so a greater percentage of grassland would have to be improved for wildlife for CP10 re-enrollments.
4. Promote restoration of fescue pastures utilizing newer, selective herbicides and prescribed burning.

Grassland Aspects To Consider In Bobwhite Management

1. Blocks of grasses tend to be less predation prone than strips.
2. Inclusion of forbs in a native grass mix improves food (seed and insect) availability.
3. Livestock forage planting rates (7-8# PLS/Acre) are higher than rates where wildlife is the primary consideration (5# PLS/Acre is fine).
4. Quail nesting in residual grasses need adequate bare ground for movement.
5. Grazing pressure should leave at least 300 nest sites/acre to reduce predation exposure.

6. Stubble heights (grazed or hayed) should be a minimum of 9".
7. A native grass stand is most likely inadequate if invaded by exotics.
8. Burn frequency varies, but in most of bobwhite range, once every 3 years is a reasonable frequency.
9. Where annual rainfall is less than 25 inches, the lack of bare ground is rarely a factor in quail management.
10. In the Southeast, a 25% of forage base in native grasses is a reasonable balance.

LITERATURE CITED

Abrahamson, W.G., and D.C. Hartnett. 1990. Pine flatwoods and dry prairies. Pages 103-149 in R.L. Myers and J.J. Ewel, eds., Ecosystems of Florida. Univ. of Central Florida Press. Orlando, FL. 765 pp.

SOUTHERN PINE FORESTS

Breck Carmichael, Wildlife and Freshwater Fisheries Division, South Carolina Department of Natural Resources, P.O. Box 167, Columbia, SC 29202

Reggie E. Thackston, Wildlife Resources Division, Georgia Department of Natural Resources, Rt 5, Box 180, Forsyth, GA 31029

Ecology and Status

In the South, there are more acres of timberland than cropland and pasture combined. Approximately one-half of this timberland area (~ 89 million acres) is comprised of pine types, which includes pine plantations, natural pine and mixed pine-hardwoods (USDA, 1988). The large amount of land-area dominated by pine forests renders this habitat extremely important to bobwhite quail across the region. Locally, pine forests may be the only habitats available to bobwhite.

Unfortunately, due to a variety of factors, most southern pine forests are only marginally suitable for habitation by quail, or not suitable at all. Within pine plantations, high stocking rates, short rotations, lack of openings, a lack of prescribed burning, and changes in pre-plant site preparation methods have all contributed to a degradation of habitat quality for bobwhites (Brennan 1991). Many mixed pine hardwood stands resulting from natural succession have matured, developed closed canopy overstories and hardwood midstories that have shaded out understory vegetation, and greatly reduced habitat quality for quail and other early successional species.

Over the last two decades, the conversion of croplands to pine plantations within landscapes already dominated by forest cover has taken place on a broad-scale through federal government cost-share programs such as the Conservation Reserve (CRP) and the Forestry Incentives Program. Biologists in the Southeast have noted that crop fields established in pine are characterized by low diversity of understory plants compared to traditional clearcut and naturally regenerated or planted sites (Carmichael 1997). Bobwhites and other early successional habitat dependent species simply cannot thrive in these areas.

Pine Forest Management Types

The Society of American Foresters (SAF, 1980) recognizes ten forest cover types within the southern yellow pines group, and five cover types within the oak-pine group. For the purposes of bobwhite management, these can be combined into three basic categories: Longleaf-Slash, Loblolly-Shortleaf and Oak-Pine. The following descriptions are taken from SAF (1980).

Longleaf-Slash - Longleaf pine comprises a majority of the trees in the overstory, and within its range slash pine may grow in association. Both longleaf and slash may occur on a variety of sites from dry sandy ridges to poorly drained flatwoods. Common woody associates may include dogwood, southern red oak, blackjack oak, water oak, sweet gum, gallberry, saw

palmetto and others depending on geographic location and site characteristics. Ground cover composition is typically bluestems, panicums, wiregrass, and asters, as well as partridge pea and other legumes.

Historically, longleaf pine forests covered an estimated 92 million acres, stretching from Southeast Virginia to east Texas (Frost 1991). Today, less than 4 percent of the original longleaf acreage remains, and much less represents an intact, functioning longleaf ecosystem (Johnson and Gjerstad, 1998). Longleaf pine lends itself particularly well to management for bobwhite quail, due to the tree's more compact growth habit and compatibility with prescribed burning.

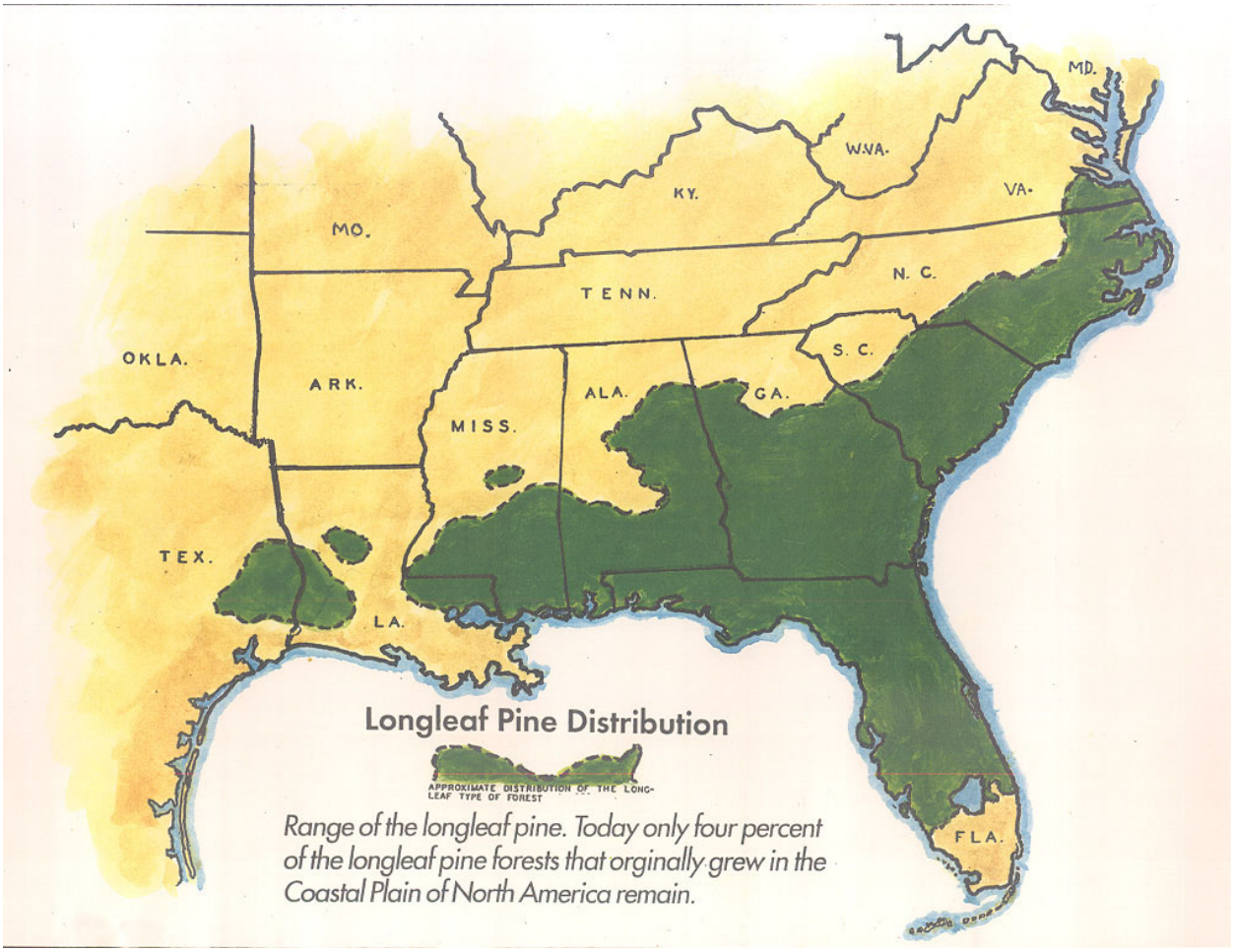


Figure 1. Historic range of longleaf pine.

Loblolly-Shortleaf - This type is composed of either pure stands of loblolly pine, or mixtures with shortleaf and/or other species. Pure shortleaf stands are rare. Associates are many, with sweetgum being one of the most common. Others include hickories, white and southern red oaks, red maple, water oak and yellow poplar. Woody understory species include beauty berry, yellow jasmine, sumac, grapes and japanese honeysuckle. Throughout the range, herbaceous ground cover is usually sparse because of heavy shading. Pure plantations of loblolly are broadly distributed, especially on industrial paper company lands, and on other private holdings

where croplands have been converted to pine. These habitats are quite difficult to manage for bobwhite if maximum fiber production is the primary land-use goal.

Oak-Pine - Subtypes are longleaf pine-scrub oak and loblolly pine-hardwood associations. The longleaf-scrub oak community tends to occur exclusively on droughty, infertile soils. The scrub oaks include turkey, blackjack, bluejack and sand post oaks with persimmons, sumacs and hawthorns sometimes present. Herbaceous ground cover is sparse but may include wiregrass, bluestems, milkpeas and panicums.

The loblolly pine-hardwood type is ubiquitous, occurring on a wide range of sites. Loblolly usually comprises 20% or more of the stocking. Typical associates range from sweet bays, swamp tupelos and magnolias on moister soils to various oaks and hickories on uplands. Understory species may include dogwood, gallberry, blueberry, honeysuckle and yellow jasmine. Herbaceous ground cover is usually sparse and succession favors the hardwoods.

Success of bobwhite management within the oak-pine types is highly dependent upon burning or mechanical disturbances, usually combined with selective removal of hardwoods. Oak-pine forests are usually viewed more as "deer and turkey woods" than quail management opportunities.

Southern Pine Forests as Bobwhite Habitat

Pine forests in the South historically provided moderate to excellent habitat for quail, both in the nesting season and as winter range. Low-intensity silvicultural practices, frequent "controlled" burning and widespread free-ranging of livestock insured high understory plant diversity and a frequent disturbance regime. In the last 40-50 years, demand for wood fiber and higher profits have led to increasingly intensive forest management. Use of prescribed fire has greatly diminished and livestock have been removed to improved pastures. Forests have become dense and are poor quail habitat (Rosene 1969).

Specific Problems

- Although professional foresters have begun to prescribe lower density initial stocking rates for pine plantations, planting rates of 700-900 trees per acre are still not uncommon. This results in rapid canopy closure and very low to zero ground cover for bobwhites. Even stands with stocking rates of 500 trees per acre rapidly close canopy.

- Conversion of croplands to pine plantations continues, especially in areas already dominated by forest cover.

- Many pine plantations are not thinned. Of the stands which are thinned, the frequency and intensity of thinning is insufficient to elicit a positive bobwhite habitat response.

- Use of prescribed burning has greatly declined, primarily due to smoke-management liability issues.

- There are more than 5,000,000 acres of CRP pine stands that can be improved for quail and other wildlife. The 50-point Environmental Benefits Index, established under the 1996 Farm Bill requiring 15 to 20% openings, thinning and prescribed burning has the potential to greatly enhance this habitat type. However, these stands were exempted from the thinning requirement during the first three years of the CRP contract. At present most of this acreage has not been thinned and burned at the intensity necessary for substantial improvement in habitat conditions.

- Improved varieties of loblolly and slash pine are the regeneration species of choice, even on longleaf sites and areas that formerly grew oak-pine associations.

- Pine rotations are becoming shorter due to rapid growth of improved seedlings, weed competition control and fertilization of established stands. These intensively managed, short rotation stands rarely reach sufficient age to "open-up" and begin to produce bobwhite habitat.

- Pre-plant site preparation techniques have evolved away from mechanical means towards almost exclusive use of herbicides. Tank-mixes of various compounds effectively control most herbaceous and woody understory species until the pine seedlings dominate the site. Clearcuts that formerly could be relied upon to produce bobwhites for 5-7 years post-harvest, now produce no quail at all.

- Best management practices such as the preservation of streamside management zones (SMZ's) are an asset for water quality and may provide some food for bobwhites in the form of hard mast. However, some biologists theorize that SMZ's also act as "ecological traps" rendering quail and other edge species more vulnerable to predation from hawks, owls and other predators utilizing the SMZ's as travel corridors.

- Raking pine straw and marketing it for mulch has become lucrative resulting in pine stands with clean understories.

Assumptions

Detailed below are the assumptions used in estimating quail population levels and calculating quail population response to habitat improvement within southern pine forests. These estimates are made based on current research and general observations by wildlife biologists and managers across the South. The actual response will vary depending on site-specific ecological conditions coupled with the landscape context.

- Closed canopy pine forest with no thinning and prescribed burning, where suitable habitat is ephemerally provided by regeneration areas and natural disturbances: base quail population is estimated at 1 covey per 1,000 acres.

- Pine forests with moderate thinning (20% to 30% sunlight) and infrequent burning (4 to 6 years) = 4 coveys per 1,000 acres, or net quail response of 3 coveys per 1,000 acres over base level in this management scenario.

- Pine forests with heavy thinning (40% to 60% sunlight) and frequent burning (2 to 3 years) = 8 coveys per 1000 acres, or net quail response of 7 coveys per 1,000 acres over base level in this management scenario.

- Pine forests with heavy thinning, frequent burning, and 15% to 20% fallow openings = 12 coveys per 1000 acres, or net quail response of 11 coveys per 1,000 acres over base level in this management scenario.

Population and Habitat Objectives

Broad population objectives should be to restore population densities to an average of one bird to 10 to 20 acres across the southern pine forest type, which would approximate quail population levels that existed in 1980. This will maintain population viability while facilitating increases in quail populations on those lands where quail are part of the management objective.

The state wildlife agency habitat objective for quail on public and private lands should be the maintenance of quality ground cover conditions in new and existing forest stands. The recommended goal is to restore or improve at least four percent per year on public lands and one percent per year on private lands between now and 2025. This should entail the improvement of existing forest stands of all types and establishing additional acreages of longleaf within its historic range. As feasible, long harvest rotations and frequent understory disturbance should be used in the management of all pine forests on public lands. Recommendations specific to longleaf management are consistent with those identified in the Conservation Reserve Program Longleaf Pine Conservation Priority Area Proposal.

Pine Forests Recommendations and Opportunities

Southern pine forests comprise a substantial proportion of the bobwhite's geographic range in the Southeast. If southeastern quail populations are to be restored to 1980 levels then management practices must be implemented to establish and maintain quality understory conditions in southern pine forests. Across this region, Longleaf/Slash, Loblolly/Shortleaf and Oak/Pine are the predominate pine forest types. Within these forest types, the abundance of quail and several priority non-game birds is strongly associated with the structure and composition of the ground layer vegetation. In general, quail are favored by grass, and forb ground cover that develops in open and frequently burned pinewoods, and for the first two to four years following forest regeneration cuts (Landers and Mueller 1986). Management for maximum economic return is not consistent with providing optimum habitat for quail. However, through careful planning timber can be managed for reasonable economic returns while maintaining viable and 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, the establishment and management of openings, and prescribed burning. The specific timing and intensity of practice implementation often varies by forest type, climatic, edaphic, spacial, and temporal conditions. However, there are some general management

guidelines that can be followed to enhance habitat for quail and other early succession wildlife in these habitat types.

Timber Harvest and Regeneration

Forest Management Methods

All-aged and even-aged are the two primary methods of forest management. All-aged management results from harvesting a portion of a timber stand and by selection of individual trees or small groups of trees throughout the life of a stand. The stand will then 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 low overstory stocking levels which enhances ground cover conditions for bobwhite.

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 seed tree, shelterwood, and clearcutting. 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 4 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. Regardless of the method used, management practices must be applied that keep sunlight on the forest floor and frequently set back plant succession to establish and maintain a diversity of grasses and forbs in the understory, while controlling hardwood invasion into the midstory.

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 it's historic range, is better suited to 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; d) it is relatively disease resistant; and 4) it can be burned while in the grass stage (Landers and Mueller 1986). As previously discussed, the longleaf pine ecosystem once occupied approximately 92 million acres of the Southeast but has been greatly diminished due to conversion to other forest types and land uses, and this has contributed substantially to the decline in southeastern 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 greatly 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) that are canopied above with bare ground below. This provides excellent brood range, fall and 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 can vary greatly depending on the herbicide(s) used and the method of application. In general, the use of herbicides that leave legumes, blackberries, and other important quail food and cover plants should be favored over those that control all vegetation. 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.

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 8'x10' or 8'x12' allows for the establishment and maintenance of grasses, forbs, legumes, soft mast producers and other desirable food and cover plants. Additionally, 15% to 40% of each stand should be established in openings of two to five acres in size (Clay Sisson, personal communication). These openings can be managed through combinations of winter discing, prescribed burning, herbicide, 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

When properly applied, thinning can be used in pine stands to improve quail habitat, upgrade timber quality, and provide economic revenue to the landowner. Stands should be thinned to place 40% to 60% of the ground in direct sunlight at high noon. This normally approximates a basal area that is $\geq$25 square feet below the 50-year site index. Heavier thinnings are necessary on infertile soils. Within pine plantations, removing entire rows and then thinning diseased, deformed, and smaller trees within rows is recommended. Regardless of the thinning method used the majority of the ground must be placed in direct sunlight to facilitate the development of adequate food and cover**.**

Rotation Age

The time to harvest and regenerate a pine stand depends on economic, wildlife and aesthetic objectives, pine species present, fertility of the site and overall health of the stand. Where quail are part of the management objective long rotations should be favored. This can be 60-80 years for loblolly, slash, and shortleaf pine, and even longer for longleaf pine, if desired. Long rotations present the manager 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 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 hardwood 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 non-game species that utilize closed canopy hardwoods.

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, due to low fuel loads, it may be necessary to periodically use mechanical or chemical techniques in conjunction with prescribed fire to remove the hardwoods and restore desirable ground cover conditions.

Prescribed Burning

Prescribed burning is one of the most cost effective and efficient tools available for managing both pine timber and quail habitat (Stoddard 1931). 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; and 4) decreases the abundance of invertebrates that parasitize quail. Prescribed burns should be conducted annually with around 30% of the area left un-burned to provide food, nesting and escape cover. Another alternative is to establish permanent firebreaks that create a checkerboard pattern of 10 acre to 50 acre blocks (smaller is better). These blocks can then 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 cycle or longer may be sufficient. On most sites, prescribed burns should be conducted during winter - early spring.

Occasional growing season burns may be needed to control hardwood encroachment into pine stands. More specifically, pine stands established on old agricultural fields have fuel conditions that are best suited to winter-spring 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. Loblolly, slash, and shortleaf stands can usually be burned for the first time when they are 10 to 15 feet tall. Longleaf stands can be burned in their second year when seedlings are still in the grass stage. Timber stands managed under all-aged systems require special consideration for prescribed fire. Prior to prescribed burning, young pine regeneration areas scattered throughout the stand, must be protected by firebreaks. An exception to this is the longleaf pine type where seedlings in the grass stage can and should be burned to control brown spot disease.

Forest Openings, Roads, and Permanent Firebreaks

Idle openings are critical for providing brood range, food and cover for quail. As previously indicated, at least 15% to 40% of each forest stand should be maintained in openings that are two to five acres in size. These openings should be managed by rotational winter discing, planting, burning, herbicides or mowing so that 1/3 to 2/3 of each opening remains fallow each year.

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 pine stands are in the sapling stage. When a stand is regenerated or thinned, roadsides can be widened to 20' to 40' on each side and these areas can be managed as long linear fallow fields as previously described. Roads and firebreaks with a 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 the pine stand.

Opportunities for achieving southeastern pine forest type population and habitat objectives for bobwhites can best be accomplished through:

- Emphasizing habitat management for quail and other early succession species on state wildlife management areas and other public lands including U.S. Forest Service lands.

- Utilizing federal incentive programs such as Forest Stewardship, Stewardship Incentives Program, Forestry Incentives Program, Wildlife Habitat Incentives Program and CRP to focus bobwhite habitat restoration efforts. Strive to retain the Longleaf Pine Conservation Priority Area in the CRP.

- Developing state wildlife agency administered habitat cost-share and incentive programs for private lands that target quail and other early succession species.

- Allocating additional manpower and funding for quail management technical assistance.

- Establishing forestry/wildlife partnership programs with forest industry.

- Allocating at least two wildlife biologist man-years within each state to work at the national, regional, and local level with Federal Agricultural Policy (Farm Bill) development and implementation.

LITERATURE CITED

Brennan, L.A. 1991. How can we reverse the Northern Bobwhite population decline? Wildl. Soc. Bull. 19(4): 544-555.

Carmichael, D.B. 1997. The Conservation Reserve Program and wildlife habitat in the southeastern United States. Wildl. Soc. Bull. 25(4): 773-775.

Frost, C.C. 1991. Four centuries of changing landscape patterns in the Longleaf Pine Ecosystem. In Herman S. (ed.) Proceedings, 18th Tall Timbers Fire Ecology Conference. The Longleaf Pine Ecosystem: Ecology, Restoration and Management. May 30 - June 2, 199l. Tallahassee, Fl. Tall Timbers Research, Inc. 118 pp.

Johnson, R., and D. Gjerstad. 1998. Landscape scale restoration of the Longleaf Pine Ecosystem. Restoration and Management Notes, 16:1 pp 41-45.

Landers, J.L., and B.S. Mueller. 1986. Bobwhite quail management: a habitat approach. Publication No. 6. Tall Timbers Research Station. Tallahassee, Fl. 39 pp.

Rosene, W. 1969. The bobwhite quail: its life and management. Rutgers University Press, New Brunswick, N.J. 418 pp.

SAF. 1980. Forest Cover Types of the United States and Canada. F.H. Eyre, (ed.). Washington, D.C. 148 pp.

Stoddard, H.L., Sr. 1931. The Bobwhite Quail - Its Habits, Preservation and Increase. Charles Scribner's Sons, New York, New York. 559 pp.

USDA. 1988. The South's Fourth Forest: Alternatives for the future. U.S. Forest Service, For. Res. Rep. No. 24, Washington, DC. 512 pp.

APPENDICES A - F

Appendix A.			ca. 1980 BOBWHITE QUAIL HARVESTS														
								BCR									
	Shortgrass	Cent. Mixed	Edwards	Oaks &	Eastern Tall-	Central	West Gulf	Mississippi	SE Coastal	Appalachian		New Engl./	Peninsular	Tamaulipan	Gulf Coast		
	Prairie	Grass Prair.	Plateau	Prairies	Grass Prairie	Hardwoods	Coast. Pl/Ou.	Alluvial Valley	Plain	Mountains	Piedmont	Mid-Atl.Coast	Florida	Brushland	Prairie		% of total
STATE	18	19	20	21	22	24	25	26	27	28	29	30	31	36	37	**TOTAL**	harvest
AL						138,280			898,820	276,560	69,140					1,382,800	0.070
AR						486,008	283,505	40,501								810,014	0.041
FL									316,556				507,682			824,238	0.042
GA									900,000	60,000	240,000					1,200,000	0.061
IL					859,500	95,500										955,000	0.049
IN					21,287	55,395										76,682	0.004
IA					498,228											498,228	0.025
KS	179,702	564,164			337,621	7,623										909,408	0.046
KY						604,372		16,117	104,758	80,583						805,830	0.041
LA							285,040	20,360	61,080						40,720	407,200	0.021
MD											13,391	120,516				133,907	0.007
MS								150,459	1,354,140							1,504,599	0.077
MO					977,516	504,032		45,821								1,527,369	0.078
NE		342,600			335,748											678,348	0.035
NC									483,463	20,237	300,358					804,058	0.041
OH					18,517	500				1,835						20,852	0.001
OK	82,537	1,093,619		412,686	268,246	41,269	165,075									1,980,895	0.101
SC									865,403	10,817	205,533					1,081,753	0.055
TN						524,388		7,491	816,546	149,825						1,498,250	0.076
TX	82,506	333,052	190,103	679,547			73,476							719,672	57,775	2,053,625	0.105
VA									144,863	57,208	211,505					413,576	0.021
WV										52,390						52,390	0.003
TOTAL	344,745	2,333,435	190,103	1,092,233	3,316,663	2,457,367	807,096	280,749	5,945,629	709,455	1,039,927	120,516	507,682	719,672	98,495	19,619,022	1.000
%total harvest	0.018	0.119	0.010	0.056	0.169	0.125	0.041	0.014	0.303	0.036	0.053	0.006	0.026	0.037	0.005	1.018	
IL & IN - 1981 season																	
NC - 1983 season																	
OH - season closed 1979-83; reopened in 1984																	
VA - 1978 season																	

Appendix B.				ca. 1999 BOBWHITE QUAIL HARVESTS													
								BCR									
	Shortgrass	Cent. Mixed	Edwards	Oaks &	Eastern Tall-	Central	West Gulf	Mississippi	SE Coastal	Appalachian		New Engl./	Peninsular	Tamaulipan	Gulf Coast		
	Prairie	Grass Prair.	Plateau	Prairies	Grass Prairie	Hardwoods	Coast. Pl/Ou.	Alluvial Valley	Plain	Mountains	Piedmont	Mid-Atl.Coast	Florida	Brushland	Prairie		% of total
STATE	18	19	20	21	22	24	25	26	27	28	29	30	31	36	37	**TOTAL**	harvest
AL						20,170			131,105	40,340	10,085					201,700	0.030
AR						143,677	51,313	10,263								205,253	0.031
FL									61,265				98,255			159,520	0.024
GA									725,280	45,330	135,990					906,600	0.135
IL					403,750	21,250										425,000	0.063
IN					30,383	69,815										100,198	0.015
IA					169,252											169,252	0.025
KS	176,732	554,830			332,041	7,497										894,368	0.133
KY						216,018		5,761	37,443	28,802						288,024	0.043
LA							25,830	1,845	5,535						3,690	36,900	0.005
MD											1,381	12,425				13,806	0.002
MS								5,555	105,545							111,100	0.017
MO					386,700	113,432		15,468								515,600	0.077
NE		104,700			102,606											207,306	0.031
NC									120,382	7,111	97,471					224,964	0.034
OH					18,000	400				1,600						20,000	0.003
OK	10,283	596,423		102,832	113,115	51,416	154,247									1,018,033	0.152
SC									83,570	983	13,765					98,318	0.015
TN						166,279		1,123	246,048	35,952						449,402	0.067
TX	26,331	195,726	60,653	59,353			8,424							195,726	30,567	550,449	0.082
VA									45,460	13,893	42,804					102,157	0.015
WV										15,717						15,717	0.002
TOTAL	213,346	1,451,679	60,653	162,185	1,555,847	809,954	239,814	40,015	1,561,633	189,728	301,496	12,425	98,255	195,726	34,257	6,713,667	1.000
%total	0.032	0.216	0.009	0.024	0.232	0.121	0.036	0.006	0.233	0.028	0.045	0.002	0.015	0.029	0.005	1.032	
harvest																	

Appendix C. Breeding Bird Survey Trends: 1982-1999

Bird Conservation Region **Trend**

Number	*Name*	*Number of Routes*	*% per year*
18	Shortgrass prairie	44	-2.454
19	Central mixed grass prairie	80	-0.714
20	Edwards Plateau	17	-6.770
21	Oaks and Prairies	57	-3.852
22	Tallgrass Prairie	185	-1.912
24	Central Hardwoods	114	-4.448
25	West Gulf Coastal Plain	65	-8.238
26	Mississippi Alluvial Valley	32	-5.965
27	Southeastern Coastal Plain	227	-5.774
28	Appalachian Mountains	135	-7.692
29	Piedmont	98	-8.352
30	Mid-Atlantic	82	-7.405
31	Peninsular Florida	38	-4.305
36	Tamaulipan Brushland	21	-6.733
37	Gulf Coastal Prairie	22	-4.555

Appendix D. 1997 NRI, land use 1982, acres X 1000, 95% confidence intervals occur to the right of each estimate.

BCR	State	Area	Crop82	Othercrop82	Past82	Hay82	Range82	For82
18	KS	4,936.3	3,772.1	1,233.0	3.5	55.0	919.5	0.0
18	OK	1,178.4	405.3	65.1	1.8	4.1	628.7	0.0
18	TX	19,602.2	10,479.8	530.7	27.8	64.3	8,208.0	0.0
19	KS	29,282.8	17,935.0	3,888.1	140.0	687.4	9,541.7	209.2
19	NE	34,159.5	11,383.9	1,314.7	746.0	1,232.8	19,997.0	342.3
19	OK	16,786.3	8,143.7	472.5	598.4	205.6	6,997.1	180.7
19	TX	22,217.9	6,390.2	334.8	255.1	80.1	14,883.1	0.0
20	TX	8,553.2	546.8	90.5	162.3	12.9	7,454.6	0.0
21	OK	9,943.8	1,370.0	143.1	1,745.1	164.7	4,272.8	1,440.4
21	TX	35,862.1	7,383.9	1,287.7	6,322.1	227.0	18,679.8	76.2
22	IL	27,269.0	19,638.1	175.5	2,173.0	703.3	0.0	2,261.5
22	IN	7,153.3	5,351.5	29.2	408.4	133.8	0.0	505.7
22	IA	27,506.4	19,733.6	89.8	4,039.3	1,721.5	0.0	1,353.0
22	KS	18,063.5	7,203.4	174.6	1,975.7	1,022.0	6,014.3	1,208.0
22	MO	16,994.9	8,740.1	232.4	4,519.8	859.4	12.7	2,122.3
22	NE	7,249.0	5,297.1	70.7	902.6	464.9	151.2	248.8
22	OH	11,904.5	8,260.1	193.7	601.9	411.8	0.0	1,121.5
22	OK	4,407.2	851.8	23.4	749.8	32.1	1,773.7	468.8
24	AL	388.5	200.9	11.7	38.9	12.8	0.0	82.5
24	AR	5,794.4	56.0	2.7	2,004.5	38.5	26.3	2,824.2
24	IL	6,237.4	3,578.0	77.8	781.6	194.3	0.0	1,071.4
24	IN	10,380.4	4,638.8	115.4	1,462.7	396.2	0.0	2,733.2
24	KS	378.2	207.8	0.0	60.0	26.2	21.2	39.3
24	KY	15,398.2	4,596.2	129.1	4,733.1	1,168.6	0.0	4,272.4
24	MO	23,296.5	3,792.3	97.4	7,771.2	1,241.0	130.5	8,479.1
24	OH	1,231.2	499.9	22.3	137.6	75.8	0.0	287.8
24	OK	2,609.3	226.6	8.1	1,020.0	12.6	285.6	850.1
24	TN	7,960.5	1,370.1	68.2	2,210.6	397.0	0.0	3,517.2
25	AR	15,521.4	660.9	55.7	2,653.6	116.7	19.5	8,923.1
25	LA	8,770.4	546.2	33.2	928.8	83.4	0.9	5,851.9
25	OK	9,813.1	571.9	108.2	3,160.2	90.4	1,025.0	3,867.6
25	TX	21,157.4	1,235.5	253.4	7,628.4	74.5	738.3	8,840.9
26	AR	12,721.1	7,384.4	111.3	1,066.9	109.7	0.0	3,153.8
26	IL	291.9	156.5	1.5	30.3	3.7	0.0	55.9
26	LA	8,703.2	3,237.3	331.5	487.2	25.4	0.6	3,833.0
26	MS	3,685.7	2,752.5	30.8	47.3	12.6	0.0	483.5
26	MO	4,322.5	2,467.9	46.8	426.7	62.0	0.0	855.0
26	TN	124.1	84.0	1.8	0.2	1.6	0.0	13.2
27	AL	18,327.1	2,800.8	670.4	1,999.1	128.8	83.2	11,511.4
27	FL	12,564.6	1,191.9	283.9	708.4	63.5	2.7	7,611.2
27	GA	22,183.0	5,671.4	1,192.8	1,061.5	61.6	0.0	12,444.2
27	KY	1,620.2	798.8	18.3	228.9	37.7	0.0	384.7
27	LA	2,537.0	206.4	61.9	445.8	47.7	1.5	1,575.4
27	MS	26,528.9	4,647.4	458.1	3,992.7	197.5	0.0	14,647.7
27	NC	14,769.1	3,564.1	324.8	220.2	23.3	0.0	6,945.0
27	SC	11,106.2	2,679.1	212.6	228.3	66.1	0.0	5,962.3
27	TN	7,328.2	3,068.4	78.8	854.5	134.5	0.0	2,621.7

27	VA	2,611.8	542.1	72.5	37.6	3.4	0.0	1,338.7
28	AL	12,317.0	1,427.4	125.5	1,489.9	93.6	0.0	7,500.7
28	GA	3,108.8	145.5	11.5	364.2	15.0	0.0	1,684.0
28	KY	8,845.0	539.2	43.9	1,100.2	213.2	0.0	5,787.4
28	NC	4,588.4	196.2	33.3	490.4	65.9	0.0	2,148.7
28	OH	9,984.3	2,509.8	194.0	1,896.5	897.8	0.0	4,270.4
28	PA	23,368.2	3,861.2	352.8	2,026.3	1,927.6	0.0	13,911.2
28	TN	11,560.8	1,069.0	108.8	2,312.9	373.1	0.0	5,925.2
28	VA	8,779.5	669.4	43.4	1,672.1	400.6	0.0	3,749.5
28	WV	15,508.2	1,094.8	97.5	1,910.0	775.3	0.0	10,412.6
29	AL	2,391.2	80.0	19.0	263.2	12.5	0.0	1,736.5
29	GA	12,448.7	749.9	138.4	1,559.9	107.3	0.0	7,787.1
29	MD	716.6	301.1	12.6	145.3	69.5	0.0	171.1
29	NC	14,351.8	2,937.6	566.7	1,305.2	251.7	0.0	7,866.1
29	SC	8,833.1	898.5	229.1	1,021.9	62.3	0.0	5,292.9
29	VA	12,473.1	1,798.4	390.3	1,516.4	507.8	0.0	7,447.1
30	MD	6,159.2	1,319.0	132.8	289.5	92.5	0.0	1,737.8
30	VA	3,222.7	387.7	31.7	42.7	8.2	0.0	920.5
31	FL	24,969.1	2,362.9	2,091.9	3,697.5	61.3	4,548.1	5,252.0
36	TX	18,991.1	2,138.2	412.7	670.8	84.5	15,383.1	0.0
37	LA	11,366.2	2,420.6	519.6	484.4	24.2	267.4	2,160.7
37	MS	312.7	16.1	0.0	21.9	0.0	0.0	187.8
37	TX	17,331.5	4,510.1	489.1	2,220.7	113.8	5,756.2	720.9

Appendix E, Table 1. Agricultural land use in 1997 by BCR and State. Acres x 1000

BCR	State	Area	Crop97	Othercrop97	Past97	Hay97	Range97	For97
18	KS	4,936.3	3,124.6	993.2	9.1	47.5	830.6	0.0
18	OK	1,178.4	275.4	12.9	15.5	4.8	592.3	0.0
18	TX	19,602.2	8,248.8	580.3	112.1	40.1	7,980.7	0.0
19	KS	29,282.8	16,507.9	4,139.1	202.8	757.2	9,114.2	230.6
19	NE	34,159.5	11,259.0	1,078.1	650.6	1,260.5	19,619.2	348.8
19	OK	16,786.3	6,846.8	300.4	1,134.5	162.1	6,837.3	200.5
19	TX	22,217.9	4,941.1	459.1	286.2	51.6	15,101.0	0.0
20	TX	8,553.2	491.2	97.6	191.7	7.8	7,342.5	0.0
21	OK	9,943.8	1,174.4	92.4	1,893.6	177.3	3,818.6	1,688.2
21	TX	35,862.1	6,324.0	1,075.9	6,406.9	166.3	18,286.7	117.8
22	IL	27,269.0	19,303.9	93.8	1,634.6	536.9	0.0	2,419.5
22	IN	7,153.3	5,228.8	67.5	315.1	151.4	0.0	494.1
22	IA	27,506.4	18,821.5	45.8	3,160.5	1,492.7	0.0	1,623.7
22	KS	18,063.5	6,693.3	45.0	2,071.4	1,199.5	5,761.8	1,274.9
22	MO	16,994.9	7,865.3	112.5	3,519.0	1,684.1	3.0	2,483.2
22	NE	7,249.0	4,948.3	16.0	802.8	350.3	122.0	263.8
22	OH	11,904.5	7,820.9	127.0	430.0	350.1	0.0	1,152.2
22	OK	4,407.2	812.0	18.3	745.3	34.8	1,667.3	523.4
24	AL	388.5	153.2	13.9	69.6	23.3	0.0	81.9
24	AR	5,794.4	26.4	2.9	1,903.8	23.5	26.4	2,856.2
24	IL	6,237.4	3,327.2	14.8	651.7	235.0	0.0	1,102.4
24	IN	10,380.4	4,617.3	75.0	1,258.5	530.4	0.0	2,756.9
24	KS	378.2	198.1	0.0	67.7	28.7	21.3	40.4
24	KY	15,398.2	4,124.2	31.1	4,162.7	1,619.5	0.0	4,771.7
24	MO	23,296.5	3,434.8	25.9	7,051.2	1,599.8	84.5	9,089.1
24	OH	1,231.2	455.0	4.0	92.5	81.5	0.0	289.6
24	OK	2,609.3	181.1	9.2	1,015.7	6.8	253.8	905.7
24	TN	7,960.5	1,121.1	29.5	1,968.6	626.7	0.0	3,602.5
25	AR	15,521.4	568.2	38.8	2,497.8	105.4	11.5	8,985.1
25	LA	8,770.4	400.3	124.2	906.7	86.8	0.0	5,882.9
25	OK	9,813.1	447.0	51.6	3,285.4	67.2	863.5	3,963.6
25	TX	21,157.4	794.0	147.9	6,345.3	79.4	787.3	9,889.8
26	AR	12,721.1	7,029.9	87.4	970.2	118.4	0.0	3,169.4
26	IL	291.9	144.6	0.0	24.9	2.7	0.0	56.1
26	LA	8,703.2	2,965.1	515.3	531.5	15.7	6.8	3,720.2
26	MS	3,685.7	2,618.6	131.0	42.3	5.2	0.0	465.5
26	MO	4,322.5	2,451.1	58.8	358.6	179.9	0.0	858.6
26	TN	124.1	82.8	0.0	0.0	0.5	0.0	13.2
27	AL	18,327.1	1,725.1	644.2	1,760.8	152.9	73.6	11,970.9
27	FL	12,564.6	610.5	265.5	731.3	65.2	12.8	7,565.8
27	GA	22,183.0	4,268.6	1,389.1	1,080.8	136.6	0.0	12,725.7
27	KY	1,620.2	643.3	7.6	194.7	46.9	0.0	407.1
27	LA	2,537.0	134.7	65.3	436.0	23.0	2.1	1,558.7
27	MS	26,528.9	2,727.7	411.0	3,638.2	392.0	0.0	15,564.0
27	NC	14,769.1	3,358.9	297.7	217.1	144.0	0.0	6,462.1
27	SC	11,106.2	2,067.5	300.8	225.4	77.0	0.0	5,979.5
27	TN	7,328.2	2,526.4	76.9	858.3	312.5	0.0	2,653.8

27	VA	2,611.8	462.5	81.0	49.7	10.8	0.0	1,259.2
28	AL	12,317.0	1,034.0	109.6	1,483.8	106.1	0.0	7,459.2
28	GA	3,108.8	103.1	7.0	361.3	21.3	0.0	1,560.0
28	KY	8,845.0	410.7	2.6	1,444.4	240.4	0.0	5,488.2
28	NC	4,588.4	118.6	22.8	435.8	39.4	0.0	2,036.5
28	OH	9,984.3	2,369.3	42.3	1,393.7	1,103.4	0.0	4,671.7
28	TN	11,560.8	913.7	51.4	2,203.6	542.1	0.0	5,772.3
28	VA	8,779.5	627.9	32.6	1,493.4	478.8	0.0	3,850.7
28	WV	15,508.2	864.4	55.5	1,528.4	696.0	0.0	10,581.5
29	AL	2,391.2	41.4	6.7	232.3	11.7	0.0	1,749.0
29	GA	12,448.7	384.9	84.7	1,444.0	149.5	0.0	7,274.1
29	MD	716.6	280.8	18.7	100.7	92.3	0.0	179.9
29	NC	14,351.8	2,161.8	305.1	1,414.1	401.4	0.0	7,460.2
29	SC	8,833.1	506.7	101.0	976.1	151.4	0.0	5,208.5
29	VA	12,473.1	1,484.5	122.3	1,427.2	783.2	0.0	7,374.7
30	MD	6,159.2	1,180.4	84.0	261.5	94.7	0.0	1,623.5
30	VA	3,222.7	342.6	46.8	29.1	24.4	0.0	831.2
31	FL	24,969.1	2,141.1	2,065.9	3,524.1	39.2	3,215.7	4,970.6
36	TX	18,991.1	1,765.8	348.2	610.3	32.1	15,367.0	0.0
37	LA	11,366.2	2,159.1	1,091.7	547.2	62.1	268.3	2,064.6
37	MS	312.7	6.1	2.2	31.0	3.9	0.0	179.3
37	TX	17,331.5	3,845.6	1,164.3	2,084.2	41.7	5,670.3	808.4

Appendix E, Table 2. Softwood forest land use in 1997 by BCR and State. Acres x 1000.

BCR	State	LongSlash97	LoblShort97	PineHdWd97	Other_for97
18	KS	0.0	0.0	0.0	0.0
18	OK	0.0	0.0	0.0	0.0
18	TX	0.0	0.0	0.0	0.0
19	KS	0.0	0.0	3.8	226.8
19	NE	0.0	0.0	34.5	314.3
19	OK	0.0	0.0	5.8	194.7
19	TX	0.0	0.0	0.0	0.0
20	TX	0.0	0.0	0.0	0.0
21	OK	0.0	0.0	0.0	1,688.2
21	TX	0.0	10.5	40.0	67.3
22	IL	0.0	0.3	7.8	2,411.4
22	IN	0.0	0.0	8.3	485.8
22	IA	0.0	0.0	26.1	1,597.6
22	KS	0.0	0.0	28.4	1,246.5
22	MO	0.0	0.0	41.1	2,442.1
22	NE	0.0	0.0	8.2	255.6
22	OH	0.0	0.0	4.3	1,147.9
22	OK	0.0	0.0	0.0	523.4
24	AL	0.0	5.7	16.8	59.4
24	AR	0.0	17.4	861.6	1,977.2
24	IL	0.0	1.3	10.8	1,090.3
24	IN	0.0	12.1	116.8	2,628.0
24	KS	0.0	0.0	3.3	37.1
24	KY	0.0	32.4	214.0	4,525.3
24	MO	0.0	47.7	1,314.1	7,727.3
24	OH	0.0	0.0	6.7	282.9
24	OK	0.0	0.0	77.9	827.8
24	TN	0.0	58.5	236.4	3,307.6
25	AR	0.0	3,286.2	3,792.9	1,906.0
25	LA	121.5	4,286.0	770.4	705.0
25	OK	0.0	562.6	1,613.0	1,788.0
25	TX	11.4	3,916.8	4,102.7	1,858.9
26	AR	3.3	834.4	487.9	1,843.8
26	IL	0.0	0.0	0.0	56.1
26	LA	16.8	824.1	445.6	2,433.7
26	MS	0.0	0.0	0.0	465.5
26	MO	0.0	1.3	56.1	801.2
26	TN	0.0	0.0	0.0	13.2
27	AL	1,150.4	4,081.5	3,733.9	3,005.1
27	FL	4,340.5	13.8	931.1	2,280.4
27	GA	4,489.1	2,521.8	3,642.9	2,071.9
27	KY	0.0	12.9	1.2	393.0
27	LA	16.2	693.7	175.1	673.7
27	MS	1,213.3	4,643.0	6,309.1	3,398.6
27	NC	121.5	3,169.7	1,532.9	1,638.0
27	SC	337.7	2,108.0	1,754.1	1,779.7
27	TN	0.0	213.7	297.5	2,142.6

27	VA	0.0	499.1	363.2	396.9
28	AL	52.4	2,274.4	2,968.6	2,163.8
28	GA	0.0	46.3	1,487.3	26.4
28	KY	0.0	6.3	419.5	5,062.4
28	NC	0.0	18.6	1,392.3	625.6
28	OH	0.0	51.4	153.1	4,467.2
28	TN	2.8	529.9	1,788.0	3,451.6
28	VA	0.0	1.5	789.7	3,059.5
28	WV	0.0	288.5	422.7	9,870.3
29	AL	15.0	756.2	570.8	407.0
29	GA	16.0	3,048.4	3,634.7	575.0
29	MD	0.0	2.1	13.8	164.0
29	NC	12.6	2,163.6	2,936.8	2,347.2
29	SC	99.6	2,070.0	1,949.4	1,089.5
29	VA	7.0	1,471.7	3,693.5	2,202.5
30	MD	0.9	194.3	490.5	937.8
30	VA	0.0	210.2	422.6	198.4
31	FL	1,953.5	6.9	1,171.6	1,838.6
36	TX	0.0	0.0	0.0	0.0
37	LA	214.0	464.3	330.3	1,056.0
37	MS	93.0	0.0	40.4	45.9
37	TX	0.0	197.1	306.0	305.3

Appendix E, Table 3. Land use in Conservation Reserve Program in 1997. Acres x 1000.

BCR	State	CRP	CRPgrass	CRPtrees	CRPwildlife	Other_ld97
19	KS	1,674.1	1,667.8	4.2	2.1	1,432.4
19	NE	456.9	418.3	8.4	30.2	1,376.6
19	OK	938.4	938.4	0.0	0.0	805.9
19	TX	1,227.3	1,205.5	4.2	17.6	690.7
20	TX	20.5	20.5	0.0	0.0	685.4
21	OK	25.6	25.6	0.0	0.0	1,100.3
21	TX	162.6	145.0	3.1	14.5	4,527.7
22	IL	414.0	385.8	16.7	11.5	3,970.3
22	IN	200.3	189.9	4.8	5.6	1,773.2
22	IA	1,626.4	1,607.5	15.4	3.5	2,626.2
22	KS	458.0	458.0	0.0	0.0	1,549.0
22	MI	78.8	74.4	2.5	1.9	787.7
22	MO	1,345.6	1,306.1	2.2	37.3	1,745.5
22	NE	380.9	362.6	3.5	14.8	707.2
22	OH	239.2	233.2	4.9	1.1	2,308.9
22	OK	5.6	5.6	0.0	0.0	545.0
24	AL	0.0	0.0	0.0	0.0	71.7
24	AR	0.0	0.0	0.0	0.0	415.3
24	IL	305.5	276.1	25.2	4.2	547.5
24	IN	102.5	100.9	1.6	0.0	1,257.1
24	KS	2.6	0.4	0.0	2.2	52.8
24	KY	213.2	202.7	3.2	7.3	1,916.7
24	MO	222.4	210.4	1.0	11.0	1,887.9
24	OH	37.0	36.0	1.0	0.0	345.8
24	OK	3.7	3.7	0.0	0.0	223.5
24	TN	55.3	48.9	5.0	1.4	1,089.1
25	AR	46.8	27.8	16.8	2.2	1,133.1
25	LA	20.4	0.0	10.6	9.8	813.2
25	OK	10.2	9.4	0.0	0.8	739.7
25	TX	58.4	38.9	1.3	18.2	2,428.7
26	AR	183.6	53.7	129.9	0.0	1,130.8
26	IL	6.5	6.2	0.3	0.0	27.6
26	LA	99.6	64.5	33.1	2.0	1,122.3
26	MS	27.7	6.1	20.7	0.9	426.0
26	MO	38.1	34.5	3.6	0.0	340.0
26	TN	0.3	0.3	0.0	0.0	26.1
27	AL	479.0	190.6	288.4	0.0	1,998.1
27	FL	119.9	5.1	114.8	0.0	2,114.9
27	GA	539.6	18.0	482.3	39.3	2,643.1
27	KY	119.0	117.6	0.0	1.4	256.3
27	LA	14.8	6.1	6.8	1.9	397.1
27	MS	768.8	294.6	441.7	32.5	2,212.1
27	NC	17.8	4.8	13.0	0.0	3,859.7
27	SC	204.5	37.7	152.0	14.8	2,094.1
27	TN	312.8	282.8	27.1	2.9	910.9
27	VA	16.7	8.5	8.2	0.0	701.2
28	AL	43.0	10.3	32.7	0.0	1,817.4

28	GA	0.0	0.0	0.0	0.0	436.9
28	KY	0.0	0.0	0.0	0.0	640.3
28	NC	0.0	0.0	0.0	0.0	564.3
28	OH	41.5	39.8	1.7	0.0	1,260.2
28	TN	5.5	5.5	0.0	0.0	1,666.0
28	VA	0.0	0.0	0.0	0.0	821.9
28	WV	0.0	0.0	0.0	0.0	1,324.4
29	AL	0.0	0.0	0.0	0.0	200.2
29	GA	54.9	11.3	39.2	4.4	2,761.0
29	MD	3.1	0.0	3.1	0.0	143.8
29	NC	113.6	40.7	60.3	12.6	3,009.8
29	SC	58.0	21.1	34.7	2.2	1,587.8
29	VA	45.5	21.1	24.4	0.0	1,691.1
30	MD	14.9	13.6	0.4	0.9	2,941.2
30	VA	8.5	7.9	0.5	0.1	1,927.2
31	FL	0.0	0.0	0.0	0.0	8,767.1
37	LA	5.5	0.8	3.4	1.3	6,047.7
37	MS	2.3	0.0	0.4	1.9	80.2
37	TX	20.9	20.9	0.0	0.0	4,512.5

Appendix F. How to calculate the habitat and population increases needed to achieve the 1980 bobwhite density in a BCR on the land base suitable for management in 1997.

A. Assumptions

1. Our goal is to restore bobwhite populations to the density that existed in the BCR in 1980 on the land base of improvable acres within the BCR in 1997.
2. The land base selected as Improvable Acres will be chosen and defined by the Chapter author(s). For the example used in this instruction sheet (BCR 27) it was defined as Agricultural Land, which included all croplands, pasture, hay, and range. These land use types were used to calculate the number of coveys needed to restore the bobwhite density, but pinelands were also utilized as a land use type that could be managed to restore a portion of the required coveys.
3. Lack of good to excellent nesting and brood-rearing cover is the most critical habitat factor limiting bobwhite production on a majority of its range.
4. Four acres of good quality nesting habitat should produce 1 covey of 12 bobwhites added to the autumn population. Native warm season grasses should produce this quality of nesting and brood-rearing habitat.
5. The bobwhite harvest rate is estimated to be 33% of the pre-harvest bobwhite density. Thus, pre-harvest populations can be derived by dividing the total quail harvest in any given area by 0.33.

B. Formula Terms and Data Sources for determining the number of coveys that must be added to a BCR to achieve the 1980 density on Improvable Acres. We have chosen BCR 27 to demonstrate how these data are used to produce the Chapter presentation.

1. QH 1980 = Total estimated bobwhite harvest in the BCR in 1980. Data are presented in the 1980 Quail Harvest Table.
2. QH 1999 = Total estimated bobwhite harvest in the BCR in 1999. Data are presented in the 1999 Quail Harvest Table.
3. 1980 IA = Improvable acres in 1980. This number will be derived from acreages presented in the 1982 National Resources Inventory tables. The categories selected will be based upon the knowledge and experience of the Chapter authors. For BCR 27, Ralph selected the land use types of cropland, pasture/hay, and range.
4. 1999 IA. Improvable Acres in 1999. Data base is 1997 NRI tables.
5. 1980PHP and 1999PHP = Estimated pre-harvest bobwhite population for the BCR in 1980 and 1999. See assumption 5, and formula terms 1 and 2 to calculate this (remember to divide number of quail by 12 to determine the number of coveys needed.
6. 1980QD and 1999QD = Pre-harvest quail density on improvable acres in 1980 and 1999.

C. Procedure for calculating the population goal (determining the number of coveys that need to be added to restore the density of bobwhites in the BCR to 1980 level.)

The example used is BCR 27 - Southeastern Coastal Plain.

1a. QH 1980 (5,945,629 quail) divided by 0.33 = 1980 PHP (18,017,057 quail).
b. QD 1980 = 1980 PHP (18,017,057) divided by 1980 IA (39,170,000) = .460 quail/IA.

2a. QH 1999 (1,561,633) divided by 0.33 = 1999 PHP (4,732,221).
b. QD 1999 = 1999PHP (4,732,221) divided by 1999 IA (32,706,000) = .145 quail/IA

3. 1980 QD (0.460) x 1999 IA (32,706,000) = 15,044,760 quail in PHP for BCR 27.

4. From this total (15,044,760) subtract the existing population in 1999 (4,732,221) to determine the number of additional bobwhites needed (10,312,539) to restore the population to its 1980 density (0.460 birds/IA).

5. Divide this number by 12 to determine the number of new coveys needed to be added to the Southeastern Coastal Plain Bird Conservation Region (859,378 coveys).

6. We generated this number for BCR 27 using the management practices described in the BCR 27 chapter, assuming 4 acres of warm season grasses would add 1 new covey, and 1000 acres of pine management would add 1 new covey.