Winter Movement Patterns of Merriam's Turkeys in North-central Arizona

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Abstract. I studied Merriam's turkey (*Meleagris gallopavo merriami*) movement patterns around roost sites in north-central Arizona during the winters of 1990–1991 through 1993–1994 to determine if distance from roost sites influenced habitat use. Knowledge of turkey movement patterns surrounding winter roosts would allow managers to predict potential adverse effects on habitat use from land management activities on winter range. I located 16 winter roost sites and 260 independent flock diurnal-use sites by visually locating radio-marked turkeys. Turkeys concentrated their diurnal use activities around roost sites, selecting areas ≤0.8 km from roost sites. Turkeys used habitat >0.8 km and ≤1.6 km from roost sites proportionate with availability and avoided habitats >1.6 km from roost sites. Land management activities ≤1.6 km from roost sites have the potential to impact wintering turkey populations. Efforts to increase suitable winter habitat for turkeys should include recruiting suitable roost sites within otherwise suitable habitat. Roost densities of ≥0.8 per km^2 seem optimal on winter turkey ranges.

Key words: Habitat selection, habitat use, *Meleagris gallopavo merriami*, roost.

Winter habitats are critical wildlife ranges. In Arizona, Merriam's turkey survival is lowest during winter, and winter habitat conditions influence mortality rates (Wakeling 1991). Timber harvesting, fuel-wood cutting, and prescribed burning are management activities that may impact turkey winter range. Natural resource managers need more information to better understand how land management activities influence winter habitat conditions.

Winter roost sites of Merriam's turkeys are typically traditional and frequently reused (Schemnitz et al. 1985). Habitat recommendations for Merriam's turkey generally suggest a minimum roost density of 0.9 per km^2 (Hoffman et al. 1993, Mollohan et al. 1995). Yet, empirical data have not been used to demonstrate that this density is adequate, nor have movements been examined around these roost sites. My objectives were to examine the influence of distance from winter roost sites to habitat use and to evaluate roost site density within habitats selected by a radio-marked population of Merriam's turkeys.

Study Area

The 860-km^2 Chevelon study area (CSA) was located on the Mogollon Rim, approximately 65 km south of Winslow, Arizona, on the Apache-Sitgreaves National Forests. Elevations ranged from 1,700 m in the northern portion to 2,430 m in the southern portion. Annual precipitation averaged 47.2 cm, with two concentrations, the first during winter storms in January through March, and the second during summer storms in July through early September (National Oceanic and Atmospheric Administration 1991).

Five cover types were present on the CSA based on U.S. Forest Service Terrestrial Ecosystem Surveys (Laing et al. 1989): (1) mixed-conifer (20.1%); (2) ponderosa pine (*Pinus ponderosa*)-Gambel oak (*Quercus gambelii*) (34.9%); (3) pinyon (*Pinus edulis*)-juniper (*Juniperus* spp.) (44.4%); (4) aspen (*Populus tremuloides*) (0.4%); and (5) meadow (0.2%). Mixed-conifer cover types were dominant above 2,340 m and extended downward along east-facing slopes and drainages. This habitat included Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), limber pine (*Pinus flexilis*), and Rocky Mountain maple (*Acer glabrum*). Ponderosa pine dominated west-facing slopes between 2,340 and 1,850 m. Below 1,850 m, the pinyon-juniper cover type was dominant, with ponderosa pine stringers along drainages. At elevations below 2,150 m, pinyon pine and alligator juniper (*Juniperus deppeana*) increased. Gambel oak occurred as a widespread codominant with ponderosa pine and in pockets in the mixed-conifer and pinyon-juniper associations.

Timber harvesting and livestock grazing were the major land uses on the CSA. Logging began in the late 1930s, and initial harvests were group or individual tree selections. Even-aged management was prevalent in the 1980s, but has been limited since 1990. Timber harvests have been conducted on 20-year stand entries, although some stands have been re-entered within 5 years. Most ponderosa pine stands on level terrain had been logged at least once; however, little logging occurred on steeper slopes in larger canyons. Cutting of fuel wood, particularly in the pinyon-juniper cover type, increased over the past two decades. Until the 1960s, sheep were the primary livestock on the CSA. Summer grazing by cattle has been the predominant livestock use on the CSA since the 1960s.

Methods

I captured turkeys during January 1 to March 31 1988–1992 with drop nets or rocket nets (Glazener et al. 1964, Bailey et al. 1980) located at sites

baited with whole oats. A radio-telemetry unit (Telonics model LB 400, Mesa, Arizona) was secured on the back of each turkey with a 5-mm bungee harness.

Because I conducted trapping and capture efforts concurrently with winter movement data collection, I bisected the CSA with a north-south division closely corresponding with West Chevelon Canyon. To avoid movement biases related to artificial bait placement, I established bait sites, trapped, and radio-marked turkeys on half of the CSA. On the alternate half, I monitored movements and habitat use of previously marked birds. I annually alternated trapping and monitoring activities between sides of the CSA.

I obtained locations from radio-marked turkeys within 3.2 km of roost sites between November 15 and April 15 from 1990–1991 through 1993–1994. I located turkeys approximately twice daily, although no individual turkey or flock was located more than once daily to reduce data autocorrelation.

Locations were plotted on U.S. Geological Survey 7.5' topographic maps and Universal Transverse Mercator (UTM) coordinates recorded. Roost locations from radio-marked turkeys were also mapped and UTM coordinates recorded. A Geographical Information System (GIS) was used to plot roosts and delineate distance-class habitats of 0.8, 1.6, 2.4, and 3.2-km radii surrounding each roost site. These isometric distance-classes were used because they provided quartile classes for analysis across most turkey locations. GIS was then used to calculate the number of locations and the amount of area exclusive to each distance-class habitat. Only the area and locations $\leq$0.8 km from roost sites were classified as within the first distance-class, only the area and locations >0.8 and $\leq$1.6 km from roost sites were classified as within the second distance-class, and so on through the third and fourth distance-classes. Locations >3.2 km from roosts were excluded from analysis because the large areas and relatively few locations would result in inflated statistical probabilities.

Because of the way I located turkeys, I assumed the number of locations within each distance-class would represent the proportion of time turkeys spent within that area. I calculated the expected number of turkey locations that should have occurred within each distance-class proportionate to the area within each distance-class. I used a chi-square goodness-of-fit test to determine if turkeys used habitats of varying distances from roost sites consistent with availability. The goodness-of-fit test was appropriate because availability of distance-classes was known and not estimated from plots (Thomas and Taylor 1990). I used Bonferroni confidence intervals (Byers et al. 1984) to test for selection of individual distance-classes. Jacobs' *D* selectivity index (Jacobs 1974) was used to determine the relative degree of selection or avoidance of each distance-class habitat. I calculated the density of roost sites within those distance-class habitats that were selected and those selected and used consistent with availability to determine what density of roost sites seemed favorable to wintering turkeys.

Results

Seventy (49 F and 21 M) Merriam's turkeys were captured and radio-marked. Based on visual radio-marked turkey locations, I found 16 roosts and 341 diurnal-use sites. Only 260 locations (76.2%) were within 3.2 km of roost sites. Distance-classes around roost sites encompassed 29.4, 89.1, 150.8, and 215.2 km^2, respectively (Fig. 1).

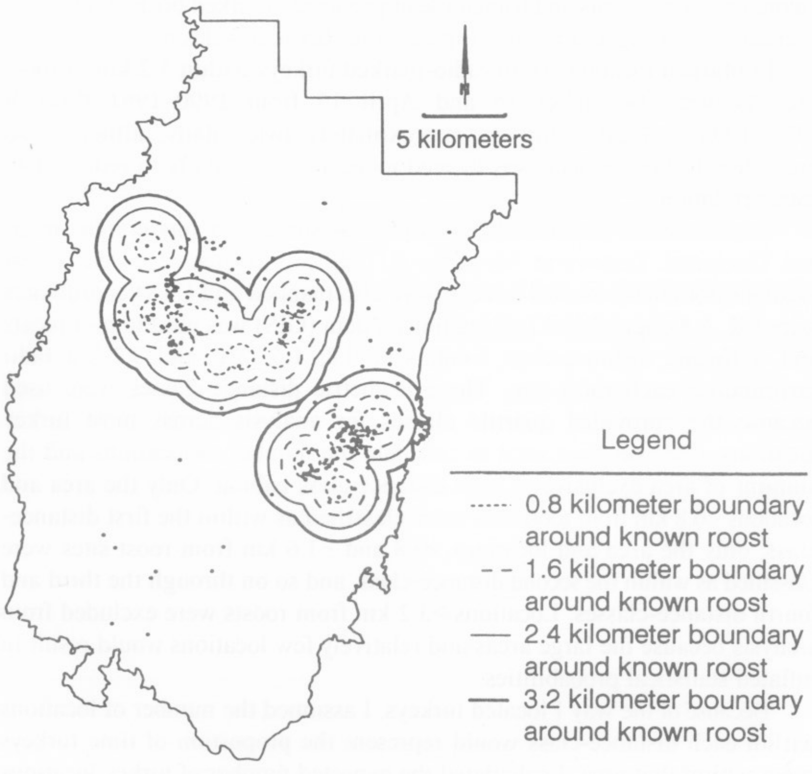

Fig. 1. Distance-class habitats and locations of radio-marked turkeys on the Chevelon study area, Arizona, 1990–1994.

Turkeys selected (X^2 = 386.769, 3 df, P <0.001) habitats <0.8 km from roosts for most daily activities (Table 1). Areas between 0.8 and 1.6 km from roosts were used consistent with availability. Habitats >1.6 km from roosts were used less than available for daily activities (Table 1). The density of roosts within the selected distance-class habitat (<0.8 km) from roosts was 0.8 per km^2. The density of roosts within those distance-class habitats selected and used as available (i.e., all areas <1.6 km from roosts) was 0.3 per km^2.

Table 1. Selection of concentric distance-class habitats surrounding roosts during winter by Merriam's turkey on the Chevelon study area, 1990–1994.

Distance-class (m)	Area (km^2)	Locations	Observed proportion	Expected proportion	Bonferroni confidence interval[a]	Selection[b]	Jacobs' D
0.8	29.4	118	0.469	0.131	0.387–0.551	+	0.708
1.6	68.9	86	0.343	0.307	0.265–0.421	=	
2.4	61.7	32	0.126	0.275	0.071–0.181	-	-0.449
3.2	64.5	15	0.062	0.287	0.022–0.102	-	-0.718

[a] Overall X^2 = 386.769, 3 df, P < 0.001.

[b] + denotes selection, - denotes avoidance, and = denotes use consistent with availability.

Discussion

Winter roost sites influence turkey habitat use. Turkeys used habitats close to roost sites for the bulk of their activities, avoiding those areas too far from a roost. Thus roost sites are important components to ensure widespread use of an area by turkeys. Maintenance of roost sites, therefore, is critical.

Although winter roost sites are typically traditional (Schemnitz et al. 1985), land management activities could substantially alter their use. For example, Scott and Boeker (1977) found that major alterations via timber harvest to surrounding habitats caused roost site abandonment, also resulting in abandonment of the habitat within the roost site vicinity.

Turkey winter roost sites are easily identified and can be protected from management activities. But, protecting roosts is not enough. Management activities that influence the surrounding habitat quality should also be considered when planning land management activities. Limiting land management activities that are detrimental to winter feeding habitat (Rumble and Anderson 1993, Wakeling and Rogers 1996) to only those areas >1.6 km from identified winter roost sites would favor wintering turkeys.

Roost availability would influence habitat use of large areas by turkeys. Habitats that seem otherwise suitable may simply be too far from roosting habitat. Maintaining existing roosts is important. More uniform use of habitat may be increased by recruiting suitable timber stands for potential roost sites. In one instance, the range of Rio Grande turkeys (*M. g. intermedia*) was expanded with the addition of suitable artificial roost structures (Kothmann and Litton 1975). The same effect should occur by recruiting roost sites in Merriam's turkey habitat.

Winter roost densities are critical for turkey populations. Turkeys are more dependent on fewer roost sites during winter than summer (Shaw and Mollohan 1992, Hoffman et al. 1993). Although turkeys displayed an array of affinity to roost sites in my study, they generally used a given site 10–30 days. Changes in roost site use seemed to be influenced by disturbance and food availability. Most flocks in my study used >4 roost sites per winter. Suggested roost densities of 0.9 per km^2 (Phillips 1982, Hoffman et al. 1993, Mollohan et al. 1995) may provide a lower threshold for maintaining stable turkey populations in winter habitats of the Southwest. Winter roost densities <0.3 per km^2 are probably insufficient to support wintering turkey populations.

Winter roost sites should be identified and protected from timber harvest at densities >0.9 per km^2. Some roost sites may not be used every year because nearby food sources are undependable (Wakeling and Rogers 1995); these roosts will probably be reused during more favorable subsequent years and should also be protected. Known roost sites should be recorded in a GIS database. GIS covers could then be used to identify those areas with insufficient roosts. Recruitment of suitable roost sites into low density roost areas will increase turkey habitat use. Management activities that degrade winter feeding habitat should be relegated to those areas >1.6 km from known roost sites.

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Literature Cited

Bailey, W., D. Dennett, H. Gore, J. Pack, R. Simpson, and G. Wright. 1980. Basic considerations and general recommendations for trapping the wild turkey. Proceedings of the National Wild Turkey Symposium 4:10–23.

Byers, C. R., R. K. Steinhorst, and P. R. Krausman. 1984. Clarification of a technique for analysis of utilization-availability data. Journal of Wildlife Management 48:1050–1053.

Glazener, W. C., A. S. Jackson, and M. L. Cox. 1964. The Texas drop-net turkey trap. Journal of Wildlife Management 28:280–287.

Hoffman, R. W., H. G. Shaw, M. A. Rumble, B. F. Wakeling, C. M. Mollohan, S. D. Schemnitz, R. Engel-Wilson, and D. A. Hengel. 1993. Management guidelines for Merriam's wild turkeys. Colorado Division of Wildlife Division Report 18, Fort Collins. 24 pp.

Jacobs, J. 1974. Quantitative measurement of food selection. Oecologia 14:413–417.

Kothmann, H. G., and G. W. Litton. 1975. Utilization of man-made roosts by turkey in west Texas. Proceedings of the National Wild Turkey Symposium 3:159–163.

Laing, L., N. Ambos, T. Subirge, C. McDonald, C. Nelson, and W. Robbie. 1989. Terrestrial ecosystem survey of the Apache-Sitgreaves National Forests. U.S. Forest Service, Southwest Region, U.S. Government Printing Office, Washington, D.C. 453 pp.

Mollohan, C. M., D. R. Patton, and B. F. Wakeling. 1995. Habitat selection and use by Merriam's turkey in north-central Arizona. Arizona Game and Fish Department Technical Report 9, Phoenix. 46 pp.

National Oceanic and Atmospheric Administration. 1991. Arizona climatological data. Volume 95. National Climatic Center, Asheville, NC.

Phillips, F. 1982. Wild turkey investigations and management recommendations for the Bill Williams Mountain area. Arizona Game and Fish Department Special Report 13, Phoenix. 50 pp.

Rumble, M. A., and S. H. Anderson. 1993. Macrohabitat associations of Merriam's turkeys in the Black Hills, South Dakota. Northwest Science 67:238–244.

Schemnitz, S. D., D. L. Goerndt, and K. H. Jones. 1985. Habitat needs and management of Merriam's turkey in south-central New Mexico. Proceedings of the National Wild Turkey Symposium 5:199–231.

Scott, V. E., and E. L. Boeker. 1977. Responses of Merriam's turkey to pinyon-juniper control. Journal of Range Management 30:220–223.

Shaw, H. G., and C. Mollohan. 1992. Merriam's turkey. Pages 331–349 *in* J. G. Dickson, editor. The wild turkey: biology and management. Stackpole Books, Harrisburg, Pa.

Thomas, D. L., and E. J. Taylor. 1990. Study designs and tests for comparing resource use and availability. Journal of Wildlife Management 54:322–330.

Wakeling, B. F. 1991. Population and nesting characteristics of Merriam's turkey along the Mogollon Rim, Arizona. Arizona Game and Fish Department Technical Report 7, Phoenix. 48 pp.

Wakeling, B. F., and T. D. Rogers. 1995. Winter habitat relationships of Merriam's turkeys along the Mogollon Rim, Arizona. Arizona Game and Fish Department Technical Report 16, Phoenix. 41 pp.

Wakeling, B. F., and T. D. Rogers. 1996. Winter diet and habitat selection by Merriam's turkeys in north-central Arizona. Proceedings of the National Wild Turkey Symposium 7:175–184.