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A Turkey Nesting Study in Gregory County, South Dakota

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A TURKEY NESTING STUDY IN GREGORY COUNTY, SOUTH DAKOTA

by

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Abstract

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Nest site vegetation characteristics and selection by wild turkey hens in Gregory County, South Dakota were examined during 1984 and 1985. A total of 23 adult and 12 juvenile hens were monitored during the study. Average adult nesting rate was 42% (31% in 1984 and 54% in 1985). No juveniles nested either year. Nesting success in 1984 and 1985 was 80% and 0%, respectively. Data was collected from 8 woodland and 5 grassland nests. Nest initiation dates ranged from 20 April to 13 June. Nest sites were chosen in locations having overhanging vegetation within 1 m above the nest bowl. Grassland nests appeared to be in areas with moderately dense understory cover (<0.9 m). Nest site locations indicated a selection for woodland habitat.

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INTRODUCTION

During the last few decades, the wild turkey (Meleagris gallapavo), has been re-established throughout its original range in South Dakota (Schorger 1966) and has been introduced into other areas of the state. Restocking has been accomplished through the efforts of the South Dakota Department of Game, Fish, and Parks and the help of private individuals.

Wild turkeys were once thought to require large, undisturbed tracts of woodlands isolated from human interactions. However, research has shown turkeys to be very adaptable to a variety of habitats and also opportunistic when choosing nest sites (Leopold 1944, Ligon 1946, Stoddard 1963, Logan 1973).

More recent studies have shown the importance of specific vegetational information about nest sites and have given a more detailed analysis of these characteristics. Wild turkey nest sites in the montane regions of the southeastern United States were usually adjacent to a tree or other vertical object. Healy (1981)described ground cover (<25 cm tall) around the nest sites as thin, while woody understory (>50 cm tall and 2.5 cm dbh) was moderately dense. This combination of characteristics afforded a hen a wide field of view and also provided concealment. In southeastern Minnesota, Lazarus and Porter (1985)found nest sites were predominately in areas having at least 40% canopy cover, 0.9 stems/m, and 32% and 19% forb cover in the understory and ground layer, respectively. Although the turkey is able to adapt to varied habitat conditions, without specific and quantitative information, it is

difficult to identify habitats and microhabitats suitable for nest sites in differing locals. Management to maintain or improve turkey nesting habitat in southcentral South Dakota is dependent on such quantitative information.

Hillestad and Speake (1970) stated that lack of high quality nesting and brood-rearing habitat may well be the weak link in wild turkey management. The study herein, was designed to determine those habitat characteristics selected by wild turkey hens for nesting in southcentral South Dakota. Nest site selection is influenced by topographical, micro-climatological, and vegetational characteristics of the local habitat. Therefore, any management plans involving habitat manipulation to increase or maintain wild turkey productivity must be geared specifically to this region. The following null hypotheses were developed for this research project:

1. Ho: Vegetation and physical attributes of wild turkey nest sites and those of randomly-selected non-nest sites within the same cover types are not significantly different.
2. Ho: Turkey nests, located within the study area, are distributed in proportion to the availability of the cover types on the study area.

Field objectives of this study were to examine (1) specific nest site vegetation characteristics and (2) nest site locations with regard to nest distribution in available cover types.

STUDY AREA

This project was conducted on 12,614 ha located in Gregory County in the southcentral part of South Dakota, approximately 8 km north of St. Charles. The study area is situated in the Missouri River Breaks geographical region, and the majority of the land is part of the C. Kehn Ranch. Average annual air temperature is 8.9 C; the area has an annual average precipitation of 56 cm. Primary soil formations include loams, sandy loams, silty clays, and clays. Two major drainages in the area, Sand Creek and Burnt Rock Creek, and their secondary drainages intersperse the grassy uplands with wooded sideslopes and bottomland. Grasslands were dominated by sideoats gramma (Bouteloua curtipendula), blue/hairy gramma (B. gracilis/ B. hirsuta), and sedges (Carex spp.), while the woodlands were dominated by bur oak (Quercus macrocarpa) and green ash (Fraxinus pennsylvanica) (McCabe 1984). Primary land use was cattle grazing, although a small portion of the study area was farmed for hay, small grains, and corn. Stock dams located throughout the area provided permanent water sources.

METHODS

Capture and Marking

Turkeys were captured during the spring seasons of 1984 and 1985 using a cannon net (Austin 1965) and walk-in traps (Petersen and Richardson 1975), pre-baited with whole corn. Cannon-netting was done in a hay yard located on a farmstead within the study area. Walk-in

traps were placed along ridges at the top of wooded draws. Trapping began in early March and ended in late May. In addition, there were 2 days of mid-winter trapping each year.

All captured hens were fitted with a size 24, aluminum, butt-end leg band (National Band and Tag Co., Newport, KY.), which was attached to the right tarsometatarsus. Each bird was placed in a burlap bag of pre-determined weight and weighed with a "Model 50" laboratory scale (Douglas Homs Corp., Belmont, CA) to the nearest 0.1 kg. The birds were aged (Latham 1956) as adult or juvenile (<2 yrs) by examining the tenth primary. Patagial tags (Knowlton et al. 1964) were placed on both wings. Tags were numbered to correspond with the leg-band numbers and color-coded to show if the hens were radio-transmittered.

Radio-transmitters (Advanced Telemetry Systems, Inc., Bethel, MN), with frequencies between 150.000 and 152.000 MHz and powered by lithium batteries, were attached to the captured hens. Each 100 gm transmitter was mounted on the back of the turkey by a loop under each wing and a neck loop. In 1984 transmitters were attached using a plastic-coated, stainless steel cable to form neck and wing loops. Aluminum crimps were built into the transmitters and held the cable in place. Parachute cord was used in 1985, because it made the radio easier to attach, was more flexible, and was lighter. Nenno and Healy (1979) found transmitters, within the weight range used on this project, had a minimal effect on behavior and body condition after being attached for a few days. Because adult hens have a greater tendency to nest (Wheeler 1948, Williams et al. 1976), only 12 juvenile hens were fitted with transmitters.

Monitoring

Radio-collared turkey hens were monitored by using 3 pairs of 4 element, parallel, Yagi antennas; Advanced Telemetry Systems' "Challenger 200" programmable, scanning receivers; and null/peak combiners. Each pair of antennas was mounted on 1 of 3, 12.2 m towers located 1.2, 1.8, and 2.5 km apart in a triangular pattern. Telemetry readings on each bird were taken simultaneously from 2 of the towers. Accuracy of the telemetry system was checked before each set of readings by calibrating the antennas to a beacon transmitter set at a pre-determined direction from each tower.

From May through August in 1984 and April through August in 1985, each radio-collared hen was monitored hourly, sunrise to sundown, 2 days a week, to determine if incubation had begun. Hourly telemetry readings varied only ± 1 degree throughout the day if a hen was incubating. To verify whether a hen was incubating, telemetry readings were taken at night to check if there was movement to a roost site. Incubating hens do not roost, therefore, no change in night telemetry readings indicated a hen was incubating.

After incubation had begun, a ground search for the turkey was made using a hand-held Yagi antenna to determine the location of the nest. Since nest abandonment occurs most often in the early stages of incubation (Mosby 1940, Dalke et al. 1946), the search was not made until the hen had been incubating for at least 1 week to minimize abandonment due to human disturbance (Williams et al. 1980).

In addition, ranchers found turkey nests while working on the study area. These nests were not used in the cover-type use analyses, because the nests were not found by a random search. However, data collected at these nest sites, and the associated non-nest sites, were used in the vegetation analyses and the nest production calculations whenever possible.

Cover Mapping

Study area boundaries were determined by drawing a circle having a radius equal to the farthest distance (5.6 km) a nest site was located from the capture site. Three dominant cover types (grasslands, woodlands, and agricultural lands) were delineated on aerial photographs and topographic maps. The area of each cover type was determined using an electronic table digitizer, and the percentage of each cover type was then calculated. On-site observation was used for verification and to differentiate between grasslands and agricultural lands. Grasslands consisted of grazed, ungrazed, and hayed prairie. Any cultivated fields, including wheat, soybean, and alfalfa fields were considered agricultural lands. In addition, the percentage of each cover type was calculated for a subsection (7,285 ha) of the study area. Previous studies determined this subsection, which included all three cover types, intensively used by the turkeys (McCabe 1984, Craft 1986). Two farmsteads were located within this subsection, which the turkeys frequented throughout the winter and summer.

Vegetation Sampling

Estimates of canopy cover, understory cover density, and ground cover were made at nest site locations and randomly-selected, non-nest sites within the same cover types. All nests were catagorized into woodland, grassland, or agricultural cover types. A nest site was defined by a circle with a diameter of 3.57 m (1/1000 ha), with the nest bowl at the center. The circle was then divided into quarters along the cardinal axes. At woodland nest sites, all trees having a diameter at breast height (dbh) >3 cm were counted, and the distance from the nest to the nearest tree in each quadrat was recorded. Canopy cover was estimated using a Model C densiometer (Lemmon 1957). Densiometer readings were taken at a height of 1 m in each of the 4 cardinal directions 1.78 m (the radius of the nest circle) from the nest, and 1 was taken directly over the nest.

A vegetation profile board (Nudds 1977) was used to measure understory cover density. The 1.8 m board was divided into 2, 90 cm sections and measured 25 cm wide. The percentage of each section covered by vegetation was recorded. Vegetation profile board readings were taken in each of the 4 cardinal directions, 5 m from the nest (the distance found to give the greatest variation in vertical cover). Ground cover was estimated using a 50 x 20 cm Daubenmire frame (Daubenmire 1968). The percent cover of grasses, forbs, shrubs, and seedlings in each sampling frame was recorded. Daubenmire plots were located in each of the 4 cardinal directions 1.78 m from the nest. Also, the presence or absence of vegetation directly over the nest bowl was recorded.

Vegetation sampling was done only after the hen and brood had left the nest site. No attempt was made to collect data at the nest site while the hen was sitting to avoid potential nest abandonment. If telemetry readings indicated a hen had permanently left the nest site area, vegetation sampling was done at that time.

Because of a 2-3 week laying period and a 26 day incubation period (Williams 1972), the vegetation around the nest site changed from the time when the hen chose the nest site and when vegetation measurements were taken. To obtain data on vegetation growth at the time the hen chose the nest site, alternate sites in woodlands, grasslands, and alfalfa fields were sampled every 3 weeks starting in April. Comparing the data collected from the early sampling to that of the later sampling showed the relative change in vegetation over time. The mean values for the vegetation readings, taken after a clutch had hatched, was destroyed, or abandoned, were adjusted for this relative change to present the possible vegetation characteristics at the time of nest site selection.

Data Analysis

Data obtained by vegetation sampling (Table 1) was analyzed by using stepwise discriminant analysis (Nie et al. 1975), except the data on overhanging vegetation, which was analyzed using a chi-square goodness of fit test. The proportion of nests located in each cover type was calculated and compared to the proportion of each cover type available. A chi-square goodness of fit test was used to determine if a

Table 1. Variables used in vegetation analyses between nest sites and non-nest sites in grasslands, woodlands, and agricultural fields.

Variable	Explanation
All sites	
GRASS	ave. 4 Daubenmire readings for % grass cover
FORB	ave. 4 Daubenmire readings for % forb cover
SHSE	ave. 8 Daubenmire readings for % shrub/seedling cover
NBBOT	ave. lower 3 sections of the 4 Nudds' board readings
NBTOP	ave. upper 3 sections of the 4 Nudds' board readings
DENSM	ave. 5 densiometer readings
OVVEG	presence (1) / absence (0) of overhanging vegetation directly over the nest site
Woodland sites only	
NUTS	no. trees (>3 dbh) within 3.54 m of the nest site
QDIS1	distance from nest (cm) to nearest tree in NE quadrat
QDIS2	distance from nest (cm) to nearest tree in SE quadrat
QDIS3	distance from nest (cm) to nearest tree in SW quadrat
QDIS4	distance from nest (cm) to nearest tess in NW quadrat

cover type was used significantly ($P \leq 0.05$) more than others. If there were significant differences, confidence intervals were constructed around the proportion of observed use of the cover types to determine selection or avoidance (Neu et al. 1974).

RESULTS

A total of 23 adult and 12 juvenile wild turkey hens were monitored during 1984 and 1985. In 1984, 4 monitored hens nested, and 3 were successful (Table 2). Another nest, also successful, was found by a rancher and was included in nest success and nesting rate calculations and in the discriminant analysis of the nest site vegetation. Nesting success (calculated by dividing the number of nests having at least 1 egg hatched by the total number of nests incubated) was 80%. Seven radio-transmittered hens nested in 1985. One hen also attempted to renest after her first nest was destroyed. None of these nests were successful. The average adult nesting rate (computed by dividing the number of nests incubated by the number of hens monitored) was 42% (31% in 1984, 54% in 1985). No juveniles were found to have nested either year.

Seven of the 8 nests found in 1985 were destroyed by predators (Table 2). The other was abandoned. Evidence found at the destroyed nest sites was indicative of mammalian, rather than avian, predators (Davis 1959). Eggs were usually removed from the nest, and broken or smashed. Investigator disturbance may have been associated with one nest failure. The nest was found one morning and was destroyed within

Table 2. Production and fate of wild turkey nests found in woodlands, grasslands, and agricultural fields during 1984 and 1985 on a study area in Gregory County, South Dakota.

Bird No.	Date Initiated	Date Hatched	# Eggs Laid	# Eggs Hatched	# Eggs Infert.
Woodland nests					
XX	21 Apr 84	2 Jun 84	17	14	2
45	7 May 84	18 Jun 84	9	9	0
73	13 May 84	24 Jun 84	10	9	0
38	unknown 84	destroyed (6/??)	>5		
05	21 Apr 85	destroyed (5/09)	10		
77	30 Apr 85	destroyed (6/04	9		
01	3 May 85	abandoned (6/04)	10		
21	10 Jun 85	destroyed (7/05)	>7		
Grasssland nests					
60	20 Apr 84	1 Jun 84	12	11	0
05	23 May 85	destroyed (6/12)	4		
70	28 May 85	destroyed (6/21)	10		
84	10 Jun 85	destroyed (7/05)	11		
27	13 Jun 85	destroyed (7/18)	11		
Alfalfa field nests					
XX	20 May 84	7 Jul 84	10	6	2

24 hrs. The other hens, which had their nests eventually destroyed, continued sitting 4-12 days after I visited them, therefore investigator disturbance was not considered to have influenced these failures.

Six nests were found by ranchers in alfalfa fields when the hay was being cut. All but one, which hatched successfully 11 days after the hay was cut, were destroyed by the windrower. These nests were not used in the cover-type analysis, but were used to compare nest site vegetation characteristics at nest initiation with nests in other habitats.

Initiation dates of successful nests were determined by back-dating 6 wks from hatching dates (16 days for laying, 26 days for incubation). Initiation dates of unsuccessful nests were determined by aging the embryos if there were intact eggs at the nest, or by using the telemetry data to determine when incubation started and back-dating 16 days to account for the laying period. Nest initiation dates ranged from 20 April to 13 June. Six of the 8 woodland nests were initiated before 15 May. The successful nest found in alfalfa was initiated 20 May. With one exception, all nests located in the grasslands were initiated after 15 May. The hen that nested in the grasslands during April did so in a field of ungrazed, warm-season, residual grass. Two grassland nests were located under thickets of snowberry (Symphoricarpos albus) and wild plum (Prunus americana) in grazed pastures. Two other grassland nests were located in ungrazed pastures: 1 in orchard grass (Dactylis glomerata) and 1 under a small bur oak sapling.

Analysis of nest sites and randomly-selected, non-nest sites within the grasslands indicated that understory cover density <0.9 m was the only discriminating variable. This accounted for 50% of the variation between sites when entered into the discriminant equation. Understory cover density around the nest sites was higher than that of non-nest sites, the averages being 63% and 28%, respectively (Fig. 1, Appendix 1). Sixty percent of the nest sites and 100% of the non-nest sites were correctly reclassified using the discriminating ability of this variable.

Discriminant analysis of woodland nest sites and randomly-selected non-nest sites was unable to determine any discriminating variables (Fig. 2, Appendix 2). All woodland nests were located next to a tree or under a shrub. Of the 8 woodlands nests, 4 were found next to bur oaks, 2 were under gooseberry bushes (Ribes spp.), 1 was under a gooseberry bush next to a bur oak, and 1 was under a gooseberry bush next to a green ash.

By using the initiation date of the successful nest in the alfalfa field (initiation dates for the other nests could not be calculated), a comparison was made between the vegetation in the grasslands and the alfalfa fields at the time of nest site selection. Average height of vegetation in alfalfa fields was double that of grassland vegetation, the means of the understory cover density <0.9 m being 36% and 18%, respectively. Ground cover in the grasslands consisted of 84% grass and 6% forbs, while alfalfa fields had 26% grass and 53% forbs.

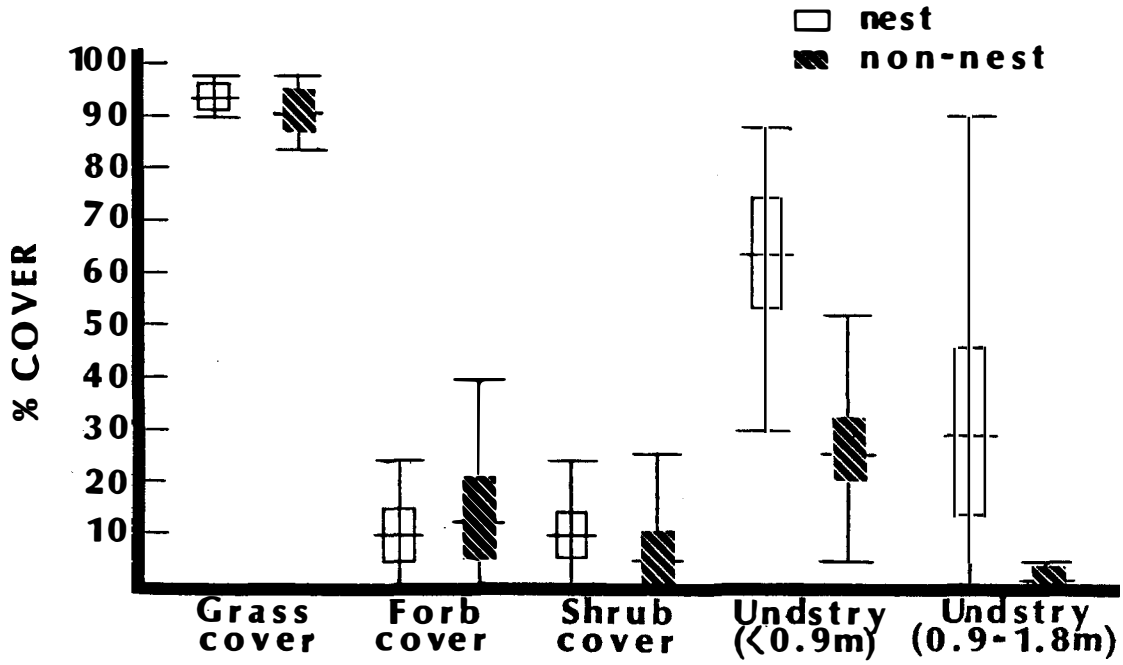

Figure 1. Means, ranges, and standard errors of all variables used in stepwise discriminant analysis between wild turkey nest sites (n = 5) and non-nest sites (n = 5) located in grasslands on a study area in Gregory County, South Dakota during 1984 and 1985.

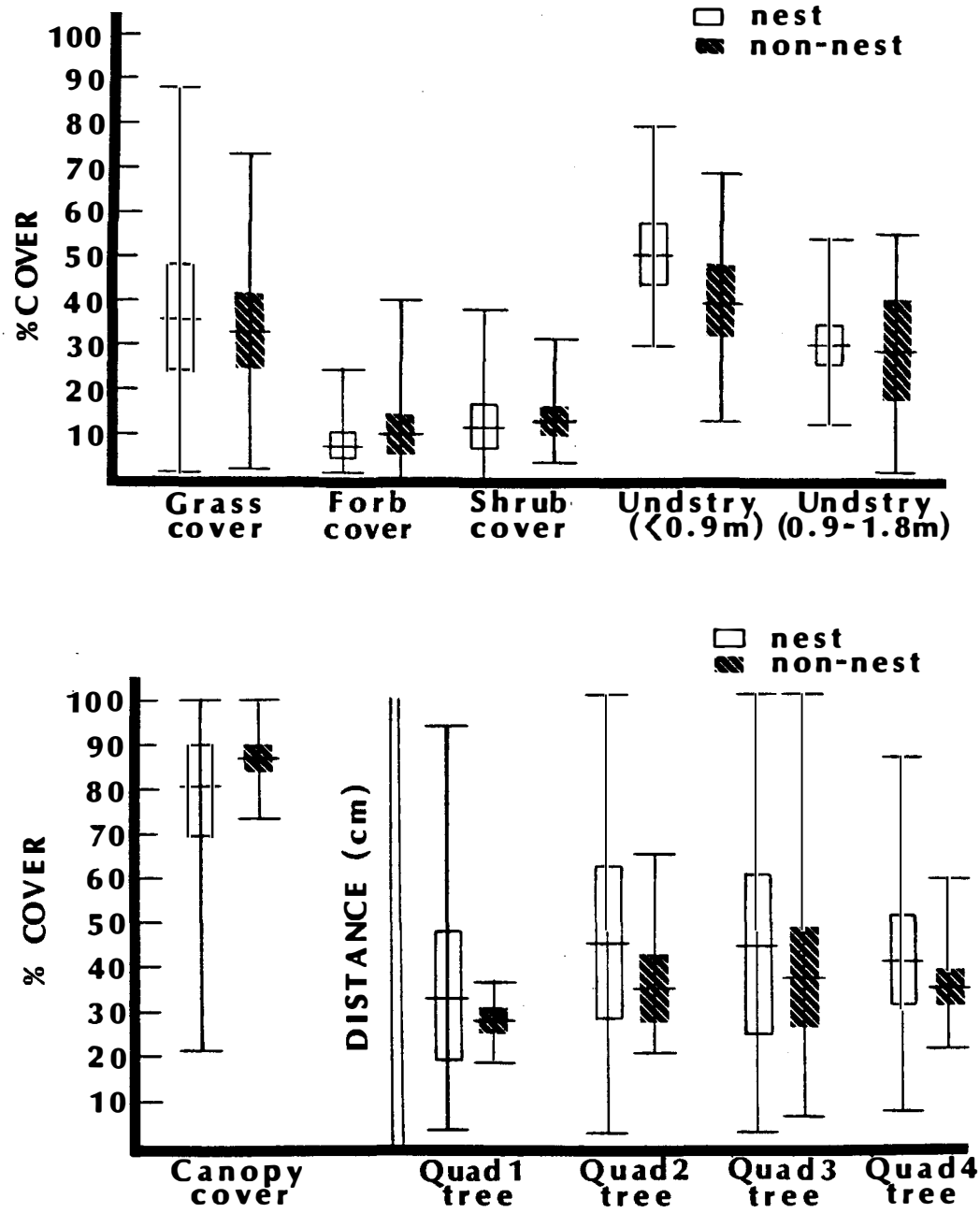

Figure 2. Means, ranges, and standard errors of all variables used in stepwise discriminant analysis between wild turkey nest sites (n = 8) and non-nest sites (n = 8) located in woodlands on a study area in Gregory County, South Dakota during 1984 and 1985.

Chi-square analysis showed a significant difference (χ^2 = 22.28, $P \leq 0.01$) between the occurence of overhanging vegetation within 1 m above nests and non-nest sites; overhanging vegetation was present at more nest sites.

Chi-square goodness of fit tests for cover-type use indicated there was a significant difference ($P \leq 0.05$) between the number of nests found in woodlands and grasslands and the number expected if the hens were randomly selecting nest sites (Table 3). Selection/avoidance analysis determined that woodland habitat was being selected ($P \leq 0.05$) by hens for nest sites, while grasslands were neither selected nor avoided (Table 4). Within the intensively-used subsection, there was no significant difference ($P \leq 0.05$) between the number of nests found in the different cover types and the number expected in each (Table 3).

DISCUSSION

Productivity data from 1984 and 1985 for the wild turkey population in Gregory County, South Dakota showed a decrease in reproductive success. Although the failure of juvenile hens to nest added to the low nesting rate and subsequent low productivity, the small percentage of adult hens that nested is of major concern. The average adult nesting rate of 42% for this population indicated a definite lack of reproduction compared to other studies on different populations, which reported nesting rates of 94% (Glidden 1977), 96% (Hayden 1979), and 64% (Williams et al. 1980).

Table 3. Chi-square values for cover type use by nesting wild turkey hens during 1984 and 1985 within a 12,614 ha area and an intensively used 7,285 ha subsection of the area in Gregory County, South Dakota.

Cover type	Total Area (ha)	Total % of area	Proportion Observed	Proportion Expected	Chi-sq. value
12,614 ha area					
Grassland	7356	58	5	7.54	
Woodland	3189	25	8	3.25	9.88*
Agriculture	2069	16	0	2.08	
7,285 ha subsection					
Grassland	2024	67	4	6.03	
Woodland	778	25	5	2.25	4.76
Agriculture	233	8	0	0.72	

* significant at 0.05 level

Table 4. Selection or avoidance of cover types for nest sites by wild turkey hens within a 12,614 ha area in Gregory County, South Dakota.

Cover type	Actual Proportion and 95% Confidence Intervals	Proportion observed
Grassland	0.58 (0.14 < P < 0.73)	0.44
Woodland	0.25 (0.27 < P < 0.86)*	0.56

* selected for (actual proportion < lower confidence limit)

The success rate of 80% in 1984 was much higher than previous findings by Wheeler (1948), McDowell (1956), and Logan (1973), who reported 27%, 35%, and 39%, respectively. With a high success such as this, the low nesting rate may not have been a major factor affecting population growth. Trapping data from 1985 seemed to support this data, as 47% of all birds cannon-netted and 60% of all birds caught in walk-in traps were juveniles. In 1985 the total nest failure of all monitored birds, coupled with the low nesting rate, could have had a severe affect on the population. Trapping done in early January and mid-February of 1986 resulted in only 7% of 27 birds captured being juveniles.

There seems to be a trend to select woodlands for nest sites, although due to the small sample size, this may not be indicative of what was actually happening. Woodland selection for nest sites has been documented in Missouri (Leopold 1944), New Mexico (Ligon 1946), and Alabama (Wheeler 1948). Woodlands provided overhead concealment as well as concealment at ground level, but woodlands make up only 25% of the available habitat on the study area. The major portion of the area was grassland (58%), of which little was considered usuable nesting habitat. Nesting opportunities in the woodlands were greater than those in the grasslands, due to the scarcity of concealing vegetation in the grasslands. Vegetation in most of the grasslands was never at a great enough height or density to provide adequate cover. Those areas which were not grazed were used for hay, or the vegetation was sparse. Nesting opportunities in the grasslands were limited to shrub thickets or the few areas which had not been grazed during the past few years.

Alfalfa fields were able to provide concealment for the turkey hens, as well as a clear field of vision above 40 cm. Nests located in the alfalfa fields were situated away from roost trees used by avian predators. Unfortunately, due to the early first cut of hay, most nests were destroyed. This was the case both years of the study.

CONCLUSIONS

The success of wild turkey populations in southcentral South Dakota has been shown to be dependent upon the quality, and to some extent quantity, of habitat in the area. Wild turkey hens need adequate cover for successful nest concealment. Since land use practices in the woodlands are seemingly conducive to wild turkey nesting, there is no reason to change those practices.

Three techniques may be used to improve the grassland habitat for wild turkey nesting. The first is to implement some type of grazing rotation for the pastures. Allowing some pastures to rest for a year, or for at least a growing season, would enhance those areas for turkey nesting. Also, preserving or promoting shrub thickets would provide turkeys with more nest sites in grasslands. The third method would involve delaying the first cut of hay until the last week of June on private land managed primarily for wild turkeys. This would allow extra time for nests in hayfields to hatch, instead of destroying those nests with the windrower.

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Appendix 1. Means, ranges, and standard errors of all variables used in vegetation analyses between wild turkey nest sites (n = 5) and non-nest sites (n = 5) located in grasslands on a study area in Gregory County, South Dakota during 1984 and 1985.

	Nests			Non-nests		
Variable	$\bar{X}$	Range	S.E.	$\bar{X}$	Range	S.E.
Overhanging vegetation	1.0	1.0 - 1.0	0.0	0.2	0.0 - 1.0	0.2
Grass cover	93.4	90.0 - 97.0	1.2	91.0	84.0 - 97.0	2.4
Forb cover	10.2	0.0 - 24.0	5.1	11.6	0.0 - 40.0	7.2
Shrub and seedling cover	10.0	0.0 - 24.0	4.6	5.0	0.0 - 25.0	5.0
Understory cover (<0.9 m)	63.8	31.0 - 86.0	10.4	27.8	5.0 - 52.0	8.2
Understory cover (0.9 - 1.8 m)	31.4	0.0 - 90.0	16.9	1.0	0.0 - 4.0	0.8

Appendix 2. Means, ranges, and standard errors of all variables used in vegetation analyses between wild turkey nest sites (n = 8) and non-nest sites (n = 8) located in woodlands on a study area in Gregory County, South Dakota during 1984 and 1985.

	Nests			Non-nests		
Variable	$\bar{X}$	Range	S.E.	$\bar{X}$	Range	S.E.
Overhanging vegetation	1.0	1.0 - 1.0	0.0	0.1	0.0 - 1.0	0.2
Grass cover	35.0	1.0 - 86.0	11.2	33.0	2.0 - 73.0	8.5
Forb cover	7.8	1.0 - 24.0	3.3	10.4	0.0 - 40.0	4.5
Shrub and seedling cover	14.2	0.0 - 38.0	4.6	14.6	5.0 - 31.0	3.2
Understory cover (<0.9 m)	50.0	30.0 - 77.0	5.5	39.6	15.0 - 71.0	6.8
Understory cover (0.9 - 1.8 m)	30.5	14.0 - 54.0	4.3	27.8	1.0 - 55.0	6.8
Densiometer readings	81.2	22.0 - 99.0	9.1	86.6	74.0 - 99.0	3.4
Distance to tree in NE quadrat (cm)	32.1	4.0 - 93.0	10.9	29.2	20.0 - 37.0	1.8
Distance to tree in SE quadrat (cm)	48.4	3.0 - 112.0	13.2	36.0	22.0 - 63.0	4.7
Distance to tree in SW quadrat (cm)	47.0	3.0 - 176.0	20.6	38.2	8.0 - 124.0	13.1
Distance to tree in NW quadrat (cm)	43.8	10.0 - 88.0	8.6	37.1	21.0 - 57.0	4.4
Number of trees at nest site	1.6	0.0 - 5.0	0.6	0.2	0.0 - 1.0	0.2