

Changes in Northern Bobwhite Habitat and Populations in a Southern Mississippi Wildlife Management Area: 1955–1992

Jeffrey M. Lee,¹ *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Leonard A. Brennan,¹ *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Abstract: Empirical case histories that relate long-term northern bobwhite (*Colinus virginianus*) population declines to changing habitat conditions are rare in the scientific literature. We examined long-term (38 years; 1955–1992) changes in habitat conditions and bobwhite population trends at Copiah County Wildlife Management Area (CCWMA), Mississippi. Between 1955 and 1992, proportion of CCWMA in old fields declined from 70% to 20%, proportion of area in forest with <50% canopy cover declined from 18% to 0%, and proportion of forests with >50% canopy cover increased from 19% to 78%. During the same 38-year period, bobwhite density declined from 0.48 birds/ha to 0.08 birds/ha. Harvest rate declined from 1.76 birds/hunter day in 1955 to 0.5 birds/hunter day in 1992.

Proc. Annu. Conf. Southeast. Fish and Wildl. Agencies 48:201–207

During the past 3 decades, northern bobwhite populations have significantly declined across most of their geographic range. This population decline has been most pronounced in the southeastern United States (Droege and Sauer 1990, Brennan 1991, Church et al 1993). Possible reasons for the decline could be increased predation and increased use of pesticides (Brennan 1991). However, broad-scale habitat loss because of changing land use in agriculture and forestry is typically considered the primary reason for this decline (Klimstra 1982, Brennan 1991, Roseberry 1993).

Empirical case histories that relate bobwhite population changes to long-term changes in vegetation and habitats are scarce in the bobwhite literature. Only 5 examples of this type of study are known (Vance 1976, Roseberry et al. 1979, Exum et al 1982, Roseberry and Klimstra 1984, Dimmick 1992). This lack of information is probably because there are few places where detailed population data exist in conjunction with habitat data over a period of several decades.

¹ Present address: Tall Timbers Research Station, Rt. 1, Box 678 Tallahassee, FL 32312.

The purpose of this paper is to provide a case history that illustrates how bobwhite harvest rates and habitat components have changed on a public wildlife area in Mississippi over a 38-year period. We quantified changes in proportions of 3 habitat types and related these changes to bobwhite population abundance.

This project was funded by the Mississippi Department of Wildlife, Fisheries and Parks. F. Miller and the Remote Sensing Lab at Mississippi State University provided valuable assistance. Aerial photographs were provided by the Mississippi Forestry Commission and the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service office in Copiah County. Special thanks to M. G. Chambers for her patience, expertise, and help.

Methods

This study was conducted on the Copiah County Wildlife Management Area (CCWMA), a tract of 2,900 ha located in the central pine-hardwood region of southern Mississippi (Hood 1956a). This area is owned by the Mississippi Department of Wildlife, Fisheries and Parks (MDWF&P). During the 1950s, 1960s, and 1970s, CCWMA was managed almost exclusively for northern bobwhite. Since this time, the management objectives have become much broader. Currently, most vegetation at CCWMA consists of dense mature pine (*Pinus* spp.) stands or mixed pine-upland hardwood forest. Approximately 200 ha of CCWMA consists of fallow fields or fields which were in hay production from the 1970s until 1990.

Delineation of Habitat Types

Aerial photography of CCWMA was obtained for 1955, 1972, and 1992. Three habitat types were delineated including open fields, pine forest with tree canopy coverage <50%, and pine forest with tree canopy coverage >50%. The rationale for discriminating between pine forest stands with <50% and >50% forest canopy is that stands with <50% canopy cover are considered suitable bobwhite habitat (Stoddard 1931), whereas those with >50% canopy coverage are considered either marginal or unsuitable as bobwhite habitat (Rosene 1969).

Habitat types were transferred to a U.S. Geologic Service (USGS) 7.5 minute quadrangle map using a Sketchmaster to remove distortion. Map coverages of habitat types were then digitized using PC ARC/INFO (ESRI Inc. 1989). Habitat type attribute data were added to the 3 coverages to discriminate among the 3 habitat types. A subset containing 132 ha of CCWMA was used to compare among years 1955, 1972, and 1992. This particular area was chosen because it contained key landmarks and roads that were necessary to reference various scales of photographs to the USGS quadrangle map.

Population Assessments

Hunter harvest data (hunter days and number of bobwhites bagged per hunt) were collected from CCWMA records (information on file in MDWF&P

office; Jackson, Miss.) for all years between 1972 and 1992. Additional bobwhite hunter harvest and population data on quail at CCWMA were obtained from Hood (1956b) and Brennan et al. (1991). Hood (1956b) obtained population estimates with mark-recapture techniques, while Brennan et al. (1991) used trained dogs to locate coveys and make population estimates. Continuous hunter harvest data for the years 1955–1992 do not exist at CCWMA. Simple linear regression analyses were used to test for trends in harvest rate from 1972 to 1992.

Results

Proportions of habitat types delineated at CCWMA changed significantly ($X^2 = 181.4$, $df = 4$, $P = 0.001$) from 1955 to 1992 (Fig. 1). Stands with tree canopy coverage $<50\%$ increased ($X^2 = 32.5$, $df = 1$, $P < 0.001$) from 1955 to 1972 then declined ($X^2 = 84.0$, $df = 1$, $P < 0.001$) during the next 20 years (Fig. 1). Forest with tree canopy cover $>50\%$ increased ($X^2 = 87.2$, $df = 1$, $P < 0.001$) from 1955 to 1992 (Fig. 1). Fields, stands with tree canopy cover $<50\%$, and stands with tree canopy cover $>50\%$ composed 88.8 ha, 20.5 ha, and 23.0 ha, respectively, of the total 131.6 ha area in 1955 (Fig. 2a). In 1972, fields comprised 41.3 ha, stands with tree canopy cover $<50\%$ totaled 63.7 ha, and 26.3 ha of the total area were stands with tree canopy coverage $>50\%$ (Fig. 2b). Fields, stands with tree canopy cover $<50\%$ and stands with tree canopy cover $>50\%$ in 1992 comprised 25.1 ha, 0.0 ha, and 74.9 ha, respectively, of the area (Fig. 2c).

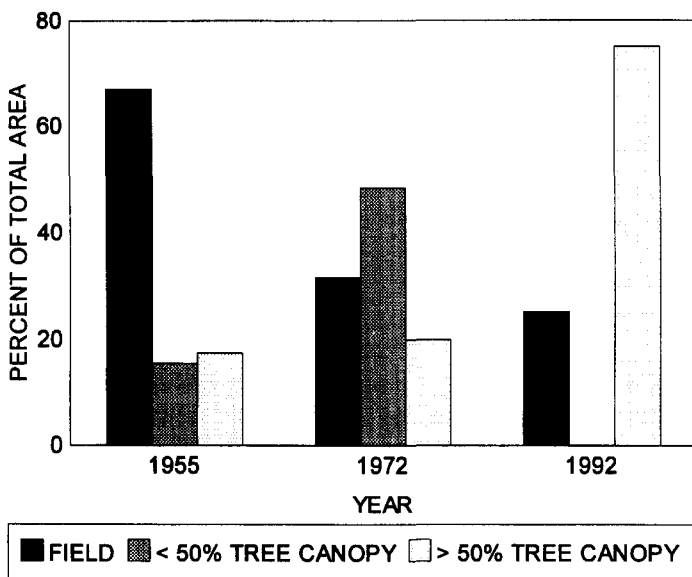


Figure 1. Percent change in habitats for a selected 131.6-ha portion of Copeiah County Wildlife Management Area, Mississippi, for 1955, 1972, and 1992.

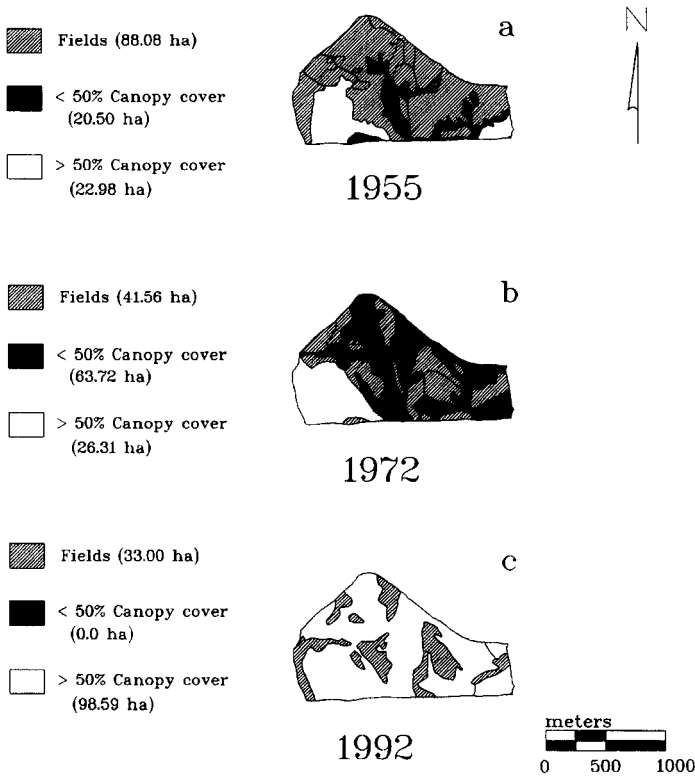


Figure 2. Maps depicting change in habitats for a selected 131.6-ha portion of Copiah County Wildlife Management Area, Mississippi, for 1955, 1972, and 1992.

Northern bobwhite harvest rate (*N* bagged/hunter day) was level from 1972 to 1981 (r^2 0.25, n = 10, P = 0.084) and declined from 1982 to 1992 (r^2 0.78, n 11, P < 0.001) (Fig. 3). Densities of bobwhites at CCWMA declined from 0.69/ha in 1955 to approximately 0.08/ha during 990 (Table 1). Harvest rate ranged from 1.76/hunter day in 1955 to 0.5 per hunter day in 1992 (Fig. 3).

Discussion

Although other sources of variation exist, a general consensus among wildlife scientists is that habitat loss from changing land use is primarily responsible for regional bobwhite population declines (Edwards 1972, Klimstra 1982, Brennan 1991, Roseberry 1993). However, very little information that directly supports this consensus is available. Leopold (1929) observed that quail were “very abundant” throughout Mississippi, but that deer and turkey were “scarce and in short supply.” Leopold related abundance of quail to the widespread presence of tenant farms, crude agriculture with numerous fallow fields, and frequent

Table 1.

Estimated fall northern bobwhite population density values from 1950 to 1955 and in 1990 at Copiah County Wildlife Management Area, Mississippi.

Year*	Quail/ha
1950	0.48
1951	0.48
1952	0.49
1953	0.60
1954	0.75
1955	0.69
1990	0.08

*Data for 1950–1955 from Hood (1956b); data for 1990 from Brennan et al. (1991).

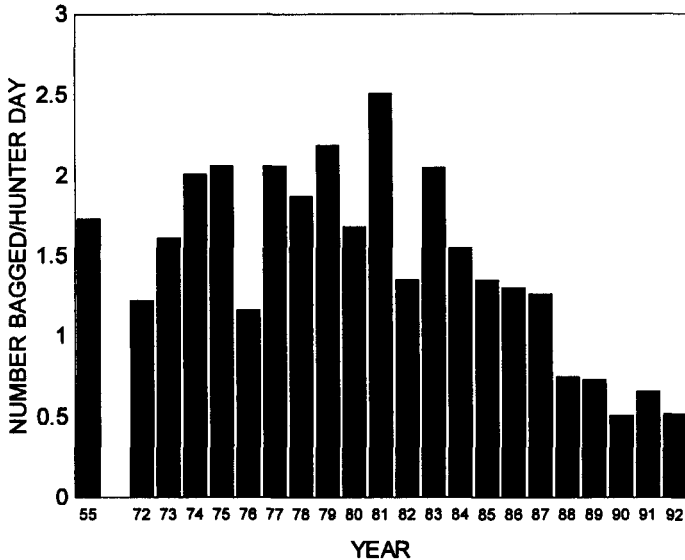


Figure 3. Harvest rate (N bagged/hunter day) of northern bobwhites from 1955 and from 1972 to 1992 for the Copiah County Wildlife Management Area, Mississippi. Regression analyses were performed on data from 1972 to 1992.

burning of the open woods. Efforts are underway at CCWMA to restore habitat conditions similar to those produced by tenant farming practices.

Roseberry et al. (1979) and Dimmick (1992) provide 2 empirical examples that directly relate declining bobwhite populations to a deterioration in habitat conditions. The study by Roseberry et al. (1979) was conducted over a 9-year period in agricultural environments of southern Illinois. They observed that as fallow areas moved through secondary plant succession, bobwhite populations declined rapidly, even without hunting. A primary difference between the study by Roseberry et al. (1979) and our study was that they had demographic data in addition to basic measures and indices of abundance. Thus, Roseberry et al. (1979) were able to identify that a lack of annual production, and not changes in survival, were responsible for the decline.

Although Dimmick (1992), like our study, did not have demographic data, his linkage of long-term bobwhite declines at Ames Plantation in western Tennessee was based on a compelling correlation with changing land use. Dimmick (1992) observed that loss of nesting habitat at Ames was a key factor in the decline he observed from 1966–1991. This loss of nesting habitat was related to increased acreages planted to soybeans and the “cleaning-up” of idle areas that contained high quality nesting and brood habitat. Similarly, studies by Vance (1976), Exum et al. (1982), and Roseberry and Klimstra (1984) demonstrated that increasing agricultural field size and reducing brushy vegetation around and within fields adversely affected nesting habitats during summer and protection cover during winter.

At CCWMA, decline of fallow-field habitats and loss of open, park-like pine forest apparently caused the deterioration of habitat. Both early-successional, fallow-field environments, and open-canopy pine forests are important components of bobwhite habitat in the southeastern United States (Rosen 1969).

Assumptions and Management Implications

Our results provide a case history that illustrates how forest and old-field habitats changed over a 38-year period, and how decline in a bobwhite population occurred during the last 20 years. Our results cannot demonstrate that a causal relationship exists between the changing proportions of habitat types and the decline in bobwhite populations observed at CCWMA. This assumption could be tested by controlled, experimental manipulations of the present habitat conditions at CCWMA. Several replicate units at CCWMA could be “returned” to the proportion of habitat types present during a previous period (either 1955 or 1972), and the resulting bobwhite population response monitored. Control, or unmanipulated areas, also should be monitored to assure that if a positive population response to management occurs, it is not a function of some other factor such as favorable weather conditions.

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