Nest-site Characteristics of Relocated Eastern Wild Turkeys in Texas

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Abstract: Past research suggests nesting habitat limits survival and growth of some eastern wild turkey (*Meleagris gallopavo silvestris*) populations. However, information on nest-site selection is primarily on established populations with limited data on restocked birds. Our objectives were to assess nest-site characteristics of relocated birds and determine causes of nest failure in the Post Oak Savannah of eastern Texas. Radio-tagged wild turkey hens (N = 48) were relocated to 4 areas in winter 1994. We compared understory and ground cover characteristics between 22 nest sites of radio-tagged turkeys and 22 random sites. Furthermore, we measured Euclidean distance to transition zones ("edges") and presence/absence of protective barriers ("guard object") at nest and random sites. Important nest-site characteristics were lateral cover, height of vegetation, and protective barriers. Mammalian predation was the major cause of nest failure.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 50:449–456

Wild turkey numbers were estimated to be <100 birds in the Pineywoods and Post Oak Savannah regions of eastern Texas in 1942 (Newman 1945, Gould 1975).

Initial restoration efforts within these 2 regions of using wild-trapped Rio Grande (*M. g. intermedia*) and pen-raised turkeys were unsuccessful (Newman 1945, Mosby 1975). Many southeastern states had success using wild-trapped eastern broodstock in their restoration programs (Kennamer and Kennamer 1990). Recent success by Texas Parks and Wildlife Department (TPWD) in obtaining wild-trapped birds from other states (National Wild Turkey Federation's [NWTF] Target 2000 program) has accelerated the restoration program in the state (Campo et al. 1984, Kennamer and Kennamer 1990). Subsequent restoration efforts were in the Pineywoods Region, and recently, these efforts have expanded into the Post Oak Savannah Region which is the western limit of the range of the eastern wild turkey (Newman 1945, Gould 1975, Campo et al. 1984).

Past research indicates nesting habitat limits survival and growth of some wild turkey populations (Williams et al. 1968, Speake et al. 1969, Hillestad and Speake 1970, Everett et al. 1980, Campo et al. 1989). Turkeys nest in a wide variety of habitats (Lazarus and Porter 1985, Porter 1992), although certain habitat characteristics are important for turkeys. For example, lateral cover appears to be an important nest-site characteristic because it obscures horizontal vision, thus decreasing the possibility of nest predation (Healy and Nenno 1983, Lutz and Crawford 1987, Martin 1993). However, information on nest-site selection is primarily on established populations (Lazarus and Porter 1985, Badyaev 1995), with limited data on restocked birds.

Turkey hens have been reported to have specialized nesting requirements (McGuiness et al. 1990, Badyaev 1995), which suggests relocation may limit the time for hens to locate suitable nesting habitat. Lopez (1996) found nest success in the Post Oak Savannah was the lowest (43%–45%) in this subspecies' range. Objectives of our study were to assess nest-site characteristics of relocated wild turkeys. Specifically, we examined 2 questions: (1) Was nest-site selection by female turkeys random?; and (2) What was the major cause of nest failure?

Funding for the project was provided by Turkey Stamp Funds of TPWD and the Texas A&M University System. We are grateful to TPWD biologists J. Yantis, K. Irwin, and R. Knight for their help in transporting and releasing birds for the project. We thank J. Dickson, D. Slack, F. Smeins, M. Peterson, E. Hellgren, M. Weinstein, G. Norman, and an anonymous reviewer for providing helpful comments for this manuscript. We also thank D. Plitt and Texas Municipal Power Agency, M. Irwin and the Aluminum Company of America, D. Mahoney and the Brazos River Authority, and L. Becktold for use of their property. Special thanks to Iowa Department of Natural Resources (IDNR), Missouri Department of Conservation (MDC), and NWTF for providing birds for this study.

Methods

Study Areas

The Post Oak Savannah region is bounded by the Pineywoods on the east, Blackland Prairies on the west, and Coastal Prairies on the south (Gould 1975). Open stands of post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), and black

hickory (*Carva texana*) characterize upland sites. Currently, dense brush understories have increased in southern counties due to long-term heavy grazing pressures and fire suppression (Allen 1974). The primary invasive brush species is yaupon (*Ilex vomitoria*), which forms dense understory stands with the majority of the shrub's canopy between 1 and 5 m above ground (J Yantis, TPWD, pers. commun.). Bottomland species include water oak (*Q. nigra*), willow oak (*Q. phellos*), American elm (*Ulmust Americana*), cedar elm (*U. crassifolia*), and overcup oak (*Q. lyrata*) (Allen 1974, Gould 1975). Openings in this area are primarily improved pastures. Four study areas (Alcoa, Camp Creek, Round Prairie and Mabry West quandrangles) were selected by TPWD biologists as release sites based on landowner cooperation, property size (minimum of 2,000 ha; study areas, range 2,200–3,000 ha), and general habitat characteristics within 100 km of Bryan, Texas, in Robertson, Leon, Milam, and Grimes counties.

In winter 1994, 62 eastern wild turkeys (Iowa—26 Jan 1994, 12 adult males, 32 adult females, 16 juvenile females; Missouri—7 Feb 1994, 2 adult males) were captured, transported, and released into 4 study areas under the direction of TPWD, IDNR, and MDC biologists. Fourteen gobblers (12 adults, 2 juveniles) from Missouri were released the following year (22 Jan 1995). Before release, all birds were fitted with a battery-powered, 115-g., 150–152 MHz radio transmitter (Advanced Telemetry Systems, Inc., Isanti, Minn.) and TPWD numbered leg bands. Radio transmitters were <3% of body mass and equipped with a mortality switch adjusted for 12-hour delay (no mortality signal was emitted during incubation). Transmitters were attached using 0.3 cm shock-cord harness (Am. Cord & Webbing Co., Woonsocket, R.I., Williams et al. 1968), and birds were aged and sexed (Pelham and Dickson 1992).

Radiotelemetry

Radio-tagged birds were monitored (Jan 1994–Jan 1996) 2–3 times/week. Triangulation was used to determine hen locations from fixed stations (White and Garrott 1990). Beginning 1 April, we located hens 3–4 times per week to determine nesting status. If a hen was found at the same location for 8–10 successive days, we assumed the hen was incubating. Nest sites were located, flagged, and sampled after incubation was complete or the nest was deserted. We determined and categorized nest fate into 4 groups from field evidence: hatched clutch, predated nest, disturbed nest due to agricultural activities (e.g. mowing), and unknown.

Habitat Measurements

We sampled vegetation structure at nest sites and randomly located sites for 2 nesting seasons (spring 1994, 1995). For random sites, UTM coordinates were randomly selected (minimum/maximum x-coordinate, minimum/maximum y-coordinate of study area boundary) and located with a hand-held GPS unit from each study area. We determined lateral cover (i.e., visual obstruction) and height of understory and ground cover using a range pole (Robel et al. 1970). The range pole was observed from nest center at heights of 0.25 (distance—1 m), 0.50 (distance—2 m), 0.75 (distance—3 m), and 1.00 m (distance—3 m) in the 4 cardinal directions. Visual

obstruction indices (9% coverage of range pole/distance to range pole) for each height were calculated and averaged for nests and random sites sampled, and compared using a standard *t*-test (Ott 1993, SAS Inst. 1985). We measured 2 physiographic variables at each nest site: Euclidean distance to transition zone ("edge") and presence/absence of protective barrier (<0.5 m). Nest sites were considered to be within a transition zone if the distance to edge was <20 m (Seiss et al. 1990). We defined a protective barrier as an object preventing approach of a potential predator in at least 1 direction (e.g., tree, embankment). Frequency of occurrence within transition zone and presence/absence of protective barrier at nest sites and random points were determined and compared using a Chi-square goodness-of-fit test (Ott 1993). For all comparisons, we accepted statistical significance at $P < 0.05$.

Results

Telemetry data suggested 30 turkeys incubated nests and we flagged 28 nests. Habitat data were collected at 22 nests (Table 1). Relocated hens nested in a variety of cover types (6 wooded, 18 pasture), preferring ($\chi^2 = 6.00$, 1 *df*, $P < 0.001$) pasturelands. Mean visual obstruction indices between nests and random sites were different ($P = 0.002$ at 0.25 m; $P < 0.001$ at 0.50, 0.75, 1.00 m) at all heights (Fig. 1). Mean vegetation heights were higher ($P < 0.001$) for nests ($x \pm SD = 0.67 \pm 0.29$ m) than random sites ($x \pm SD = 0.15 \pm 0.10$ m).

Female turkeys did not show preference ($\chi^2 = 2.53$, 1 *df*, $P = 0.112$) for transition zones when selecting a nest. An edge occurred near 77% (17/22) of nests sampled, whereas 55% (12/22) of random sites occurred near edge. We found a difference ($\chi^2 = 31.37$, 1 *df*, $P < 0.001$) in the presence of protective barriers observed between nests (20/22) and random sites (2/22).

Table 1. Summary of nest fate for incubating wild turkey hens relocated into the Post Oak Savannah of Texas, April–June, 1994–1995.

Description	*N*
Nest attempts (exhibiting localized movements)[a]	30
Flagged	28
Not flagged	2
Nests flagged	28
Predated	12
Mammalian	9
Snakes	3
Hatched	8
Unknown	6
Found	2
Not found	4
Mowed	2

a. Hens found at same location for 8–10 successive days; 28 first-nest attempts, 2 renests.

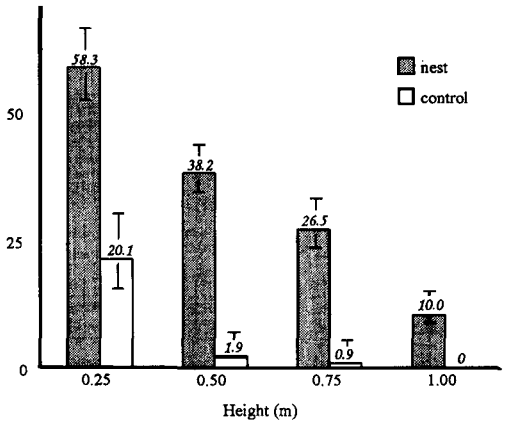

Figure 1. Mean visual obstruction indices (% coverage of range pole/distance to range pole; MVOI) between nest sites of wild turkeys and random locations at different heights. Mean value reported above bar. Lines above and below bars represent SE of mean.

Nest predation accounted for most nest desertion (N = 12), followed by unknown (N = 8) and agricultural activities (e.g. mowing, N = 2) (Table 1). Nest success (N = 8) for the 1994 and 1995 nesting seasons was low. Mean nest incubation dates were 16 May (range: 1 May–6 Jun) and 8 May (range: 23 Apr–19 Jun) for 1994 and 1995, respectively. The number of days from release to the first-year mean incubation date was 110 days.

Discussion

We found visual obstruction indices for nests to be greater than random sites, suggesting nest-site selection of relocated wild turkeys was not random. These results were consistent with past research (Healy and Nenno 1983, Lutz and Crawford 1987, Porter 1992) which suggested well-developed herbaceous understories (height 0–1 m) were an important factor in nest-site selection.

It is widely reported that turkeys prefer transition zones when selecting nest sites (Williams et al. 1968, Lazarus and Porter 1985, Holbrook et al. 1987, Seiss et al. 1990). It is hypothesized such areas increase nest success and poult survival by providing resources (i.e., insects, travel cover) in close proximity (Holbrook et al. 1987, Lazarus and Porter 1985, Seiss et al. 1990). We detected no difference in proximity to edge between nests and random sites. This lack of difference might be explained by historic and current land-use practices that have resulted in a patchy landscape (i.e., small woodlots, pastures) with increased edge.

Presence of a protective barrier associated with nests also is widely reported (Lazarus and Porter 1985, Porter 1992); however, these observations have not been

evaluated quantitatively (Porter 1992). Holbrook et al. (1987) reported hens selected nest sites that were well-concealed but did not impede escape from the nest. In our study, a tree or other protective barrier was an important nest-site characteristic. Possible benefits of a protective barrier for a nesting hen might include overhead protection from predation (e.g., avian predator), lateral protection (i.e., approach of potential predator in at least 1 direction) from predation (e.g., mammalian predator), and shelter against climactic elements (e.g., rain, sun).

Suitable nesting habitat may be limited in the Post Oak Savannah, resulting in the high nest predation and low nest success observed in our study. It is hypothesized that predator efficiency increases as suitable nesting habitat declines (i.e., predation risk increases where prey are concentrated (Haensly et al. 1987, Martin 1993, Badyaev 1995). In addition, it also has been suggested that habitat patterns (i.e., small patches, edges) serve as travel lanes for predators (Horkel et al. 1978, Haensly et al. 1987, Martin 1993), which results in higher predation risk.

Hunter card surveys (Texas Parks and Wildl. Dep. 1995) indicate increasing turkey numbers in the northern Post Oak Savannah (Red River and Lamar counties), whereas it has been difficult to establish populations in the southern region (location of 4 study areas). Furthermore, spotlight surveys (Texas Parks and Wildl. Dep. 1980–1994) found twice as many mammalian predators in the northern Post Oak Savannah when compared to southern counties. These surveys suggest potential nest predation in northern Post Oak Savannah is similar or greater than predation in southern counties. However, if nesting habitat is limiting in the southern Post Oak as we propose, predation risk to nesting hens would increase (Martin 1993, Badyaev 1995) and explain low nest success.

Historically, the Post Oak Savannah was in constant transition from prairie to savannah to forest as a result of wildfires (Allen 1974). However, within the last 50 years, this open savannah has reverted to dense woodlands with stands of yaupon understories due to fire suppression and heavy grazing (McCaleb 1954, Allen 1974). Typically, the canopy of yaupon is between 1 and 5 m above ground (J. Yantis, TPWD, pers. commun.), and does not provide suitable nesting cover. As a result, forested areas have little or no herbaceous understories (height 0–1 m). Moreover, pasturelands are either heavily grazed or mowed for hay during the nesting season. For these reasons, we believe nesting habitat is limited in this area.

Management Implications

We recommend that criteria used in the selection of future release sites should include the amount of suitable nesting habitat available (>40% coverage). Plant successional stages (dense lateral cover, height 0–1 m) selected by wild turkeys can be increased and maintained by prescribed fire (3–5 year cycle) and light to moderate grazing practices. Initially, dense yaupon understories may be reduced by mowing or bush-hogging, and maintained with mechanical treatments (i.e., mowing, bush-hogging, 2–3 years) or prescribed fire (3–5 years). We recommend such activities should be delayed until after the peak hatching period (mid-Jun) to avoid disturbing nesting

hens. We recommend that only sites with suitable nesting and brood-rearing habitat be considered in future releases.

Literature Cited

Allen, H. G. 1974. Woody vegetation of the lower Navasota River watershed. M.S. Thesis, Texas A&M Univ., College Station. 80pp.

Budyaev, A. V. 1995. Nesting habitat and nesting success of eastern wild turkeys in the Arkansas Ozark Highlands. Condor 97:221–232.

Campo, J. J., C. R. Hopkins, and W. G. Swank. 1984. Mortality and reproduction of stocked eastern wild turkeys in east Texas. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 38:78–86.

———, ———, and ———. 1989. Nest habitat use by eastern wild turkeys in eastern Texas. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 43:350–354.

Everett, D. D., D. W. Speake, and W. K. Maddox. 1980. Natality and mortality of a north Alabama wild turkey population. Proc. Natl. Wild Turkey Symp. 4:117–126.

Gould, F. W. 1975. Texas plants - a checklist and ecological summary. Texas Agric. Exp. Sta. Misc. Publ. 585, College Station. 121pp.

Haensly, T. F., J. A. Crawford, and S. M.Meyers. 1987. Relationships of habitat structure to nest success of ring-necked pheasants. J. Wildl. Manage. 51:421–425.

Healy, W. M. and E. S. Nenno. 1983. Minimum maintenance versus intensive management of clearings for wild turkeys. Wildl. Soc. Bull. 11:113–120.

Hillestad, H. O. and D. W. Speake. 1970. Activities of wild turkeys hens and poults as influenced by habitat. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 24:244–251.

Holbrook, H. T., M. R. Vaughan, and P. T. Bromley. 1987. Wild turkey habitat preferences and recruitment in intensively managed Piedmont forests. J. Wildl. Manage. 51:182–187.

Horkel, J. D., R. S. Lutz, and N. J. Silvy. 1978. The influence of environmental parameters on nesting success of upland game birds. Proc. Southeast. Assoc. Fish and Wildl. Agencies 32:234–241.

Kennamer, J. E. and M. C. Kennamer. 1990. Current status and distribution of the wild turkey, 1989. Proc. Natl. Wild Turkey Symp. 6:1–12.

Lazarus, J. E. and W. F. Porter. 1985. Nest habitat selection by wild turkeys in Minnesota. Proc. Natl. Wild Turkey Symp. 5:67–81.

Lopez, R. R. 1996. Population dynamics of eastern wild turkeys relocated into the Post Oak Savannah of Texas. M.S. Thesis, Texas A&M Univ., College Station. 54pp.

Lutz, R. S. and J. A. Crawford. 1987. Reproductive success and nesting habitat of Merriam's wild turkeys in Oregon. J. Wildl. Manage. 51:783–787.

Martin, T. E. 1993. Nest predation and nest sites: new perspectives on old patterns. BioScience 43:523–532.

McCaleb, J. E. 1954. An ecological and range vegetation analysis of the upland sites of the southern extension of the oak-hickory forest region in Texas. Ph.D. Diss., Texas A&M Univ., College Station. 99pp.

McGuiness, J. H., J. M. Benner, and W. P. Smith. 1990. Survival and nesting success of late winter wild turkey introductions. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 44:171–181.

Mosby, H. S. 1975. The status of the wild turkey in 1974. Proc. Natl. Wild Turkey Symp. 3:22–26.

Newman, C. C. 1945. Turkey restocking efforts in east Texas. J. Wildl. Manage. 9:279–289.

Ott, R. L. 1993. An introduction to statistical methods and data analysis. Fourth ed. Duxbury Press, Belmont, Calif. 1,049pp.

Pelham, P. H. and J. G. Dickson. 1992. Physical characteristics. Pages 32–45 *in* J. G. Dickson, ed. The wild turkey: biology and management. Stackpole books, Harrisburg, Pa.

Porter, W. F. 1992. Habitat requirements. Pages 202–213 *in* J. G. Dickson, ed. The wild turkey: biology and management. Stackpole Books, Harrisburg, Pa. 463pp.

Robel, R. J., J. N. Briggs, A. D. Dayton, and L. C. Hulbert. 1970. Relationships between visual obstruction measurements and weight of grassland vegetation. J. Range Manage. 23: 295–297.

SAS Institute, Inc. 1985. SAS Language guide for personal computers, version 6 ed. SAS Inst. Inc., Cary, N.C. 429pp.

Seiss, R. S., P. S. Phalen, G. A. Hurst. 1990. Wild turkey nesting habitat and success rates. Proc. Natl. Wild Turkey Symp. 6:18–24.

Speake, D. W., L.H. Barwick, H. O. Hillestad, and W. Stickney. 1969. Some characteristics of an expanding turkey population. Proc. Southeast Assoc. Game and Fish Comm. 23:46–58.

Texas Parks and Wildlife Department. 1980–94. Federal Aid Report: Furbearer animal investigations, furbearers survey and population indexing. Proj. No. W-126-R. Austin, Texas.

———, 1995. Landowner Assisted Management Permitting System (LAMPS) hunter card survey. Austin, Texas.

White, G. C. and R. A. Garrott. 1990. Analysis of wildlife radio-tracking data. Acad. Press, San Diego, Calif. 383pp.

Williams, L. E. Jr., D. H. Austin, N. F. Eichholz, T. E. Peoples and R. W. Phillips. 1968. A study of nesting turkeys in southern Florida. Proc. Southeast Assoc. Game and Fish Comm. 22:16–30.