RESPONSE OF NORTHERN BOBWHITE POPULATIONS AND THE ASSOCIATED AVIAN COMMUNITIES TO LANDSCAPE LEVEL MANAGEMENT

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INTRODUCTION

Population decline of Northern Bobwhite (*Colinus virginianus*) throughout the species' range has resulted in the development of the National Bobwhite Conservation Initiative (NBCI) (Dimmick et al. 2002) and the Arkansas Game and Fish Commission's (AGFC) development of a Strategic Quail Management Plan (SQMP). Both plans focus on habitat recovery to restore Northern Bobwhite populations to historical levels. The AGFC is using the NBCI as a guide for

future management efforts. The Arkansas Quail Committee (AQC) was formed to synthesize and implement a quail recovery plan in Arkansas. The AQC includes representatives from the AGFC, Natural Resources Conservation Service (NRCS), U.S. Fish and Wildlife Service, U.S. Forest Service, University of Arkansas Cooperative Extension Service Quail Unlimited, Farm Services Agency, timber companies, private consultants, and academia.

The AQC's management approach was to develop privately-owned focal areas (>15,000 acres) throughout Arkansas to serve as demonstration areas to recruit future participants in the Northern Bobwhite recovery program and to determine which management practices are most effective. Privately owned land is the target for habitat restoration efforts because private landowners control 90% of the land base in Arkansas.

To date, the AQC has established two focal areas: one in Fulton County and one in Searcy County. The primary funding mechanism for habitat management efforts in these focal areas has been provided through the Wildlife Habitat Incentives Program (WHIP). As stated in the NBCI, the AQC has placed a focus on implementing conservation practices designed to establish/enhance Northern Bobwhite nesting and brood-rearing habitat. Those practices include: fencing (for cattle exclusion), strip disking, prescribed burning, timber thinning, combination of thinning and burning, edge/hedgerow development (example, *Lespedeza spp.* planting), and establishment of native warm-season grasses in conjunction with removal of fescue *(Festuca arundinacea*). Although the areas have been established and are under WHIP contracts, individual farmers have 10 years to complete their management efforts. Approximately 6.5% and 7.5% of the land area in Searcy and Fulton counties, respectively, are enrolled in WHIP contracts to improve bobwhite habitat. Bobwhite and songbird response to WHIP-sponsored habitat improvements will be compare to 2 adjacent areas without WHIP-sponsored habitat improvements.

In order to evaluate the response of Northern Bobwhite to restoration efforts, we initiated two studies, one centered in Fulton Co. to evaluate habitat use by Northern Bobwhite related to specific management practices, and one centered in Searcy Co. to evaluate habitat use by brood-rearing hens along with survival of the broods. In addition, we evaluated effects of management on the entire avian community. We present our progress report in two separate sections because the research and objectives were substantially different and were conducted separately by different universities.

OBJECTIVES (Fulton County)

1.) Assess affects of management on bird communities within managed and reference areas.
2.) Monitor changes in plant community and utilize that data to evaluate changes in avian community
3.) Determine response of Northern Bobwhite to different management practices.
4.) Use hatch-year to after hatch-year ratios of Northern Bobwhite to measure recruitment within managed populations.

OBJECTIVES (Searcy County)

1.) Determine if bobwhite production and nest success increase in response to management on focal areas.
2.) Determine whether management on focal areas produces habitat appropriate for nesting bobwhite.
3.) Evaluate survival and growth of bobwhite chicks in response to habitat conditions.
4.) Identify habitat features that brood-tending adults use and determine whether restoration efforts produce similar habitat.
5.) Document bobwhite movements and determine how bobwhite brood movements are influenced by habitat conditions.

PROGRESS TO DATE

Songbird Sampling.—We conducted point counts at 30 randomly located points in each focal area (managed/unmanaged); totallying 120 count points. In 2006, we detected 70 and 81 species at the managed and unmanaged areas, respectively. In addition, we detected 31 Northern Bobwhite at managed areas and 40 bobwhite at unmanaged areas. Importantly, we detected more early-successional stage birds in the managed areas compared to the unmanaged sites. Specifically, in managed areas, we detected 54 Yellow-breasted Chats (*Icteria virens*) and 129 Indigo Buntings (*Passerina cyanea*), whereas in unmanaged areas, we detected only 27 Yellow-breasted Chats and 89 Indigo Buntings. Conversely, forest birds, such as Red-eyed Vireos (*Vireo olivaceus*), were less common in managed areas (70 detections) than in unmanaged areas (96 detections). Similarly, Acadian Flycatchers (*Empidonax virescens*) were also less common in managed areas (14 detections) than in unmanaged areas (47 detections). Several species of conservation concern were detected, including: Bell's Vireo (*Vireo bellii*), Blue-winged Warbler (*Vermivora pinus*), Prairie Warbler (*Dendroica discolor*), Bachman's Sparrow (*Aimophila aestivalis*), Grasshopper Sparrow (*Ammodramus savannarum*), Henslow's Sparrow (*Ammodramus heslowii*), and Painted Bunting (*Passerina ciris*). Bell's Vireo was detected once in the reference area and was not detected in managed areas. Blue-winged Warblers were detected more frequently in managed areas (10 detections). Prairie Warblers were also detected more commonly in managed areas (23 detections) than in reference areas (14 detections). Bachman's Sparrows were detected both in reference areas (5 detections) and in managed areas (4 detections). Henslow's Sparrows were detected 4 times in reference areas, but were not detected in managed areas. More Painted Buntings were detected in reference areas (6 detections) than in managed areas (1 detection).

In comparison to 2005 data, Northern Bobwhite numbers were lower in managed areas in 2006. We detected 50 Northern Bobwhite in managed areas in 2005, compared to 41 detections in 2006. Conversely, quail detections were higher in 2006 (40 detections) in unmanaged areas than they were in 2005 (27 detections). Blue-winged Warblers were detected more in 2006 (10 detections) than 2005 (4 detections) in the managed areas. Prairie Warblers were detected more in 2006 (23 detections) than 2005 (21 detections). Yellow-breasted Chats were also detected more in 2006 (54 detections) than 2005 (46 detections). Bachman's Sparrows and Henslow's Sparrows went undetected in 2005. We are currently analyzing these data with program

DISTANCE to estimate and compare densities of birds recorded between the managed and reference sites (Buckland et al. 2001).

We detected 71 species along the Fulton County focal area BBS route and 72 species on the reference BBS route. Species diversity was greater in 2006 along both Fulton County routes than in 2005. In 2006, sampling in the focal area yielded 46 Northern Bobwhite detections compared to 20 detections in the reference area. We also detected 39 Yellow-breasted Chats in the focal area, compared to 29 Chats in the reference area. In addition, we detected more Eastern Meadowlarks (*Sturnella magna*) (47 detections) in the focal area than we found in the reference area (14). The Searcy County data have not been analyzed.

Quail Call Counts.—The Arkansas Game and Fish Commission conducted between two and four Bobwhite call count surveys (2 routes/area; 15 points/route) starting in 2003. Number of bobwhite doubled from a mean of 4.0 birds per route in 2003 to 8.0 birds in 2004 after management was initiated. However, numbers of bobwhite dropped slightly in 2005 and 2006 (mean = 7.0 birds per route). These data indicate that although management may have had a measurable impact on the bobwhite population in Fulton County, any population increase attributable to management activities occurred within the first year and population growth did not continue in subsequent years. Data collected in the Searcy County Focal Area were also based upon sampling between two and four call count routes per year. A relatively dramatic increase to a mean of 13.7 bobwhite detected per route occurred in 2005. This increase did coincide with implementation of management at this focal area, but numbers dropped substantially to a mean of 4.5 bobwhite per route in 2006. However, this mean detection rate was still clearly greater than detection frequencies (means <2 birds/route) recorded prior to management before 2005. Although management may have contributed to this increase of bobwhite detections in the last 2 years, we suggest this dynamic pattern is most likely influenced by other factors in the Searcy County study area.

Bobwhite trapping and telemetry (Fulton County).—We captured and and radio-marked 48 Northern Bobwhite between 16 May and 12 July 2006. All 48 birds were fitted with necklace-type 5 g radio-transmitters. Of the 48 Northern Bobwhite fitted with transmitters, 47 were males and one was a female.

We radio-tracked 44 Northern Bobwhite between 17 May and 28 August 2006. No locations were obtained for two quail because we could not acquire a radio signal. A third quail was killed by a mammalian predator before we could obtain any data. Of the remaining 44 birds, 12 were killed by predators, six were lost (unable to acquire radio signal), and one died of natural causes. Of the 12 predation events, 10 were apparently caused by mammalian predators, one was caused by an avian predator, and the predator type could not be determined in one case. Twenty-seven Northern Bobwhite survived the tracking period (17 May-28 August 2006), and 12 transmitters were still active as of 2 November 2006. While radio-tracking, we located 12 nests. Five nests were destroyed by predators, four produced young, and two were abandoned before eggs were laid. One bird was killed by a predator before eggs were laid. We observed males rearing seven broods, with only four broods surviving until young were capable of flight, which occurred ca. 2 weeks post-hatch. We are still collecting data on survival and are currently analyzing habitat use data (Kopp et al. 1998, Guthery et al. 2000).

We documented 1203 GPS locations for the radio-collared quail. Our goal was to obtain a minimum of 40 points per bird to assess their habitat use. We were able to obtain sufficient data on 25 birds. The remaining 23 birds were either killed by predators or disappeared. We are in the process of mapping locations and examining habitat use related to specific management practices. We will examine the number of bobwhite locations found in the proximity of specific management practices and compare these patterns to the availability of managed areas on the landscape.

Response to Habitat Treatments in Searcy County.—Our results suggest a seasonal difference in response to habitat restoration efforts in Searcy County. Although we captured most of our sample of 51 bobwhite in management areas during the winter, none of them remained in management areas during the breeding season. Of 51 bobwhites captured in Searcy County, 17 were females and 34 were males. We captured 30 bobwhites within managed areas and 21 in adjacent areas. Two hens and one male died within 7 days of capture and were excluded from analysis. An additional hen was lost, or her collar failed, within 4 days of capture. Of the remaining 30 bobwhites captured in treatment areas, 24 moved to unmanaged areas at the beginning of the breeding season and the remaining six died before the breeding season began. In addition, of 21 bobwhites captured near managed areas, only 2 (a pair) established a home range within a managed area. The remaining 19 either did not use managed areas or used them infrequently. Further, the pair that moved into the managed area was raising a brood and only moved into the area after most of their original home range was mowed. They were both taken by predators within 19 days of entering the managed area. Occasionally, bobwhite males moved into managed sites for short periods but always returned to their home range located outside of treatment areas.

Bobwhite nesting (Searcy County).—We located 13 nests, five (38.5%) of which hatched at least one chick. None of the nests in Searcy County were located in managed areas. In fact, 12 of 13 nests were located in fescue-dominated fields and were made of fescue grass.

Of 17 bobwhite hens that were fitted with transmitters 10 attempted at least one nest and one attempted at least two nests. Thus, we monitored 12 nests attempted by females. Two hens died before the breeding season, one hen was lost or her collar failed, and three died before a nest was located. Five of 11 nesting bobwhite hens were depredated while on the nest or nearby and two died while away from the nest.

Of 34 males fitted with radio-collars, 30 entered the breeding season and 3 (10%) incubated nests. After two incubating females died, two radio-collard males took over incubation duties and one of them successfully hatched the nest. One male incubated and hatched chicks from a nest that was not laid by a radio-collared female.

Nests were initiated between 6 June and 26 August 2006. Mean clutch size for 13 completed clutches in Searcy County was 10.6 eggs and ranged from 6 to 14 eggs. Clutch size tended to decline as the breeding season progressed. Mean number of eggs that hatched from successful nests was 11.3 and ranged from 9 to 14 eggs. Ninety-four percent of the eggs in successful nests hatched. Two of the five clutches that hatched in Searcy County were raised to independence.

One male that did not incubate a nest assisted in raising chicks from an unknown nest and was successful in rearing seven chicks to independence.

Nesting success within the focal area (38.5%) is consistent with values commonly reported (32-44%; e.g., Stoddard 1931, Dimick 1974, Roseberry and Klimstra 1984, Burger et al. 1995). Although all females fitted with radio-collars that survived nested, most of them attempted only one nest before they died. According to our findings, total nesting effort, and therefore production, was reduced because of high mortality rates among adult bobwhites nesting in fescue fields. Casual observations suggest that increased mortality rates among bobwhite adults may coincide with the timing of mowing. However, analysis of adult survival data in conjunction with mowing dates around the focal area would be needed to test our hypothesis.

Mean clutch size in Searcy County (10.6 eggs per nest) was lower than has been reported by others (11.9-14.4 eggs per nest; e.g., Dimmick 1974, Roseberry and Klimstra 1984, Lehman 1984, Burger et al. 1995). However, most of our clutches were laid later in the breeding season and clutch size declines as the season progresses (Roseberry and Klimstra 1984, Burger et al. 1995,). Drought may decrease survival, the proportion of hens that nest, nesting rates (nests per hen), the length of the breeding season, and percent juveniles in the fall populations (Hernandez et al. 2005). We experienced a breeding season drought during 2005 and abundant late summer rains in 2006. We cannot discount a possible influence of weather on nesting success.

Movements and Habitat Use by Broods.—We tracked four broods in Searcy County and seven in Fulton County. One brood in Searcy County entered a management area on day 3 post hatch and three broods in Fulton County were tracked in managed areas. We collected 360 brood habitat samples on unmanaged areas, 364 brood habitat samples on managed areas, and for comparison we collected 234 samples along randomly-located transects in managed areas, and 181 samples along randomly-located transects in unmanaged areas. We used 52 habitat samples (17 samples from habitats used by chicks in unmanaged habitat, 13 samples from habitats used by chicks in managed areas, 11 samples from randomly-located points in unmanaged areas, and 11 samples from randomly-located points in unmanaged areas) for discriminate function analysis.

During 2005, we found that bobwhites tended to remain stationary for approximately 10 min after we initially located them. After they resumed moving they moved from less than 5 to 15 m every 5 min. Broods increased their rate of movements as they aged (Fig. 1). The equation for brood movements for all broods tracked in 2005 was: Rate (m/min) = (0.5759) + (0.0797) (age in days). The R^2 value (0.38) was relatively low and indicated that variation in bobwhite rate of movement is influenced by factors other than age.

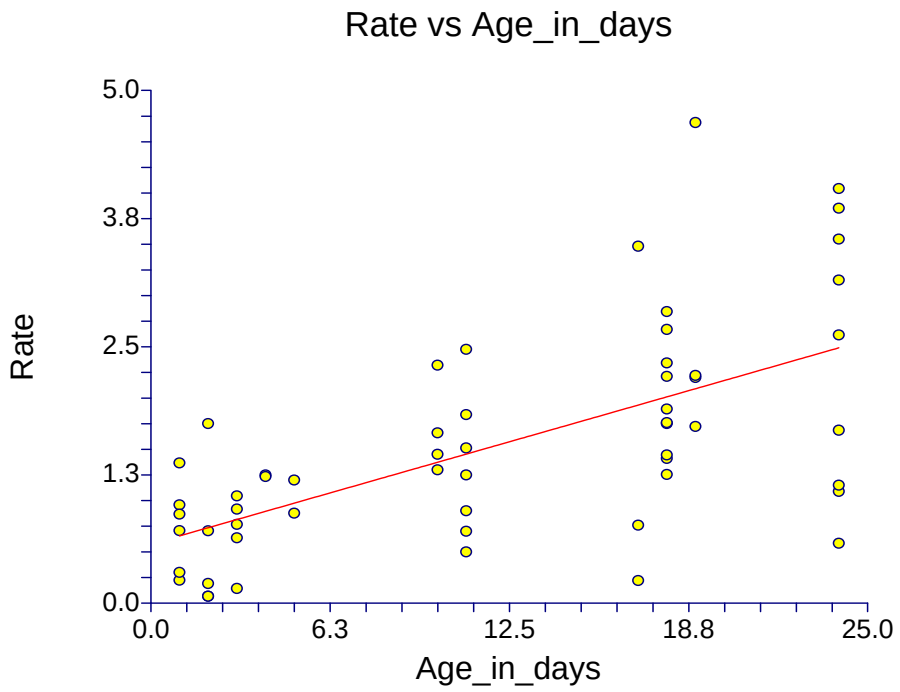

Figure 1. The rate that bobwhite broods moved (m/min) from zero days post hatch to thirty days post hatch. Broods increase their rate of movement as they got older according to the equation: Rate (m/min) = (0.5759) + (0.0797) Age in days. The R-squared value for regression line is 0.3878.

The discriminate function selected percent forbs, percent grass, and open space 5-15 cm above ground to discriminate among the chick locations in unmanaged habitats, chick locations in managed habitats, random locations in managed areas and random locations in unmanaged areas. The model correctly classified 55% of the habitat points used by bobwhite broods and randomly-located points in managed and unmanaged areas. However, the model performed better in some types of habitats than others. For instance, it correctly distinguished 9 of 11 (81.8%) randomly-located samples in unmanaged patches, but only correctly classified 2 of 11 (18.2%) points located in randomly-selected patches in managed areas. The model correctly distinguished 9 of 13 (69.2%) brood locations in managed areas, and 9 of 17 (53%) of brood locations in unmanaged areas.

Grass canopy cover was greater in unmanaged patches than managed for both brood use sites and random points. Mean percent grass was 25% for brood locations in managed areas, 35% in brood locations in unmanaged areas, 43% for random locations in managed areas, and 74% for random locations in unmanaged areas. The mean percent forb cover for brood locations in unmanaged areas was 35%, compared to 20% for brood locations in managed areas. Forb cover in random locations in managed areas was 26% and 8% in random locations in unmanaged areas. Open space 5-15 cm above ground was greater for habitats used by broods than random locations. Locations used by broods in managed and unmanaged areas averaged more open space 5-15 cm above ground (68% and 79%) than did random locations in both managed and unmanaged areas (61% and 51%).

Our hypothesis that habitat management would produce preferred bobwhite nesting and brood rearing habitat was not supported by our data. Managed habitats in Searcy County did not attract bobwhites for nesting or brood rearing. Instead, bobwhites used fescue fields to nest and rear

broods. In Searcy County bobwhites did use managed areas during the winter. Many of the bobwhites that were captured in managed areas during the breeding season were males captured by decoy trapping. These males may have been lured into managed areas by the broadcast calls of a female bobwhite. Further, most of the females and males that were captured in managed areas in winter left the treatment areas at the beginning of the breeding season and did not return. Fescue fields had thicker vegetation, and more litter to build nests, which may have attracted bobwhites to nest in those areas. Managed areas generally lacked thick grass and abundant grass litter. In addition, suitable foraging areas, identified by repeated observation of instrumented adults, were located near nest sites within their home ranges. Bobwhites may select areas for nesting with a higher percent of grass and litter (Taylor et al. 1999). Many managed areas in Searcy County did not provide thick grassy stands for nesting in close proximity to suitable foraging areas. Some managed areas in Searcy County had habitat that was structurally similar to habitat used by broods, but those areas were not near suitable nesting habitat. Other management practices, for example, yielded thick vegetation suitable for nesting, but did not produce patches that were suitable for foraging. Adults in our study selected breeding habitat that contains nesting habitat in close proximity to foraging habitat. The juxtaposition of nesting and foraging habitats is likely an important requirement because day-old broods generally move less than a meter per minute. Further, nesting adults would have an advantage if they selected nest sites close to foraging areas because they would expend less energy traveling to and from foraging areas, would spend less time away from their nests, and would probably be subject to less predation. Here, a caveat is in order. Most of the managed areas in Searcy County are quite young (less than 4 years old) and many of the landowners have not completed the prescribed treatments. Thus, with time, the treatments may develop into suitable breeding habitat over time.

Although breeding bobwhites did not use treatments in Searcy County some managed areas were structurally similar to habitats used by bobwhite during the breeding season as indicated by the discriminate function misclassification of 9 of 11 random locations in managed areas. We speculate that some of the managed areas may be isolated from bobwhite populations, which may make immigration less likely.

Insect abundance within managed areas was noticeably lower than unmanaged areas (K. Labrum pers. obs.). Future analysis of insect sweep samples will verify whether managed sites supported reduced insect abundance. Breeding bobwhites may avoid areas of low insect abundance. Breeding females consume 3 to 12.5 times more invertebrate biomass than nonbreeding females (Harveson et al. 2004). Lower insect abundance in managed areas could explain why bobwhites moved out of managed areas before breeding. Further, relatively low insect abundance could explain why chicks tended to grow more slowly in managed areas as discussed below. However, as we mentioned above, the management prescriptions are relatively new and insect abundance may increase through time.

Chick Survival and Growth.—In 2006 we captured 10 broods that contained 62 chicks. Six broods were captured twice, two broods in treatment areas and four broods in untreated areas. Forty-five chicks were captured on the first capture and 30 chicks were captured a second time. Broods not captured twice were either too old upon first capture to be captured a second time or died before the second capture was made. One brood-tending adult was depredated before the first capture. We did not detect brood amalgamation during 2006.

Mass gain tended to be substantially lower in managed areas (mean = 0.1 gm/day) compared to unmanaged areas (mean = 0.2). However the difference in mass gain per brood per day was not statistically significant ($n = 6$, $p = 0.428$, df = 4) between managed and unmanaged areas. However, low power ($\beta = 0.1059$) limited our ability to detect even very large differences in mass gain between broods in managed and unmanaged areas. A biased analysis using individual chicks as a sampling unit (biased because it violates the assumption of independence and deflates the standard deviation) resulted in a significant difference between mass gain/tarsus/day in managed versus unmanaged areas ($p = 0.0002$, df = 28, $\beta = 0.9857$). The mean mass gain/tarsus/day of all individual chicks ($n = 30$) in both managed and unmanaged areas was 0.15 /tarsus/day and ranged from 0.05–0.31.

Brood Tracking and Habitat Selection.—The tracking method that we employed allowed us to locate and sample bobwhite habitat and estimate rates of movement by broods. Bobwhite broods did not appear to select habitat randomly. Rather they were found in habitat patches that differed from random locations in managed as well as unmanaged areas.

Broods moved directly toward us several times while we were monitoring their movements. Thus, we suspect that our presence did not disrupt their movements. Broods tended to follow habitat features such as contour lines and distinct habitat patches such as streambeds, fencerows, and disked strips. Quail often moved back and fourth along these habitat features probably to increase time spent in those patches for foraging. At other times broods made one-way movements at an increased pace for relatively long distances followed by reduced movement rates when they entered a different patch. Upon entering the new patch they began moving back and forth within that patch. Movements just prior to loafing or roosting were also rapid in one direction toward a shrub or dense vegetation. Although these behavioral findings are anecdotal, they suggest that dispersion and arrangement of patches within home ranges may be important features of bobwhite brood-rearing habitat.

Characteristics identified by the discriminant function analysis associated with bobwhite use were percent grass, percent forbs, and open space at adult level (5-15 cm). Of the variables that were selected, percent grass is likely to be the most important because both the amount of open space 5-15 cm above ground and percent forbs are related to the grass cover. Percent grass in habitats used by brooding bobwhite was lower than in randomly-located plots. Further, randomly-located plots in managed habitats were structurally more similar (especially in percent grass) to habitats used by broods than to randomly-located points in unmanaged habitat. Percent of forbs in random locations in managed areas fell between habitat used by broods in managed and unmanaged areas. Bobwhite broods tend to favor areas with more forbs (Taylor and Guthery 1994). Both managed and unmanaged brood habitats had more forb cover than random plots in unmanaged areas.

The proximity of brood habitat to thick stands of grass may be important because bobwhites tend to nest in thick grass stands (Taylor et al. 1999). In addition, recently-hatched broods have limited mobility within the first few days post hatch (see Fig. 3) and need areas suitable for foraging near nest locations. Furthermore, we observed that nesting bobwhite adults usually foraged within 75 m of their nests and took broods to these same foraging areas. Consequently,

management prescriptions could be more immediately effective if they produced nesting and brooding habitats in close proximity.

Individual management prescriptions vary widely within Searcy County from burning to herbicide treatments which resulted in a wide array of different habitat conditions. Furthermore, effects of prescriptions on vegetative structure vary widely. Madison et al. (2001) found that after 1 year, burned fescue fields were indistinguishable from pre-treatment and untreated fescue fields. We observed similar results on burn-only prescriptions in fescue-dominated fields within Searcy County. Conversely, burning fallow fields that were dominated by broom sedge (*Andropogon virginicus*) produced habitats structurally similar to habitats used by broods and were identified as such by our discriminant function. In fact, we observed an unmarked bobwhite brood using one such field. Treating fields with herbicides and then planting warm-season grasses leads to grass-dominated habitat that was not used by radio-marked bobwhites that were nearby. Finally, other prescriptions produced habitats dominated by forbs on mostly bare ground. One such field was misclassified as an area used by broods. However this treatment lacked singing bobwhite males during the breeding season even though there were quail nearby. Managed areas that were misclassified as brood-used habitat by our discriminant function may lack another habitat element nearby (such as suitable nesting habitat). If we can determine why these misclassified brood habitats were not used, we can adjust management procedures to alter the habitat into something that will be used by bobwhite broods. However, we must keep in mind that that some of the misclassified brood habitats may have been used by broods that we did not monitor.

The habitat features selected by our discriminant function procedure are not the only habitat characteristics that will distinguish among different habitat categories. The procedure was conducted in a stepwise fashion; therefore it selected an optimal discriminating function using the fewest variables possible, but does not guarantee the best combination (McGrarigal et al. 2000). Further, we arbitrarily selected the 4^{th} vegetation sample from each transect and we do not know what, if any, effect our choice had on the outcome of the discriminant function analysis. By running the procedure repeatedly on different arbitrarily-selected transect samples; other discriminating variables may be identified. In future analysis, we will run the procedure on several other samples to obtain a suite of important variables that consistently discriminate the categories (managed areas used by broods, unmanaged areas used by broods, random areas in managed areas, and random unmanaged areas). Further, insect abundance and diversity may be a habitat feature that is important to bobwhite and we will include that variable in the future discriminate function analysis.

Our data on chick growth, habitat selection, and survival in both managed and unmanaged areas allows a direct assessment of the habitat management efforts undertaken in Searcy County, and to a lesser extent, Fulton County. Our findings suggest that quail in Searcy County tended to leave managed areas at the beginning of the breeding season and seldom returned. Although management efforts sometimes produced habitat that brooding quail could use, broods that actually used managed areas tended to grow more slowly than did broods that were raised in fescue fields. Unfortunately, our data are limited in scope because of a very small sample size. We hope to add additional samples in the coming year which will increase the power of our analysis.

Vegetation Sampling.—In 2005 and 2006, we sampled 128 vegetation plots each year in Fulton County to monitor the changes in the plant community in response to management. Of the 128 sites, 68 are in reference areas and 60 are in managed areas. In 2005 and 2006, we sampled 120 vegetation plots in Searcy County. Of the 120, 60 are in reference areas and 60 are in managed areas.

We also sampled 84 and 108 vegetation plots at locations used by radio-collared quail in Fulton County in 2005 and 2006, respectively. The vegetation sampling plots were located both in high-use sites and low-use quail sites, and these data are currently being analyzed.

Age-structure (Fulton County).—We caught 23 quail between 15 November and 22 December 2005 in Fulton County. Of these, 11 were hatch-year males, six were hatch-year females, four were after-hatch-year males, and two were after-hatch-year females. Additionally, we received wings from 17 quail harvested in Fulton County. Six were hatch-year males, five were hatch-year females, four were after-hatch-year males, and two were after-hatch-year females. Overall, 70% of quail in the sample (n = 40) were hatch-year birds.

Fall Covey Counts (Fulton County).—In November 2005, we conducted fall covey-call surveys on 18 points that we randomly selected from our Fulton County bird-sampling points. Nine of the points were in reference areas, and nine were in managed areas. We detected coveys at three of the points; two were managed points and one point was a reference site. We flushed one of the three coveys, and counted 11 quail.

RESEARCH CHALLENGES

We are behind schedule analyzing the data, in part, because songbird and vegetation data colleted prior to management 2005 have been difficult to obtain. We only recently were able to acquire copies of most of the pre-management data collected before 2005. However, some of these data seem to be missing and we are working with agency biologists to determine if those data were lost or were never collected.

Our initial objective was to obtain an adequate numbers of radio locations on 50 quail in the Fulton County study area. Despite a high loss of bobwhite to predators (12 of 47; 26%) and a high frequency of radios that failed (15%) in 2006, we were able to approach this goal. During the two years of research we obtained at least 40 locations on each of 47 bobwhite (20 in 2005 and 27 in 2006). This should be an adequate sample to assess use of management prescriptions by quail.

Our initial goal to assess population productivity was to collect age-ratio data on 100 quail in the fall-winter period. We had difficulty trapping quail in 2005, probably because of a super abundant mast crop and were only able to obtain age data on 40 quail in the fall-winter of 2005. The mast crop appears to be closer to normal for 2006, and we are optimistic about fall trapping this coming late fall and winter.

PRESENTATIONS

Response of Northern Bobwhite populations and the associated avian communities to landscape level management: Progress Report. Great Arkansas Quail Outing. Arkansas Game and Fish Commission Media Day. Mammoth Springs, AR, 23-24 May, 2006.

Response of Northern Bobwhite populations and the associated avian communities to landscape level management: Progress Report. Fulton County Quail Focal Area Appreciation Day. Landowner Appreciation Banquet. Cherokee Village, AR, 26 August, 2006.

PARTICIPATING AGENCIES AND LANDOWNERS (Fulton County)

Brad Carner. AGFC employee and original project coordinator who has been extremely helpful in all aspects of the project.

Steve Fowler. AGFC Quail Biologist. Steve has helped with all aspects of the project and has now assumed the role of project coordinator.

Carrey Wilcoxson. AGFC employee who has helped answer GPS or GIS related questions.

Ted Zawislak. AGFC employee who has helped in all aspects of the project.

Landowners. Robert Clay**.** Chris Cochran, Ray Cochran, Bruce Dietsche, Colbert Gill, Ralph Griffin, Derrick Hall, Stanley Hall, JD Harnden, Al Herringer, Terry Langston, Lowell Parten, Mary Ragsdale, Victor Vaughn.

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Ted Zawislak. AGFC Private Lands Biologist. Ted provided useful information on trapping and tracking bobwhites and who has helped in all aspects of the project

Brad Carner. AGFC Turkey & Quail Biologist, Assistant Chief of Wildlife Management and co-Principal Investigator.

Mike Mowry. State Forester, Arkansas Forestry Commission. Mike provided information about forestry practices to implement habitat manipulations.

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Jason Milks. Private Lands Fire Restoration Project Manager, Nature Conservatory. Jason assisted in implementing habitat manipulations.

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NRCS INVOLVEMENT

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