

# NEST-SITE CHARACTERISTICS OF NORTHERN BOBWHITES TRANSLOCATED INTO WEEPING LOVEGRASS CRP

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## ABSTRACT

Habitat loss and fragmentation have been considered major causes for the decline of northern bobwhite (*Colinus virginianus*). There are > 400,000 ha of weeping lovegrass (*Eragrostis curvula*) Conservation Reserve Program (CRP) fields in the Southern High Plains of Texas some of which could be modified to provide usable habitat for northern bobwhites. Timely colonization of improved CRP habitat by northern bobwhite is unlikely without transplantation, because of distance from existing populations. We radio-marked and transplanted 94 northern bobwhite into weeping lovegrass CRP and monitored nest success. We recorded high nest success in 2002 (70%) and 2003 (71%) for northern bobwhite nesting in weeping lovegrass CRP in the area studied. The composition of weeping lovegrass CRP fields available in our study area appears to be suitable nesting cover for northern bobwhite.

**Citation:** Abbott, C. W., C. B. Dabbert, D. R. Lucia, R. B. Mitchell, and A. K. Andes. 2012. Nest-site characteristics of northern bobwhites translocated into weeping lovegrass CRP. Proceedings of the National Quail Symposium 7:59–62.

**Key words:** artificial brush structures, *Colinus virginianus*, Conservation Reserve Program, nesting ecology, northern bobwhite, Southern High Plains, weeping lovegrass

## INTRODUCTION

Populations of many grassland nesting birds have declined during the last 30 years (Askins 1993, Knopf 1994, Peterjohn and Sauer 1999). Habitat loss and fragmentation have been considered the major causes of the decline for most species including the northern bobwhite (Johnson and Schwartz, 1993). The Conservation Reserve Program (CRP) was initiated in 1985 under the Food Security Act to protect highly erodible lands, reduce crop surpluses, improve water quality, and secondarily to provide wildlife habitat (Bartlett 1988). Lands enrolled in CRP have been seeded with both native and exotic grass species. Weeping lovegrass, an exotic, has been seeded on 400,000 ha of land enrolled in CRP on the Southern High Plains of Texas (Oberheu et al. 1999). Many consider the dense monocultures of weeping lovegrass unusable habitat for northern bobwhites. However, research has not been conducted to evaluate

this claim (Kuvlesky et al. 2002). We were unable to find any scientific studies evaluating nest success of northern bobwhite in weeping lovegrass CRP fields. The lack of woody cover and low forb production appear to be limiting factors for quail in CRP fields. Northern bobwhites have been found to use weeping lovegrass CRP when woody cover is available. Populations might expand into weeping lovegrass CRP if woody cover or artificial cover sources were added to increase usable space for northern bobwhites. Expansion of northern bobwhites may be slow into improved CRP fields, because many areas are distant from existing populations or isolated by unimproved CRP or agricultural fields. Translocation of wild birds into improved CRP fields is an option in these cases.

Our objectives were to: (1) estimate nesting success of translocated northern bobwhite in weeping lovegrass CRP fields, and (2) identify habitat features associated with successful northern bobwhite nests in weeping lovegrass.

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## STUDY AREA

Northern bobwhites were trapped in 2002 on rangelands in 3 northwest Texas counties (Baylor: 30° 37' N, 99° 12' W; Garza: 33° 10' N, 101° 20' W; and Kent: 33° 10' N, 100° 45' W). Northern bobwhites were trapped in 2003 on rangelands in 3 northwest Texas counties (Garza, Kent, and Lubbock: 33° 35' N, 101° 52' W). All birds were released on 400 ha in Lynn County, Texas (33° 10' N, 101° 50' W); that site was enrolled in CRP and seeded to weeping lovegrass in 1989. Twenty-four artificial cover structures were evenly spaced across the study area and provided high protein feed (Bluebonnet Game Bird Poultry Starter, Ardmore, OK, USA) and water *ad libitum* (Abbott 2003). Northern bobwhites were not present on the area when we initiated the study. The predominant herbaceous plants were weeping lovegrass, silver bluestem (*Bothriochloa laguroides*), and three awn (*Aristida* spp.).

The climate of the area is subhumid with hot summers and moderate winter temperatures punctuated by severe cold spells (Mowery and McKee 1959). Soils are primarily loams and sandy loams with slopes < 1%. The average elevation of Lynn County is 951 m above mean sea level. Average annual precipitation is 51 cm with 85% occurring from 1 April through 31 October (Mowery and McKee 1959). Many potential nest predators including coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), cotton rat (*Sigmodon hispidus*), bull snake (*Pituophis catenifer*), hognose snake (*Heterodon nasicus*), rattlesnake (*Crotalus* spp.), and barn owl (*Tyto alba*) were present in the study area.

## METHODS

### Field Procedures

Northern bobwhites were captured in native rangeland off the study site from 20 February through 4 April 2002, and from 1 to 24 March 2003 using walk-in funnel traps (Smith et al. 1981) baited with milo. Traps were checked twice daily, ~ 3 hrs after sunrise and at sunset. Quail were immediately removed from traps and placed into ventilated cotton bags until they could be processed. Birds were leg-banded, classified to age (adult, immature) and gender (male, female) (Rosene 1969), and weighed to the nearest 0.01 g. Birds were placed together in a ventilated cage after processing and transported  $\geq$  56 km to the release site. All birds were radio-marked at the release site with necklace-style transmitters weighing 6.5 g and equipped with mortality sensors (American Wildlife Enterprises, Monticello, FL, USA). All birds captured during one trapping period were released together as one covey inside an artificial cover structure. Radiotelemetry was used to monitor all birds at least every 3 days from time of release until 15 August each year. All hen activity was closely monitored from the time we discovered the first nest until the end of the study period.

Nests were flagged to facilitate location at a later time. All flags were at least 5 m from the nest bowl in an attempt to minimize nest predation by animals investi-

gating the flags. We did not intentionally flush hens from nests and rarely did so inadvertently. We approached the nest to ascertain the number of eggs in each clutch when the hen was known to be away from the nest. A nest was considered successful if any of the eggs hatched. We described characteristics of nest sites and 4 locations corresponding to the 4 cardinal directions 10 m from each nest site after the eggs hatched, nests were depredated, or the hen abandoned the nest. Nest-site metrics included visual obstruction and percent ground cover of weeping lovegrass, native grass, forbs, and bare ground in a 0.25-m<sup>2</sup> quadrat centered over the nest, and distance (m) to the nearest artificial cover structure. Visual obstruction by the horizontal component of foliage was quantified using a Robel pole (Robel et al. 1970). The pole was 2.5 m high, 2.54 cm wide, and marked in alternating florescent orange and white colors at 10-cm intervals. The height of vegetation was estimated by recording the 10-cm interval that was directly above the height of the tallest vegetation directly in line of the pole. Visual obstruction was evaluated from a distance of 4 m and a height of 1 m. Non-nest sites (no nest present) were described to evaluate habitats used by northern bobwhites versus that available. All non-nest sites were  $\geq$  10 m from known nest-sites and vegetation measurements were averaged for comparisons between nest and non-nest sites.

### Data Analysis

We used stepwise logistic regression to differentiate northern bobwhite nest-sites from non-nest sites as well as successful versus depredated nests based on measured habitat characteristics. We used percent weeping lovegrass, native grasses, forbs, bare ground, and visual obstruction as the potential predictor variables to classify nest sites. These 5 variables and distance from the nearest artificial cover source were used to classify successful nests. The data sets were constructed so the analysis would solve for nest-site location and a successful nest in separate analyses. We set criteria for inclusion of a variable at 0.15 to prevent exclusion of potentially important predictor variables (Hosmer and Lemeshow 2000). We interpreted logistic regression coefficients by using odds ratios. We used 2-factor (year and location; year and success category) analysis of variance to illustrate differences in predictor variables (SPSS 2002). We used binomial proportions tests to compare nest success between years (Ott 1988).

## RESULTS

We radio-marked and transplanted 15 hens (13 subadults, 2 adults) in 2002 and 32 hens (25 subadults, 7 adults) in 2003. Five northern bobwhites nested in an area in 2002 containing weeping lovegrass and produced 7 nests. Two hens each produced 2 nests in 2002 and no hens produced more than 2 nests. Two northern bobwhites nested in a wheat field containing no weeping lovegrass in 2002. Fifteen northern bobwhites nested in an area in 2003 containing weeping lovegrass and produced 20 nests. Seven northern bobwhites nested in areas not

Table 1. Vegetation characteristics of northern bobwhite nest ( $n = 32$ ) and non-nest sites ( $n = 32$ ), Lynn County, Texas averaged over 2002 and 2003.

| Variable          | Nest site |      | Non-nest site |      | $P$     |
|-------------------|-----------|------|---------------|------|---------|
|                   | Mean      | SE   | Mean          | SE   |         |
| Weeping lovegrass | 57.88     | 4.95 | 18.13         | 4.95 | < 0.001 |
| Native grasses    | 17.34     | 4.13 | 18.16         | 4.13 | 0.217   |
| Forbs             | 1.10      | 0.75 | 2.30          | 0.75 | 0.559   |
| Bare ground       | 20.96     | 2.95 | 58.67         | 2.95 | < 0.001 |
| Robel measurement | 15.47     | 0.80 | 14.06         | 0.80 | 0.252   |

containing weeping lovegrass and produced 8 nests. Four hens produced 2 nests and no hens produced 3 nests. One male incubated a nest in 2002 while 4 males incubated nests in 2003. Re-nesting occurred after loss of a previous nest during both years with the exception of 1 hen in 2002 which successfully hatched 13 eggs, but still re-nested. Nest success was not different ( $P = 0.47$ ) between years (71% in 2002 and 70% in 2003).

Stepwise logistic regression revealed a positive relationship ( $\chi^2 = 45.87$ ,  $P < 0.001$ ) for a model with percent bare ground ( $B = -0.156$ ,  $SE = 0.040$ ,  $Wald = 15.61$ ,  $P < 0.001$ ,  $Exp(B) = 0.856$ ) as a predictor of nest sites. Potential nest-sites were 14% less likely to be classified as nest-sites with each 1% increase in the amount of bare ground present. No other variables were associated with classification of nest and non-nest sites. There was greater percent bare ground at non-nest sites compared to nest sites (Table 1). The percent weeping lovegrass composition at nest-sites was greater than at non-nest sites (Table 1), but this variable was not selected as a predictor of potential nest-site classification. No other variables differed between nest and non-nest sites. No variables were selected as predictors of successful nests ( $P \geq 0.19$ ). The absence of relationship between nest-site success and vegetative characteristics of the nest-site is illustrated by the lack of differences between successful and depredated nests in all vegetative characteristics examined (Table 2). Vegetative characteristics were not different between years for any variable ( $P > 0.05$ ). There were no year by location or year by success category interactions ( $P > 0.05$ ).

## DISCUSSION

Most quail stayed in the study area and reproduced in weeping lovegrass CRP. We observed extremely high nest success of 70 and 71%, respectively during 2002 and 2003. Our nest success was greater than reported by most other researchers in Texas (Mueller 1999 [38%], Hernández 1999 [46%], Carter et al. 2002 [38%], Treadway 2002 [42%]). It is unclear why northern bobwhites in our study had such high nest success, but the *ad libitum* availability of food and water may have affected the results. Weeping lovegrass CRP at the composition available in our study area appears to be suitable nesting cover for northern bobwhites.

Table 2. Characteristics of successful northern bobwhite nests compared to depredated nests, Lynn County, Texas averaged over 2002 and 2003.

| Variable                             | Successful |      | Depredated |       | $P$   |
|--------------------------------------|------------|------|------------|-------|-------|
|                                      | Mean       | SE   | Mean       | SE    |       |
| Weeping lovegrass                    | 36.68      | 5.35 | 41.33      | 8.38  | 0.615 |
| Native grasses                       | 16.74      | 3.43 | 20.04      | 5.38  | 0.717 |
| Forbs                                | 2.26       | 0.62 | 0.33       | 0.97  | 0.109 |
| Bare ground                          | 42.36      | 4.10 | 33.63      | 6.43  | 0.311 |
| Robel measurement                    | 14.23      | 0.68 | 16.08      | 1.07  | 0.240 |
| Distance to nearest ACS <sup>a</sup> | 266.7      | 72.4 | 255.3      | 113.9 | 0.933 |

<sup>a</sup>ACS = artificial cover source (distance in m).

Northern bobwhites generally nest in relatively thick vegetation (Rosene 1969). However, the growth form of weeping lovegrass has been suggested to be too thick for northern bobwhite use. Weeping lovegrass in our study areas was thick but did not form a monoculture throughout the sites and was not avoided by nesting northern bobwhites. Every nest initiated on sites containing weeping lovegrass contained this exotic grass within the 0.25-m<sup>2</sup> quadrat measured at the nest. Most birds select nest sites based on vegetative structure and not for or against certain grass species (Davis and Duncan 1999). We found northern bobwhite using weeping lovegrass as nesting cover in the absence of native grasses. It is unclear why no factors differentiated successful nests from depredated nests.

## MANAGEMENT IMPLICATIONS

Thousands of hectares of weeping lovegrass CRP are present in the Southern High Plains of Texas. Factors such as changes in land ownership, CRP regulations, and the present belief that weeping lovegrass and northern bobwhite are incompatible are leading many landowners to attempt to convert weeping lovegrass fields to native warm season grasses. This process is expensive and it can be difficult to establish native warm season grasses in the semi-arid Southern High Plains of Texas without a year of greater than normal rainfall. Our data suggest converting weeping lovegrass CRP to native warm season grasses may not be necessary to effectively manage for northern bobwhite. Vegetative diversity is important, but it is likely this diversity can be achieved gradually using several different management techniques. It may be beneficial to burn strips in weeping lovegrass CRP in December or January to remove accumulated litter. We recommend burning no more than half of any single area to maintain some herbaceous cover on the site. It may also be beneficial to disk a portion (up to 10%) of the burned area to encourage early seral species and increase herbaceous plant diversity.

## ACKNOWLEDGMENTS

We thank the numerous landowners that granted access to their properties to conduct this research. We

especially thank the Dr. Leon Bromberg Charitable Trust Fund for their generosity.

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