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Brood Habitat of Merriam's Turkeys in South-Central Washington

Abstract

Merriam's wild turkey (*Meleagris gallopavo merriami*) brood habitat use was studied from 17 May to 6 July 1981 in Klickitat County, south-central Washington. Garry oak (*Quercus garryana*) and ponderosa pine (*Pinus ponderosa*) -Garry oak habitats were used extensively by broods, and Douglas-fir (*Pseudotsuga menziesii*) and non-forest habitats were used less than expected ($P < 0.05$). Broods used areas with greater canopy cover, lower visibility, less slope, lower understory coverage, and habitats closer to cover than the overall environment.

Introduction

Merriam's turkeys were introduced in south-central Washington in 1960. While turkeys are currently managed as a game species in Washington, data concerning their habitat use are lacking.

Pack *et al.* (1980) statistically analyzed characteristics of turkey brood habitat in West Virginia; however, quantitative analyses of brood habitat use by Merriam's turkeys are not available. Healy and Nenno (1983) emphasized the importance of managing turkey habitat for young broods. The objectives of this study were to: 1) statistically evaluate turkey brood habitat in south-central Washington, and 2) provide data useful for management of brood habitat.

Study Area

The 4290 ha study area was located in southern Klickitat County, Washington, approximately 6 km northeast of the Klickitat River mouth. The area was characterized by gently undulating terrain dissected by steep canyons. Elevations ranged from 120 to 550 m above mean sea level. Seventy-four percent of the study area was forested. Forest types were described as Garry oak, ponderosa pine, and Douglas-fir by Franklin and Dyrness (1973). Nonforested areas were rangeland, wheat fields, and alfalfa pastures. Primary land uses were cattle grazing, wheat farming, and timber production.

Methods

Turkeys were trapped during winter using rocket nets or panel traps. Transmitters (87 g; Telonics, Mesa, Arizona) were attached to hens by a backpack mount with the harness under each wing (Everett *et al.* 1978). Radio-locations were determined by triangulation using a three-element hand-held yagi antenna and standard compass. A minimum of three bearings were taken for each location using the "loudest signal method" (Springer 1979).

Habitat use by four radio-marked broods was sampled from 17 May to 6 July 1981. Data were collected from 1-22 days post-hatching because most poult mortality occurs during this time (Glidden and Austin 1975, Little and Varland 1981) and brood food habits and habitat use may change as broods grow older (Williams *et al.* 1973, Healy *et al.* 1975, Nenno and Lindzey 1979, Pack *et al.* 1980). Each brood was located twice every other day. Locations were separated by a minimum of three hours and alternated between diurnal time periods: (1) sunrise to 1000 hours, (2) 1000 hours to 1400 hours, and (3) 1400 hours to sunset.

The northwest corner of a 15 x 25 m plot (Daubenmire and Daubenmire 1968) was placed at brood locations, and the plot was used to sample canopy height, height to lowest live tree limb, tree basal area, canopy coverage, distances to nearest cover and clearing, understory height, understory coverage, slope, and visibility. Mean canopy height and height to lowest live tree limb were determined from measurements taken with an Abney level on a subjectively selected "average" tree within the stand. Tree basal areas were calculated from diameter at breast height and density data (Avery 1967:40). Percent canopy coverage was obtained by averaging readings taken at each plot corner using a convex spherical densiometer (Lemmon 1956). Distances to nearest

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cover and clearing greater than 1 ha in size were measured from aerial photographs. Understory height was determined from an ocular estimate of the mean height of all shrub, forb, and grass species within the plot. Understory coverage was calculated as the sum of the estimated percent coverage of shrubs, forbs, and grasses within the plot. Percent slope was measured with an Abney level. Visibility was considered an index of cover density and sampled by modification of ocular estimation (DeVos and Mosby 1969:140); visibility was estimated from the plot center as the distance of unobstructed sight, averaged among four cardinal directions, approximately 1 m above and parallel to the ground. Fifty-five control plots were randomly selected for sampling from systematically located points over the entire study area. Control plots were the same size, and habitat variables were sampled in the same manner as brood plots. Control plots were used analytically to represent the random environment.

Each brood and control plot was classified as one of four habitat types based on ocular estimation of canopy coverage by tree species: 1) Garry oak = $\geq$ 60 percent Garry oak cover with $<$ 10 percent ponderosa pine and/or 30 percent Douglas-fir coverage; 2) ponderosa pine-Garry oak = $\geq$ 10 percent ponderosa pine coverage, 5–90 percent Garry oak cover, and $<$ 30 percent Douglas-fir cover; 3) Douglas-fir = $\geq$ 30 percent Douglas-fir coverage; and 4) non-forest = $<$ 5 percent total tree coverage in an area larger than 1 ha. Detailed information concerning these habitat types is reported by Mackey (1982).

Multivariate analysis of variance (MANOVA) (Cooley and Lohnes 1971:223) was used to test the hypothesis of no difference between brood and control plots considering all 10 physiographic characteristics simultaneously. If differences were detected, tests were conducted to determine which physiographic characteristics contributed significantly to the difference. Chi-square goodness-of-fit analysis was used to test the hypothesis that habitat types were utilized randomly (Sokal and Rohlf 1969:552). If a chi-square test was significant, methods of Neu *et al.* (1974) were used to determine which habitat types were used more or less than expected. "Expected" refers to the expected proportion of observations under the null hypothesis of use in proportion to availability. Expected values for chi-square tests were calculated from proportions of each habitat within the study area. Brood plots were considered independent samples of brood habitat use on the study area. Tests were considered significant at $P < 0.05$.

Results

Broods remained separate from each other during the study period and were dispersed over the entire study area. Chi-square goodness-of-fit analysis indicated habitat use was not random ($P < 0.005$, $\chi^2 = 32.1$, $df = 3$). Garry oak and ponderosa pine-Garry oak habitats were used more than expected; Douglas-fir and non-forest habitats were used less than expected (Table 1).

MANOVA analysis indicated a difference ($F_{(10,103)} = 4.33$, $P = 0.001$) between brood and control plots. Percent slope and understory coverage were less at brood plots than control plots ($P = 0.001$) (Table 2). Canopy cover was greater at brood plots, and brood plots were closer to cover than control plots ($P = 0.006$). Visibility was lower at brood plots ($P = 0.004$). Understory height was lower at brood plots, a difference which approached significance ($P = 0.056$). These data may be conservative since an unknown number of random control plots may have been sampled in suitable brood habitat.

Discussion

Garry oak and ponderosa pine-Garry oak habitats were heavily used, and non-forest habitat was used very little by turkey broods. These data indicate the importance of forest cover to young turkey broods. Studies have noted the preference of forest clearings or forest/non-forest edges to turkey broods in some eastern states (Hillestad and Speake 1970, Speake *et al.* 1975, Pack *et al.* 1980, Healy and Nenno 1983). This is likely due to greater insect and understory vegetation availability in clearings than in eastern hardwood forests (Blackburn *et al.* 1975, Martin and McGinnes 1975, Healy and Nenno 1983). Healy and Nenno (1983) identified the occurrence of herbaceous vegetation as the "essential feature" of turkey brood habitat. On my study area, Garry oak and ponderosa pine-Garry oak forests were characterized by diverse understory vegetation (Mackey 1982), and commonly contained clearings less than 1 ha in size. There appeared to be an abundant supply of insects and herbaceous vegetation in these habitats that likely provided broods with an adequate food supply and escape cover. Williams

TABLE 1. Analysis of wild turkey brood habitat use Klickitat County, Washington, 1981.

Habitat Type	Locations Observed	Proportion of Observations	Proportion of Study Area	95% Family Confidence Interval on Proportion of Observations	Use Category[1]
Garry oak	42	0.67	0.48	$0.52 \leq P_1 \leq 0.82$	M
Ponderosa pine/Garry oak	19	0.30	0.15	$0.16 \leq P_2 \leq 0.44$	M
Douglas-fir	1	0.02	0.11	$0.00 \leq P_3 \leq 0.06$	L
Non-forest	1	0.02	0.26	$0.00 \leq P_4 \leq 0.06$	L
Total	63	1.01	1.00		

[1]M = habitat used more than expected; L = habitat used less than expected ($P < 0.05$; adjusted $Z = 2.5$)

TABLE 2. Physiographic characteristics of wild turkey brood (N = 59) and control (N = 55) plots, Klickitat County, Washington, 1981.

Physiographic Characteristics	Brood Plots		Control Plots		Calculated F − Value	P > F
	$\bar{X}$	SD	$\bar{X}$	SD		
Slope (%)	15.6	10.1	23.7	16.1	10.60[a]	0.001
Understory coverage (%)	33.5	14.1	47.9	25.8	13.93[a]	0.001
Canopy coverage (%)	56.5	16.0	44.9	27.6	7.71[a]	0.006
Distance to cover (m)	1.1	6.8	7.8	17.0	7.85[a]	0.006
Visibility (m)	32.7	14.2	121.0	233.2	8.44[a]	0.004
Understory height (cm)	44.0	9.5	50.5	24.1	3.72	0.056
Height to lowest live tree limb (m)	3.0	1.4	3.3	3.4	0.24	0.624
Distance to clearing (m)	129.7	180.1	139.8	214.5	0.07	0.786
Canopy height (m)	9.8	4.2	10.1	8.8	0.05	0.822
Tree basal area (m^2/ha)	21.4	15.2	16.6	15.5	2.73	0.101

[a]Brood plots and control plots are significantly different ($F_{.05}(1,112) = 3.92$).

et al. (1974) noted that turkeys will remain in or near forest cover if preferred food such as grasses and forbs are available.

Use of Douglas-fir habitat was low, possibly due to steep slopes and understory vegetation characteristic of these sites. Broods used areas with relatively gentle slopes ($\bar{X}$ = 16 percent, SD = 10) and moderate understory coverage ($\bar{X}$ = 33 percent, SD = 14). Douglas-fir habitat occurred exclusively on steep north slopes. Approximately 45 percent of this habitat had been logged within the past 20 years, creating extremely dense understory vegetation which may have restricted brood use by limiting brood mobility and/or reducing visibility of the hen for detection of predators. Pack *et al.* (1980) observed young broods preferred gentle slopes (5-15 percent), and avoided steep slopes (> 49 percent) and forests with dense woody understories.

Land uses on the study area that should be addressed by turkey habitat management programs include: 1) clear-cutting of Garry oak and ponderosa pine-Garry oak forests, and 2) increasing human development. Clear-cutting of

forests on the study area should be avoided in favor of a selective cutting method which would maintain some forest cover. If clear-cutting must occur, clear-cuts should be less than 0.5 ha in size. Construction of buildings should be restricted to non-forested areas greater than 1 ha in size to avoid destruction of brood habitat and to minimize brood disturbance.

Due to the small number of turkey broods (n = 4) considered in the analyses, results from statistical analyses in this paper should be interpreted with caution. High error rates may occur if certain statistical analyses are applied to habitat use data when sample sizes are small (J. R. Alldredge and J. T. Ratti, unpublished data). I attempted to take a conservative approach when drawing conclusions from these data. Recommendations concerning brood habitat management should not be applied outside of the study area.

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