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Macrohabitat Associations of Merriam's Turkeys in the Black Hills, South Dakota

Abstract

Merriam's turkeys (*Meleagris gallopavo merriami)* were introduced into South Dakota in the late 1940's and have since expanded to occupy the entire Black Hills. Because little is known of their habitat requirements and the effects of forest management practices on this important game species, macrohabitat selections patterns of Merriam's turkeys in the Black Hills, SD were studied. Habitat units of 3-32 ha were delineated and described with methods used by the Forest Service for assessing impacts of management activities on wildlife. Winter habitats of turkeys were ponderosa pine *(Pinus ponderosa)* with greater than 70% overstory canopy cover. Summer habitats of turkeys were open ponderosa pine. Meadows were selected less than expected during all seasons. Resolution of conflicts over management of national forests depend largely on understanding of effects of management activities on wildlife species. Managing ponderosa pine at 14 to 18 m^2/ha basal area in mature stands will reduce winter habitat for turkeys, but is consistent with summer habitat of adult turkeys without poults.

Introduction

Wild turkeys were not native to western South Dakota, but were transplanted in 3 separate releases of 8, 15, and 6 birds in 1948, 1950, and 1951, respectively (Peterson and Richardson 1973). Population estimates of turkeys in the Black Hills of South Dakota were 1,000 in 1952 and 5,000-7,000 in 1960; current estimates exceed 10,000.

Habitat use and management of the Merriam's *(Meleagris gallopavo merriami)* turkeys in nontraditional ranges have been studied in South Dakota (Peterson and Richardson 1975) and Montana (Rose 1956, Jonas 1966). Early studies of Merriam's turkey were limited by observation methods and contained biases in the assessment of the birds' habitat needs (e.g., Jonas 1966, Bryant and Nish 1975, Petersen and Richardson 1975, Shaw and Smith 1977). Telemetry has allowed collection of unbiased data on habitat use patterns, but few studies have been conducted in ponderosa pine *(Pinus ponderosa)* forest types (Mackey 1984, 1986, Schemnitz *et al.* 1985) and these have not addressed the detailed analyses of seasonal patterns of habitat selection. Habitats in prior studies were described vegetatively based on the dominant species of vegetation (Jonas 1966; Scott and Boeker 1975; Bryant and Nish 1975; Mackey 1982, 1986; Lutz and Crawford 1989) which precludes understanding the effects of forest management activities including logging or thinning on Merriam's turkeys. Increased value of ponderosa pine timber resources, emphasis on old growth timber, and improved technology for harvesting timber have potential to impact Merriam's turkey habitat (Shaw 1986). The objectives of this study were to determine seasonal habitat use and selection patterns of Merriam's turkeys in a ponderosa pine ecosystem.

Study Area

This study was conducted in the central Black Hills of South Dakota, 16km west of Rapid City. The study are encompassed 4,380 ha. Most of the land area is under management by the Black Hills National Forest, Pactola Ranger District. Private holdings associated with ranch operations, private homes, and cabins are located in the study area.

Vegetation of the study area is primarily pure ponderosa pine forest (84%). Meadows and aspen *(Populus tremuloides)/birch (Betula papyrifera)* habitats occur in drainages, but some monotypic aspen habitats also occur on north exposures. Bur oak *(Quercus macrocarpa)* and white spruce *(Picea glauca)* comprise less than 1% of the study area. Climax vegetation or potential natural communities include: *Pinus pnderosa/Symphoricarpos albus; P. ponderosa/Arctostaphylos uva-ursi; P. ponderosa/Juniperus communis; Populus tremuloides/Corylus comuta; Q. macrocarpa/Ostrya virginiana; Q. macrocarpa/S. albus;* and *Picea borealis* Hoffman and Alexander (1987).

Geologic material is predominantly Precambrian and Cambrian granite, schists, and metasediments (Hoffman and Alexander 1987). Elevation ranges from approximately 1300 to 1800 m. Climate is continental with cold winters and warm summers (Orr 1959). January is typically the coldest month with mean temperature extremes of -11 to 2 ^{o}C; July and August are the warmest with mean temperature extremes of 15 to 29 ^{o}C. Average annual precipitation is 50 to 55 cm of which 70-80% falls between April and September (S. Dak. Climatological Summary, No. 20-39-6, U.S. Weather Bur.). Snowfall averages 84 cm, but may range from 25 to 200 cm. The combination of climate and soils is ideally suited for ponderosa pine, with dependable seed crops occurring regularly and excellent crops occurring at approximately 3-year intervals (Boldt and Van Duesen 1974).

Methods

This study was conducted over a 3-year period beginning March 1986 and ending January 1989. Some turkeys in the Black Hills used ranch feedlots and suburban housing developments for winter feeding; others remained in the forest throughout winter or until deep snow forced them to use ranches (Petersen and Richardson 1975). This research was conducted on birds in the latter category.

Turkeys were trapped during the study in late February or early March using rocket nets and drop nets over corn bait. This study focused on hens because of their importance to population growth or decline. Forty-four (36 females and 8 males) of 82 turkeys trapped were fitted with backpack radio transmitters weighing approximately 108 g.

Locations of birds began after a l-week adjustment period to the radio transmitters (Nenno and Healy 1979). Each bird that remained in the study area was relocated 3 times each week. One location each week corresponded to each of the following time periods: sunrise to 1000 hr, 1001 to 1400 hr, and 1401 hr to sunset. Roosting habitats are included in Rumble (1992) and are not part of this paper. Birds that emigrated from the defined study area were relocated at least monthly to monitor their activities and determine if they moved back into the study area. Locations were determined by plotting 2 + bearings (frequently 5 +) from known locations on USGS 1:24,000 contour maps in the field using a handheld 2-element yagi antenna. Bearings were usually taken from positions that were within 300 m of the estimated location. Each location was assigned to a habitat unit (see below) based on maps and Universal Transverse Mercator coordinates and recorded to the nearest 100 m recorded in the field. To achieve independence of observations (Alldredge and Ratti 1986), only 1 location was recorded for each bird on any given day and most were 2 days apart. Errors associated with assigning habitat units to locations were avoided by making location and habitat determinations in the field. Twenty-seven percent of all locations were either direct visual observations or telemetric locations of birds within about a 50-m radius circle within the determined boundaries of the habitat unit (Rumble 1990: 16). Habitat assignments for bird's locations were facilitated by the topographic criteria used to determine habitat unit boundaries (see below).

Habitat Descriptions

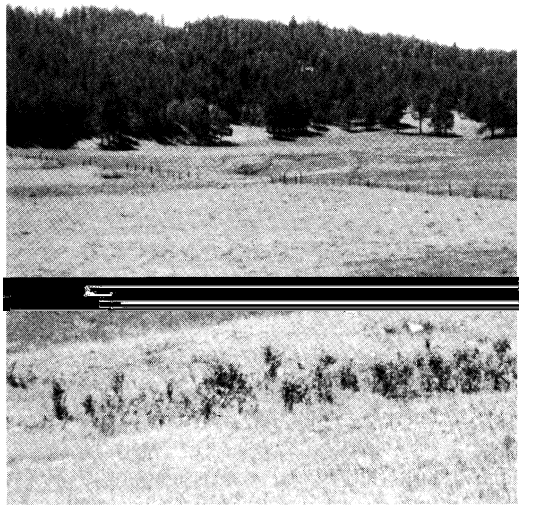
Habitats in this study were numerically identified geographical units, used by the Forest Service to partition land areas for management. Boundaries were defined by watershed topography (ridges and drainages) or distinct changes in vegetation type. Private lands in the study area were assigned to habitats based on interpretation of 1:24,000 aerial photographs. Existing habitat boundaries were extended if the vegetation type was continuous, or new boundaries were assigned if changes in vegetation type were apparent.

Vegetative descriptions of habitats were made from estimates of dbh and basal area in each delineated habitat unit. Five plots, distributed evenly across each habitat unit, were marked on 1:24,000 contour maps in the laboratory. When habitat units were too small for effective placement of 5 plots, fewer plots were used. Each plot was then relocated in the field and sampled, with trees included in sampling determined using a lo-factor prism (Sharpe et al. 1976).

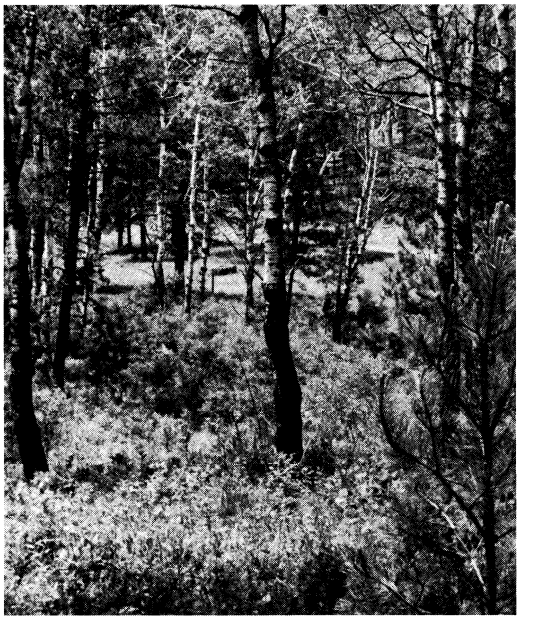
Descriptions of habitats were based on dominant species of vegetation and overstory canopy cover (Buttery and Gillam 1984). We did not stratify habitats on dbh classes because doing so did not improve understanding of habitat selection patterns of turkeys (Rumble and Anderson 1992). Overstory canopy cover (OCC) of ponderosa pine habitats was estimated based on the following

equation: OCC(%) = 0.51*BASAL AREA (FT^2/AC) - 1.94 (Bennett 1984). Aspen and birch habitats were combined because these species are managed as the same habitat by the Forest Service in the Black Hills. Our study included 513 habitat units from nine habitat categories which included meadows, aspen/birch 0-40% OCC, aspen/birch 4 1-70% OCC, aspen/birch > 7 1% OCC, ponderosa pine 0-40% OCC, ponderosa pine 41-70% occ, ponderosa pine > 71% OCC (Figure 1), spruce, and oak.

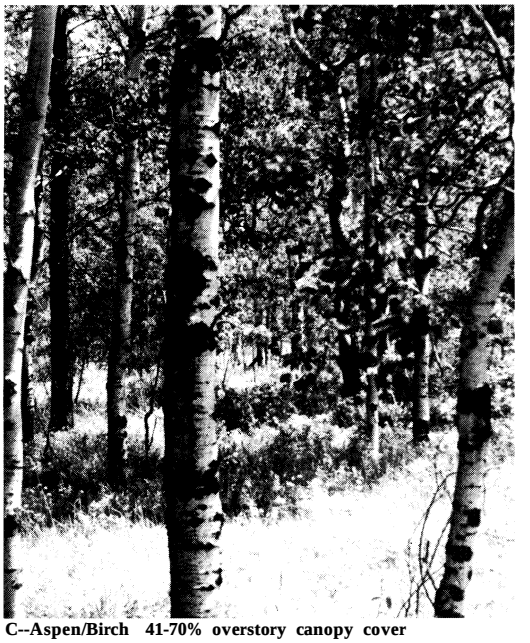
Figure 1. Major habitats represented in analyses of macrohabitat selection by Merriam's turkeys in the Black Hills, South Dakota.



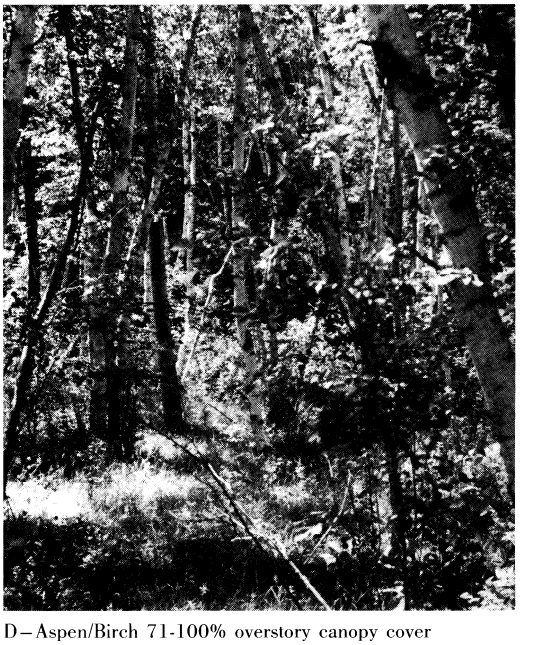
A – Meadows



B – Aspen/Birch 0-40% overstory canopy cover



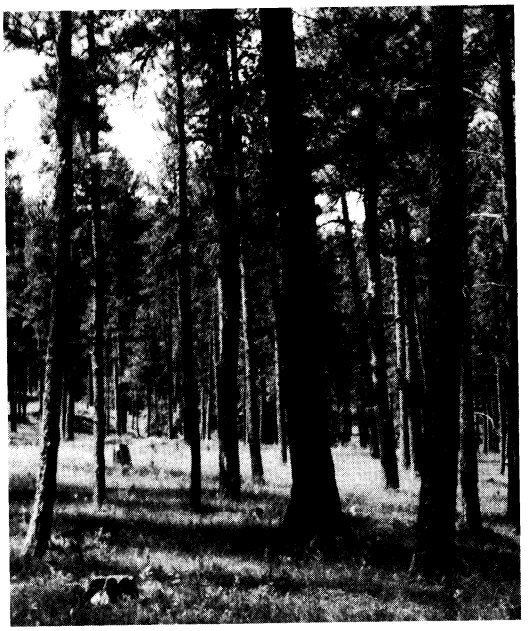
C--Aspen/Birch 41-70% overstory canopy cover



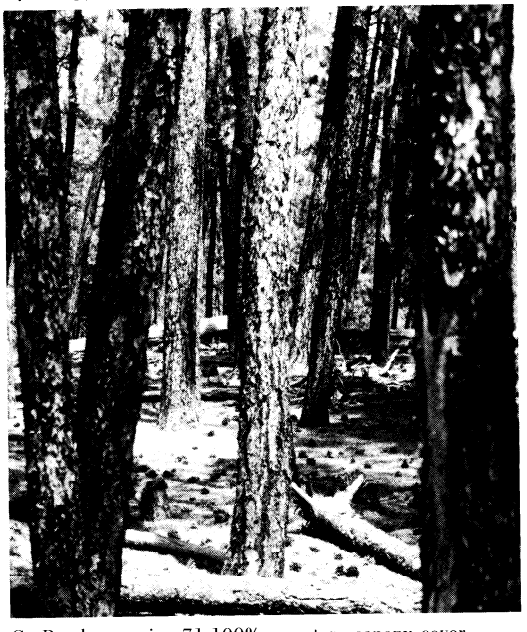
D – Aspen/Birch 71-100% overstory canopy cover

Figure 1. (Continued)

E—Ponderosa pine 0-40% overstory canopy cover



F—Ponderosa pine 41-70% overstory canopy cover



G—Ponderosa pine 71-100% overstory canopy cover

Analyses

Terminology used in this study follows Johnson (1980) and Thomas and Taylor (1990): *habitat use* implied utilization that was not compared to availability; *habitat selection* implied utilization that was compared to availability; and *habitat preference* requires differential selection of resources given equal availability and was not part of this study.

Habitat use/selection data from turkeys were stratified into seasons; December-February (winter), March-May (spring), June-August (summer), and September-November (fall). To ensure that the assumption of independence of observations was maintained, analyses were done using only 1 observation if 2 or more radio-marked birds were located together.

Chi-square tests attempt to fit a specified model to a data set and significance indicates deviations from the expected fit under the model. The model in each test was no interaction among factors of the contingency table and hypotheses are stated in a positive sense (Steel and Torrie (1980:496-499). Chi-square test of independence was used to test the hypothesis that habitat use patterns of Merriam's turkeys were similar among seasons. This hypothesis was rejected ($P \leq 0.001$) and subsequent tests of habitat selection were made within seasons. Chi-square goodness-of-fit tests with correction for continuity (Cochran 1963) were used to test the hypotheses that within seasons, habitats selected by Merriam's turkeys were not different from random allocation of observations within habitats based on proportional area. Because oak, spruce, and aspen individually comprised a small portion of the study area, initial chi-square tests were made with oak and spruce pooled, and aspen habitats pooled to reduce as much as possible the number of cells with fewer than 5 expected observations. Deviations of habitat use versus expected use for individual habitats were made individually for all habitats including the three overstory categories of aspen habitats, oak habitats, and spruce habitats, using Bonferroni Z-statistic confidence intervals around proportion of use (Neu *et al.* 1974, Byers *et al.* 1984) or by examination of chi-square residuals with G-standardization and Bonferroni correction to the Z-statistic if observed use was 0 (Mosteller and Parunak 1985). Significance of these confidence intervals hold regardless of the overall chi-square test (Neu *et al.* 1974).

Results

The hypothesis that habitat selection by Merriam's turkeys was similar to expected random allocation of observations within habitats was rejected ($P \leq 0.04$) for all seasons (Table 1). Aspen/birch habitats, 41-70% overstory canopy cover, were selected more than expected during spring and summer. Selection of aspen/birch habitats, 71-100% overstory canopy cover, was low over all seasons, but was less than expected only during spring. Open ponderosa pine habitats, 0-40% overstory canopy cover, were selected less than expected during the winter and spring. Ponderosa pine habitats, 41-70% overstory canopy cover, were selected equal to proportional availability during all seasons. Dense ponderosa pine habitats, 71-100% overstory canopy cover, were selected more than expected during fall and winter, and less than expected during summer. Meadows were selected less than expected during all seasons. Oak and spruce were not represented across all overstory canopy cover categories and comprised a small portion of the study area; therefore, few conclusions regarding selection of these habitats can be made except that use was infrequent during all seasons.

TABLE Seasonal utilization by Merriam's turkeys of habitats described by dominant species and overstory canopy cover of vegetation in the Black Hills of South Dakota (modified from Rumble and Anderson 1992).[1]

Habitat	Percent canopy cover	Proportional area	Winter (120)[2]	Spring (427)	Summer (124)	Fall (193)
Aspen/birch	0-40	0.015	0.017	0.023	0.024	0.005
Aspen/birch	41-70	0.052	0--	0.080	0.090	0.036
Aspen/birch	71-100	0.018	0.008	0.002--	0.016	0.005
Ponderosa pine	0-40	0.120	0.025--	0.084--	0.210	0.124
Ponderosa pine	41-70	0.390	0.317	0.433	0.355	0.342
Ponderosa pine	71-100	0.341	0.558+ +	0.365	0.233--	0.440+ +
Meadows		0.102	0.058--	0.009--	0.040--	0.036--
Oak	0-100	0.004	0.017	0	0.008	0.005
Spruce	0-100	0.006	0	0.002--	0.024	0.005

[1]Differences among habitats selected versus available, are indicated by -- if used less than expected and + + if used more than expected.

[2]Sample sizes (telemetry fixes) are in parentheses.

Discussion

Over the course of a year, turkeys varied their habitat selection patterns to include nearly all ponderosa pine habitats. During fall and winter, turkeys apparently sought out ponderosa pine with greater than 71% overstory canopy cover; open ponderosa pine habitats were selected by turkeys infrequently during these seasons. Late October to early November was when turkeys began to spend increased amounts of time in the dense ponderosa pine habitats. Fall and winter habitat selection patterns were consistent with periods when diets of turkeys were composed primarily of ponderosa pine seeds (Rumble 1990). It is probable that thermal and hiding cover were better met in dense ponderosa pine habitats during late fall and winter.

Habitat selection of ponderosa pine stands reversed from summer to winter. Use of open habitats increased, but not significantly. However, selection of dense ponderosa pine habitats was less than expected during summer. Summer diets of adult turkeys, were comprised mostly of grass seeds and vegetation (Rumble 1990). Greater amounts of vegetation occur under ponderosa pine habitats with open canopies (Uresk and Severson 1989). Three-fourths of Merriam's turkeys observations in ponderosa pine communities in Montana were pole size stands with an open herbaceous understory Jonas (1966).

Meadows were rarely selected by turkeys. Openings in the forest are often utilized by turkeys in the southeastern United States (Speake *et al.* 1975), in the southwest (Scott and Boeker 1977), and in Montana (Jonas 1966). Oak and spruce habitats comprised less than 1% of the study area, and few meaningful statistical patterns were evident. However, during years with good oak mast production, turkeys used oak habitats for 2-4 weeks in September and October. This suggests that the limited importance of oak habitats in our study was due to the narrow distribution of oak on the study area and irregularity of mast crops.

Aspen/birch habitats selected by turkeys in our study were primarily in drainages rather than monotypic aspen habitats that occurred on some north slopes. Winter foods of turkeys were not as available in aspen/birch habitats (Rumble 1990). However, aspen/birch habitats were used more during spring, summer, and fall. These habitats contained an abundance of grasses, forbs, and shrubs, which dominated late spring, summer, and early fall diets of turkeys (Rumble 1990). Turkeys in Utah used aspen glades (openings) as opposed to monotypic aspen habitats during summer (Bryant and Nish 1975).

Distribution of water affects habitat dispersion patterns of Merriam's turkeys in the southwest (Shaw and Smith 1977, Schemnitz *et al.* 1985). Spring weather conditions during this study were dry and some aspen/birch drainages had running water in them. Birds increased use of aspen/birch habitats with less than 70% overstory canopy cover during spring, but not statistically greater than expected from random. Free-standing water may not be required by turkeys in all habitats (Exum *et al.* 1987). Outside of the spring period, we observed turkeys at free-standing water on fewer than 10 occasions. The primary factor affecting the association of turkeys to water reported by Schemnitz *et al.* (1985) was feeding on watercress *(Nasturium officinale)* during winter.

Management Implications

Conflicts regarding management of the Black Hills National Forest can only be resolved if the effects of management actions on the wildlife species are understood. The Land and Resource Management Plan for the Black Hills National Forest proposes managing ponderosa pine habitats at 14 or 18 m^2/ha projected tree basal area when the average dbh of the stand is 25 cm. Basal area would be higher for larger diameter trees and lower for smaller diameter trees. During winter, Merriam's turkeys selected ponderosa pine habitats with greater than 70% overstory canopy cover and greater 32 m^2/ha basal area. Thirty-four percent of our study area was winter habitat for turkeys. Managing ponderosa pine stands to 14 or 18 m^2/ha basal area in mature stands will reduce availability of winter habitat for turkeys in the Black Hills. However, managing stands to 14 to 18 m^2/ha basal area would be consistent with summer habitats of adult turkeys without poults. On an annual basis, turkeys selected the full range of ponderosa pine habitats that occur in the Black Hills. If turkeys are a management priority, winter habitat should be abundant and well distributed (Hoffman *et al.* 1993) at lower elevations of the Black Hills. Management directed toward maintaining habitats in all of overstory canopy cover categories within vegetation types would ensure that habitat needs for turkeys would be met as well as many other wildlife species (Hoover and Wills 1984).

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