Habitat use and selection and home ranges of Merriam's Wild Turkey in Oregon

R. Scott Lutz
Texas Tech University, Lubbock, Texas

John A. Crawford
Oregon State University, Corvallis

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HABITAT USE AND SELECTION AND HOME RANGES OF MERRIAM'S WILD TURKEY IN OREGON

R. Scott Lutz[1] and John A. Crawford[2]

ABSTRACT.—Habitat use and selection by Merriam's Wild Turkeys (*Meleagris gallopavo merriami*) in Wasco County, Oregon, was studied during 1981–82. This turkey population selectively used forested cover types (such as ponderosa pine–Douglas-fir–oak, ponderosa pine–oak) characterized by a variety of structural features, species, and age classes. The population used single species forested cover types (oak, ponderosa pine) less than expected, used nonforested cover types in proportion to their availability, and avoided forested cover types with structure simplified by logging activities. The four age and sex classes had large seasonal home ranges ($\bar{x}$ = 1,615 ha); the smallest home ranges were exhibited by adult males in winter and the largest were shown by subadult males in fall. In most instances, turkeys used cover types as they were available. We suggest that structural complexity of vegetation, both within and among cover types, is an important component of habitat for Merriam's Wild Turkeys that should be considered in the evaluation of potential release sites and in habitat management plans.

The native range of Merriam's Wild Turkeys was described by Ligon (1946) as coinciding with the distribution of ponderosa pine (*Pinus ponderosa*) in Colorado, New Mexico, and Arizona. In addition, this subspecies was introduced into 10 other western states (Jonas 1966). Information on habitat use in both native and introduced ranges is sparse and limited to descriptions of roost and nest sites (Hoffman 1968, Boeker and Scott 1969, Jones 1981, Mackey 1984, Lutz and Crawford 1987a). Mackey and Jonas (1982) provided the only quantitative data on seasonal habitat use. They found that introduced Merriam's Wild Turkeys preferred forested cover types, such as ponderosa pine–oak (*Quercus garryana*) and Douglas-fir (*Psuedotsuga menziesii*), during winter, spring, and summer in Washington. There is no information on seasonal use of habitats by age and sex groups of turkeys.

Information on habitat use is essential for management of existing populations and useful in evaluation of potential release sites. Our objective was to determine habitat use and selection by a population of Merriam's Wild Turkeys that resulted from a transplant of 38 birds into Oregon from Colorado, Arizona, and New Mexico in 1961 (Mace 1965).

STUDY AREA AND METHODS

The study was conducted in southern Wasco County, Oregon, in 1981 and 1982.

The 135,141-ha study area encompassed portions of Mount Hood National Forest (MHNF), the Oregon Department of Fish and Wildlife (ODFW) White River Wildlife Management Area, the Confederated Tribes of Warm Springs Reservation, and adjacent private lands. Study area boundaries were delineated by the movements of radio-marked turkeys as suggested by Porter and Church (1987). The area was located primarily within the Douglas-fir and ponderosa pine forest zones described by Franklin and Dyrness (1973). Specific cover types (Lutz and Crawford 1987b), defined according to dominant vegetation and land use practices, were mapped from LANDSAT imagery. Clearcuts were classified as either recent (< 5 years since harvest) or old (10–20 years since harvest).

Turkeys were trapped from 1 January to 5 April each year with a modified walk-in trap (Ligon 1946) consisting of four welded wire panels (1 × 3 m) and a net wire (10 × 10 cm) top. We trapped and banded 113 birds, which included 28 adults (12 F, 16 M) and 85 subadults (31 F, 54 M); 66 of these birds were equipped with radio transmitters (12 adult F, 20 subadult F, 15 adult M, and 19 subadult M). We determined age and sex of turkeys from characteristics identified by Larson and Taber (1980). We recognized two age categories of birds: subadults (8–20 months old) and adults (> 20 months old). The subadult

[1]Department of Range and Wildlife Management, Texas Tech University, Lubbock, Texas 79409-2125.
[2]Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon 97331-3803.

category was based on previous work indicating that birds of the Merriam's subspecies < 2 years old were rarely involved in breeding activities (Lockwood and Sutcliffe 1985, Lutz and Crawford 1987a). Transmitters weighing 90 g and with an operational life of 12–15 months were attached with a backpack harness of rubber tubing covered by braided nylon. Transmitters contained an activity sensor that indicated when a bird remained stationary for 50–70 min. Turkeys were relocated three times weekly throughout the year to ascertain cover types used. We delineated four seasons: winter, 16 November–28 February; spring, 1 March–31 May; summer, 1 June–31 August; fall, 1 September–15 November. During radio-tracking, triangulation locations were chosen based on signal strength and the observer's experience with signal bounce. Triangulation points were plotted on habitat maps, and error polygons > 10 ha were excluded from the analysis. If a bird died within one week of capture, we assumed that the death was a result of capture stress and the bird was not used to estimate habitat use or home range. Only birds that survived an entire season were used to estimate seasonal home range sizes, but all birds that survived more than one week were used in the cover type analysis. Use of cover types was determined from 2,377 locations and based on 49 birds in winter, 32 birds in spring, 23 birds in summer, and 21 birds in fall. Home range estimates were from 32 birds during winter, 23 in spring, 22 in summer, and 21 in fall. Porter (1978) suggested that 2–3 locations/bird/week were adequate for describing home ranges. We used 18–23 locations/bird/season to estimate seasonal home ranges. Annual home range estimates were averages of seasonal home ranges. Seventeen birds were not analyzed because of radio failures (11) or capture stress (6).

Structural characteristics of vegetation within cover types were sampled with three circular plots, each with a 10-m radius and 25 m apart. Cover values for grasses, forbs, and understory and overstory trees were estimated at four randomly selected locations within each of the three plots. A sampling frame, 0.5 m in diameter, was used to estimate ground cover, and a sighting tube (James and Shugart 1971) was used to estimate canopy cover. Indices of visual obstruction of the vegetation were obtained by traversing three 10-m transects within each plot and recording contacts with vegetation at 0.5- and 1.5-m heights.

The minimum convex polygon (Mohr 1947) and harmonic mean transformation (Dixon and Chapman 1980) methods were used to estimate seasonal home ranges for the four age and sex groups (adult and subadult males and females). Home ranges were calculated with the computer program MCPAAL (Stuwe and Blowhowiak 1986). Kruskal-Wallis rank sum test (SAS Institute, Inc. 1985: 261) was used to compare differences (P < .10) among seasonal home range sizes within age and sex groups of turkeys.

Bonferroni simultaneous confidence intervals (Neu et al. 1974, Byers et al. 1984) were used to test for differences between expected and observed use of the cover types. Expected values corresponded to the relative area of the cover type, and observed values were the percentage of locations of radio-equipped turkeys in the cover type. Four categories of use were defined: (1) cover type used more than would be expected by chance (selection), (2) cover type used in proportion to its availability (proportional use), (3) cover type used but less than would be expected by chance (low use), and (4) cover type not used (avoidance).

Cover type utilization was determined (1) for all birds combined on the entire study area and (2) by sex and age groups within seasonal home ranges. Preliminary analysis revealed no differences in cover types used in home ranges calculated with minimum convex polygon and harmonic mean techniques; hence, we used only results of the minimum convex polygon. To better understand use of cover types, we investigated vegetation structure (e.g., percent cover, density) within cover types by comparison of location sites with random (available) sites. A random sample of locations (n = 337) was used for the vegetation structure utilization analysis. Random sites were sampled in each cover type to provide information on "available" vegetation structure. Differences in vegetative structure between locations used by turkeys and random sites were tested with multivariate analysis of variance (MANOVA; Hull and Nie 1981:1).

TABLE 1. Annual selection of cover types used by Merriam's Wild Turkeys, Wasco County, Oregon, 1981–82.

Cover type	Available	Used	Bonferroni
Oak[a]	0.246	0.169	0.148–0.189
Ponderosa pine[a]	0.178	0.053	0.048–0.065
Mature mixed conifer[a]	0.142	0.169	0.148–0.189
Ponderosa pine–Douglas-fir–oak[a]	0.125	0.179	0.158–0.199
Ponderosa pine–oak[a]	0.095	0.146	0.126–0.165
Thinned mixed conifer[a]	0.078	0.146	0.126–0.165
Young mixed conifer[a]	0.077	0.098	0.081–0.114
Grain	0.046	0.002	0–0.004
Rangeland[a]	0.006	0.028	0.019–0.036
Shelterwood	0.006	0	
Old clearcut[a]	0.006	0.002	0–0.004
Irrigated pasture	0.003	0.002	0–0.049
Mixed deciduous	0.002	0.002	0–0.004
Recent clearcut	0.001	0	

[a]Significant at $P < .05$.

RESULTS AND DISCUSSION

Habitat Use on the Study Area

Major cover types available on the study area included oak (24.6%), ponderosa pine (17.8%), mature mixed conifer (14.2%), and ponderosa pine–Douglas-fir–oak (12.5%). Turkeys used 12 of 14 cover types, of which 6 were selected, 3 were used in proportion to their availability, 3 were used less than expected, and 2 were avoided (Table 1). Five of the 6 most frequently used forested cover types were selected by turkeys (Table 1).

In all cover types selected by turkeys, multiple species and age classes characterized the shrub, understory, and overstory strata (Lutz and Crawford 1987b). Mackey and Jonas (1982) also found that a multispecies cover type, pine-oak, was selected during winter, spring, and summer by Merriam's Wild Turkeys in Washington. Merriam's Turkeys often were associated with ponderosa pine (Ligon 1946), but the ponderosa pine cover type was used less than expected on our study area. Both cover types that were dominated by single species, ponderosa pine and oak, were used less than expected on our study area. The permanent water sources often adjacent to irrigated pastures and moist, mixed deciduous cover types probably influenced use by turkeys. Ligon (1946) reported that water was a critical factor affecting the distribution of Merriam's Wild Turkeys. Poor water distribution, especially among the drier sites that were often dominated by ponderosa pine, could explain why turkeys used this cover type less than expected. Grain fields, composed largely of harvested winter wheat, were used during winter for foraging. This cover type may be important during winters with severe weather. Cornfields in the Midwest were used by Eastern Wild Turkeys as winter foraging sites during winters with deep snow (Porter 1978) and during years of mast failures (Kurzejeski et al. 1987). Recent clearcuts and shelterwoods were avoided by turkeys; both cover types resulted from logging activities that substantially simplified habitat structure.

We compared structural characteristics between sites used by turkeys and randomly sampled sites (Table 2). Initially, we combined all cover types and found that greater forb cover and understory density and lower overstory density and obstruction of vision at 0.5 m characterized sites used by turkeys. Individual cover types selected were characterized by either greater forb densities or by a higher density of woody plants (shrubs, understory, and overstory). Grass was identified as an important food item for turkeys (Mackey and Jonas 1982), and food availability was proposed as an influence on home range size. The preponderance of forbs in cover types used by turkeys on our study area may indicate marginal habitat quality. The higher density in cover types used by turkeys possibly afforded protection from predation, a major cause of mortality. Jonas (1966) reported that dense, pole-size stands of ponderosa pine were used frequently as escape cover by Merriam's Wild Turkeys. Quantitative descriptions of habitat used by Eastern Wild Turkeys (Gwaltney 1977, Hopkins 1981) also identified vegetation density as an important factor determining utilization of cover types.

TABLE 2. Values of structural features in cover types used and selected by Merriam's Wild Turkey, Wasco County, Oregon, 1981–1982.

Cover type	Structural feature						
	Forb cover (%)	Grass cover (%)	Shrub density (#/ha)	Understory density (#/ha)	Overstory density (%)	Obstruction of vision @ 0.5 m	Obstruction of vision @ 1.5 m
Oak (n = 33)	4	18	541	343[a]	490[b]	1.0	0.9
Ponderosa pine (n = 47)	6[a]	10	656[a]	657	198	1.4	1.3
Mature mixed conifer (n = 65)	7	6[a]	617	745[a]	201	1.3[b]	1.2[b]
Ponderosa pine– Douglas-fir–oak (n = 70)	7	7	1075	777[a]	259	2.0	1.2
Ponderosa pine– oak (n = 75)	6	14	975[a]	500[a]	232	0.9	0.8
Thinned mixed conifer (n = 17)	7[a]	3	1152	304	313	1.5	1.1
Young mixed conifer (n = 30)	8[a]	4	504	721	196	1.0	1.9
Combined cover types (n = 337)	9[a]	18	709	656[a]	217[b]	1.3[b]	1.1

[a]Value significantly (P < .05) greater than value from random site.
[b]Value significantly (P < .05) less than value from random site.

Home Ranges

Home ranges were largest in spring (2,575 ha), intermediate in fall (1,738 ha) and summer (1,509 ha), and smallest in winter (636 ha) (Table 3). Mackey (1982) reported a similar trend in seasonal home range size of Merriam's Turkeys in Washington, but sizes were substantially smaller (winter 63 ha, spring 140 ha, summer 77 ha). Subadult females in spring had the largest home ranges (4,213 ha), and adult males in winter had the smallest home ranges (347 ha). Differences among turkey home range sizes were detected in three of four seasons; only spring home range sizes were not statistically different. Our estimates of seasonal home range size also were larger than the range of 65 to 683 ha reported for Eastern Wild Turkeys (Brown 1980). Wigley et al. (1986) reported large seasonal home ranges ($\bar{x} = 1,295$ ha) for Eastern Wild Turkeys in the Ouachita Mountains in Arkansas and suggested that the large home range size was partly a response to declining habitat quality. Lutz (1987) found that turkey mortality indices were related to home range size ($r^2 = .81$, P < .05) and suggested that mobility and mortality were related.

Habitat Use Within Home Ranges

There was little selection seasonally of cover types among age and sex groups of turkeys (Table 4). Six to eight cover types were used by turkeys during each season (Table 4); three, including ponderosa pine– Douglas-fir–oak, mature mixed conifer, and oak, accounted for > 50% of the locations. In only three instances was there selection: adult females selected rangeland in winter and thinned mixed conifer in spring, and subadult females selected ponderosa pine during summer. In all other cases, turkeys used cover types seasonally in proportion to their availability. Because Merriam's Wild Turkeys rely heavily on grass and grass parts (Mackey and Jonas 1982) as food, rangeland was probably an important foraging site, especially during winter. Thinned mixed conifer was used almost exclusively as nesting habitat by adult females in spring (Lutz and Crawford 1987a). Ponderosa pine was selected only by subadult females in summer and coincided with a time of high mortality (Lutz 1987), but we do not know if this selection was causal or coincidental.

Lack of selection within home ranges by individual age and sex groups contrasted with

TABLE 3. Size (ha) of seasonal home ranges for four age and sex groups of Merriam's Wild Turkey, Wasco County, Oregon, 1981–1982.

Age/sex	Season[a]			
	Winter	Spring	Summer	Fall
Adult male (n = 6)	347 (43)	1,655 (425)	1,469 (510)	881 (83)
Subadult male (n = 11)	988 (298)	2,345 (247)	1,772 (388)	2,381 (582)
Adult female (n = 12)	288 (36)	2,085 (395)	1,307 (321)	1,273 (589)
Subadult female (n = 8)	921 (491)	4,213 (392)	1,488 (981)	2,417 (269)
$\bar{x}$	636	2,575	1,509	1,738

[a]Mean (standard error)

TABLE 4. Use (%) of cover types in seasonal home ranges by four age and sex groups of Merriam's Wild Turkeys, Wasco County, Oregon, 1981–1982.

Season Age/sex[a]	Cover type[b]										
	OCC	IP	RA	OA	PP–OA	YMC	MMD	TMC	P–D–O	MMC	PP
Winter											
AM	2	2	0	40	5	12	0	6	27	5	0
SM	0	0	5	29	11	13	0	13	14	15	0
AF	0	0	8[c]	19	17	8	0	10	6	32	0
SF	0	0	7	25	10	16	0	12	15	15	0
Spring											
AM	0	0	0	21	12	17	0	8	21	15	5
SM	0	0	1	13	18	9	0	15	18	24	2
AF	0	0	2	8	15	9	0	25[c]	15	23	4
SF	0	0	3	10	15	7	0	18	20	16	11
Summer											
AM	0	0	0	24	15	6	0	8	21	14	11
SM	0	0	0	13	14	11	1	20	18	14	9
AF	0	2	1	13	12	10	1	14	25	12	9
SF	0	0	1	8	8	8	0	14	7	17	35[c]
Fall											
AM	0	0	3	13	26	11	0	9	24	14	0
SM	0	0	0	21	24	10	0	4	19	17	4
AF	0	0	10	28	17	4	1	8	19	13	1
SF	0	0	8	25	13	6	0	15	23	4	3

[a]AM = adult male, SM = subadult male, AF = adult female, SF = subadult female.
[b]OCC = old clearcut, IP = irrigated pasture, RA = rangeland, OA = oak, PP–OA = ponderosa pine–oak, YMC = young mixed conifer, MMD = moist mixed deciduous, TMC = thinned mixed conifer, P–D–O = ponderosa pine–Douglas-fir–oak, MMC = mature mixed conifer, PP = ponderosa pine.
[c]Indicates a difference at the .05 level of significance.

apparent strong selection for habitats on a study area basis and suggested that selection processes occurred only at the higher level (i.e., study area). As an example of levels of selection, Johnson (1980) addressed the concept of the hierarchical nature of selection and suggested that the home range of an animal is indicative of second-order selection. He cautioned that comparing usage values to availabilities within the home range (third-order) could be misleading.

CONCLUSIONS

Both use and selection of cover types indicated that a variety of cover types were used by Merriam's Wild Turkeys on the study area. Cover types that were both used and selected, mature mixed conifer, ponderosa pine–Douglas-fir–oak, ponderosa pine–oak, thinned mixed conifer, young mixed conifer, and rangeland, were probably important cover types for turkeys.

Korschgen (1967) reported that most successful introductions and reintroductions of Merriam's Wild Turkeys occurred in ponderosa pine–grassland associations. Turkeys in this study used ponderosa pine much less than expected; this may have been related to the distribution of water. Apparently, an array of forested cover types rather than a single type provided the elements necessary to maintain this turkey population. Large home

ranges suggested that turkeys made substantial movements to fulfill life history needs. This was interpreted as evidence that this area represented relatively poor quality habitat. Both cover type availability and juxtaposition likely influence habitat quality, but investigating the juxtaposition of cover types was beyond the scope of our work. We suggest that structural complexity and plant species and age–class diversity, both within and among cover types, are important characteristics of potential release sites and also could serve as a habitat management goal for extant Merriam's Wild Turkey populations. Our work confirmed that turkeys were largely generalists in their use of cover types.

ACKNOWLEDGMENTS

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