Habitat Use of Wild Turkey Hens in Northwestern West Virginia

David A. Swanson,[1] *Division of Forestry, West Virginia University, P. O. Box 6125, Morgantown, WV 26506*

James C. Pack, *West Virginia Division of Natural Resources, P. O. Box 67, Elkins, WV 26241*

Curtis I. Taylor, *West Virginia Division of Natural Resources, Wildlife Resources Section, McArthur, WV 25873*

Patrick W. Brown,[2] *West Virginia Cooperative Wildlife Research Unit, P. O. Box 6125, Morgantown, WV 26506*

David E. Samuel, *Division of Forestry, West Virginia University, P. O. Box 6125, Morgantown, WV 26506*

Abstract: Little is known about effects of selective harvesting on home range and habitat use of wild turkeys. Such knowledge is needed to develop sound wild turkey management plans. Thirty-two eastern wild turkey (*Meleagris gallopavo silvestris*) hens were monitored by telemetry in Wetzel County, West Virginia, from 15 April to 18 August 1990–1992. Spring home range (N = 24) averaged 532 ha; hens (N = 6) nesting in selectively harvested habitats had significantly smaller (344 ha) home ranges than hens (N = 18) nesting in unharvested forest (609 ha) (P = 0.01). Summer home range averaged 631 ha with no significant difference (P = 0.59) between hens using unharvested (N = 11) or harvested (N = 5) stands. Although hens nested in 5 habitat types in proportion to their availability, during nesting (15 April to hatching) and brood-rearing (hatching to 18 August), unharvested chestnut oak (*Quercus prinus*) and bottomland hardwood and nonforest habitats were used more than expected. Laying-incubation ranges had significantly higher (P = 0.01) average (± SD) percent understory cover in harvested (N = 7) (59 ± 6.6%) than unharvested (N = 20) (36 ± 4.3%) areas. Percent herbaceous understory cover in brood-rearing habitat was significantly higher (P = 0.01) in harvested (N = 6) (72 ± 1.9%) than unharvested (N = 12) (60 ± 2.1%) areas. Selective timber harvesting may have increased food availability and structural heterogeneity of understory vegetation, thus improving quality of wild turkey nesting and brood-rearing habitats.

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[1] Present address: Ohio Division of Wildlife, 9650 State Route 356, New Marshfield, OH 45766.
[2] Present address: Department of Biology and Chemistry, Lake Superior State University, Saulte Ste. Marie, MI 49783.

The eastern wild turkey is an ecologically and economically important member of the forest community. Several studies investigated spring/summer habitat use of eastern wild turkeys (Hillestad and Speake 1970, Speake et al. 1975, Pack et al. 1980, Everett et al. 1981, Holbrook et al. 1987, Bidwell et al. 1989), but few reported use of selectively harvested areas during the reproductive period (Zwank et al. 1988, Campo et al. 1989*a,b*).

Over 90% of the commercial forestland in West Virginia is privately owned (Wunz and Pack 1992). Most private forest landowners in West Virginia practice a selective timber harvesting method called high-grading (i.e., the largest, most valuable trees are harvested) (Allen and Cromer 1977, Tzilkowski 1989). Rate of timber harvesting on private lands in West Virginia is expected to more than triple by the year 2000 (McCoy et al. 1988).

Little is known about effects of selective harvesting on home range and habitat use of wild turkeys (Healy 1989, 1990). Such knowledge is needed to develop sound wild turkey management plans. This paper reports the spring/summer home range and habitat use of wild turkey hens in Wetzel County, West Virginia, during 15 April–18 August 1990–1992.

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Methods

Research was conducted on 2 sites: the 61-km^2 Lewis Wetzel Wildlife Management Area in Jacksonburg and a 30-km^2 area near Pine Grove, West Virginia. Approximately 28% (14 km^2 of inholdings) of the Lewis Wetzel study area was selectively harvested between 1985 and 1992. The rest of the area was covered by 40- to 60-year-old forests dissected by utility rights-of-way (ROW), old logging roads, hunter access trails, and wildlife clearings. The Pine Grove study area, located 6.4 km northwest of the Jacksonburg study site, consisted of a mosaic of privately-owned unharvested and selectively harvested forest tracts. Between 1985 and 1992, approximately 40% of the tracts were partially or completely harvested. Dendritic drainage patterns on both study areas formed terrain characterized by narrow valleys and steep slopes. Elevations ranged from 225 to 475 m.

Turkeys were captured during fall (Sep–Oct) and winter/spring (Jan–Apr) at baited sites using cannon and rocket nets (Bailey et al. 1980). Sex and age of juveniles captured in fall were determined with the criteria of Healy and Nenno (1980). Transmitters (American Telemetry System, Isanti, Minn., and Telonics MOD-200 and MOD-300, Mesa, Ariz.) were attached to hens that weighed $\geq$1.6 kg with a backpack harness (Williams et al. 1968). Transmitters were equipped with mortality-mode switches and had expected battery lives of 24 months. All radios had a reward tag. All radio-equipped hens received numbered aluminum leg bands and wing tags.

Radio-equipped hens were located once/day 3–6 days/week from 15 April through 18 August 1990–1992 with hand-held receivers. The order hens were located was changed daily to ensure random sampling. Three directional azimuths were taken to estimate location of each hen (Nams and Boutin 1991). All azimuths for a given location were taken within 30 minutes. Most (95%) locations were made between 0600 and 2100 hours. Locations were plotted to the nearest 100-m grid intersection of the Universal Transverse Mercator system on U. S. Geological Survey topographical maps (1:24,000 scale).

Most radio-tracking was done from ridgetops. All hen locations ≤0.5 km from the observer were used in home range and habitat use analyses, whereas all locations >3.0 km from the observer were not analyzed (Garrott et al. 1986). Locations between 0.5 and 3.0 km from the observer were accepted if the angles of the intersecting compass azimuths were between 30° and 150° (Springer 1979). Accuracy of the radio-telemetry system was quantified as described by Lee et al. (1985).

Spring (15 Apr to hatching), summer (posthatching to 18 Aug), and spring/summer (15 Apr to 18 Aug) home range estimates (Mohr 1947) were calculated using McPAAL (Stuwe and Blowhowiak 1986). Spring home ranges were estimated for hens that initiated incubation (all hens located in the same place 2 successive nights between 15 April and 15 May); summer home ranges were estimated for successfully nesting hens (a successful nest was defined as one in which ≥1 egg hatched); spring/summer home ranges were estimated for all hens as defined earlier. Differences in mean home range size between hens in unharvested and harvested stands (hens were assigned to the unharvested or harvested treatment if >75% of the locations in forest cover types were in a given treatment) were examined using median and Mann-Whitney tests. Locations used in the home range and habitat use analyses were considered independent as no more than 1 location/day was included in the data set of any hen (Swihart and Slade 1985*a,b;* Swihart et al. 1988). Location data collected during the 2 weeks following radio attachment were not used in home range or habitat use analyses.

Composite spring/summer home ranges were computed to examine habitat use by hens. Habitat availability was estimated by proportion of each habitat type within the composite home range (Porter and Church 1987). Use of habitat types was estimated by proportion of telemetry locations recorded in each (Johnson 1980).

Habitat types were defined by dominant vegetation and land-use practices. Six habitat types were identified on the study areas using aerial photographs and ground reconnaissance. Forested habitat types included chestnut oak, white oak (*Quercus alba* with *Acer saccharum* subdominant), oak-hickory (70% *Quercus* spp., 20% *Carya* spp., and 10% other), mixed mesophytic (*Fagus grandifolia, A. saccharum,* and *Liriodendron tulipifera*), and bottomland hardwood (*Platanus* *occidentalis*). Nonforested habitats included pipeline rights-of-way, wildlife clearings, pastures, hayfields, or Christmas tree plantations.

Goodness-of-fit analyses were used to test the null hypotheses that hens used each habitat type in proportion to availability within the composite home range (Alldredge and Ratti 1986, 1992). If the null hypothesis was rejected, simultaneous confidence intervals (Neu et al. 1974) were calculated to determine which habitat types were used more than expected (selected), in proportion to their availability (proportional use), or less than expected (low use). Years were pooled because of small sample sizes.

Two habitat use versus availability analyses were conducted. The first compared use and availability of the 6 habitat types and the second compared use and availability of unharvested and harvested portions of the 5 forest habitat types and the nonforested ones.

Results

Seasonal home range size did not differ between adult ($N = 19$) and subadult ($N = 7$) hens or among years (Swanson 1993). Spring and summer home ranges were based on 20–30 locations/hen; spring/summer home ranges were based on 40–60 locations/hen.

Mean spring home range size (±SD) for 24 hens was 532 ± 56.8 ha (range = 193–1,307 ha). Six hens that nested in harvested forests had significantly smaller spring home ranges (344 ± 40.5 ha) than did 18 hens that nested in unharvested forests (609 ± 70.0 ha) ($P = 0.01$).

Average summer home range size for 16 hens was 631 ± 80.8 ha (range = 128–1,214 ha). Home range size did not significantly differ ($P = 0.59$) between 11 hens in unharvested (675 ± 79.0 ha) and 5 hens in harvested (651 ± 192.3 ha) habitats.

Spring/summer home range size for 26 hens averaged 1,196 ± 90.7 ha (range = 431–2,144 ha). During the spring/summer period, there was no significant difference ($P = 0.20$) in home range size between 20 hens in unharvested (1,260 ± 99.1 ha) and 6 hens in harvested (981 ± 204.2 ha) habitats.

All habitats used by radio-equipped wild turkey hens for nesting were used in proportion to their availability. Of the 27 nests located, 16 were in the mixed mesophytic type (12 in unharvested and 4 in harvested areas), 7 in the oak-hickory type (5 in unharvested and 2 in harvested areas), 2 in unharvested bottomland hardwood stands, 1 in a harvested chestnut oak stand, and 1 in an unharvested white oak stand. Unharvested chestnut oak, harvested white oak, harvested bottomland hardwood, and nonforest habitats were not used by radio-equipped hens for nesting (Table 1).

Most ($N = 17$) nests, including all 7 in harvested habitats, were in woody debris (limbs, tree tops, logging slash). Six nests were under spicebush (*Lindera benzoin*) shrubs and 2 were in thickets of blackberry (*Rubus* spp.) and grape (*Vitis* spp.). All 27 nests were ≤20 m from an edge (road, trail, or ROW); 26 were ≤10 m from an edge.

Table 1. Nesting habitat use and availability for radio-equipped wild turkey hens ($N = 27$) in Wetzel County, West Virginia, 1990–1992.

Habitat	*N* nests	% available	% used[a]	95% CI[b]
Chestnut oak unharvested	0	5	0	Not used
Chestnut oak harvested	1	4	4	−0.067, 0.147
White oak unharvested	1	5	4	−0.067, 0.147
White oak harvested	0	2	0	Not used
Oak hickory unharvested	5	10	19	−0.024, 0.404
Oak hickory harvested	2	9	7	−0.069, 0.209
Mixed mesophytic unharvested	12	40	44	0.170, 0.710
Mixed mesophytic harvested	4	12	15	−0.044, 0.344
Bottomland hardwood unharvested	2	5	7	−0.069, 0.209
Bottomland hardwood harvested	0	2	0	Not used
Nonforest	0	6	0	Not used

[a]Percentage of the 27 nests occurring in the habitat type.
[b]All habitat types used by radio-equipped wild turkey hens for nesting were used in proportion to their availability.

Habitat use analyses were based on 1,523 telemetry locations collected from 32 hens (24 adults and 8 subadults). Mean error and standard deviation of the telemetry system was 4.5° and 2.75°, respectively ($N = 80$).

Chestnut oak, bottomland hardwood, and nonforest habitat types were used more than expected, and white oak, oak-hickory, and mixed mesophytic types were used less than expected ($X^2 = 500.6$, 5 df, $P < 0.01$) (Table 2). Hens did not use all habitat types in proportion to their availability when unharvested and harvested portions of the forest types were separated ($X^2 = 741.8$, 10 df, $P < 0.01$). Unharvested chestnut oak and bottomland hardwood types were used more than expected and both unharvested and harvested white oak and mixed mesophytic types and the harvested oak-hickory type were used less than expected (Table 2).

Discussion

The spring home range size observed in this study (532 ha) was smaller than that reported for wild turkey hens in northern Alabama (Exum et al. 1987

Table 2. Spring/summer habitat use and availability for wild turkey hens (N = 32) in Wetzel County, West Virginia, 1990–1992.

Habitat	% available	% used[a]	95% CI
Chestnut oak	9	22.3+	0.187, 0.259
Chestnut oak unharvested	5	17.4+	0.147, 0.201
Chestnut oak harvested	4	4.9	0.033, 0.065
White oak	7	2.2−	0.009, 0.035
White oak unharvested	5	1.9−	0.009, 0.029
White oak harvested	2	0.3−	−0.001, 0.007
Oak-hickory	19	11.5−	0.088, 0.142
Oak-hickory unharvested	10	9.6	0.075, 0.117
Oak-hickory harvested	9	1.9−	0.009, 0.029
Mixed mesophytic	52	42.8−	0.386, 0.470
Mixed mesophytic unharvested	40	35.9−	0.324, 0.394
Mixed mesophytic harvested	12	6.9−	0.051, 0.087
Bottomland hardwood	7	11.1+	0.084, 0.138
Bottomland hardwood unharvested	5	9.1+	0.070, 0.112
Bottomland hardwood harvested	2	2.0	0.010, 0.030
Nonforest	6	10.1+	0.077, 0.125

[a] + = used more ($P \leq 0.05$) than expected, − = used less ($P \leq 0.05$) than expected.

[841 ha]) and Oklahoma (Bidwell et al. 1989 [865 ha]) but larger than those observed in southern Alabama (Speake et al. 1975 [425 ha], Everett et al. 1979 [348 ha]). Summer home range size of wild turkey hens in southern Alabama (Everett et al. 1979 [714 ha]) was similar to that observed in this study (631 ha). Smaller summer home ranges were observed in southern Alabama (Speake et al. 1975 [111 ha]) and Minnesota (Porter 1977*a* [170 ha]); larger home ranges were reported for hens with broods in northern Alabama (Exum et al. 1987 [788 ha]) and Oklahoma (Bidwell et al. 1989 [780 ha]).

Seasonal home range size of wild turkey hens is influenced by many factors (Brown 1980), including habitat quality (Porter 1977*b,* Everett et al. 1979, Exum et al. 1987). Hens in poor quality habitats (low food availability) moved over larger areas than those in high quality habitats (high food availability) to obtain requisites for survival and reproduction (Speake et al. 1975, Everett et al. 1979).

In northwestern West Virginia, laying-incubation ranges had significantly higher ($P = 0.01$) percent understory cover in harvested ($N = 7$) (59 ± 6.6%) than unharvested ($N = 20$) (36 ± 4.3%) areas (Swanson 1993). Likewise, percent herbaceous understory cover in brood-rearing habitat was significantly higher ($P = 0.01$) in harvested ($N = 6$) (72 ± 1.9%) than unharvested ($N = 12$) (60 ± 2.1%) areas (Swanson 1993). During laying and incubation periods, home ranges were smaller in harvested areas, suggesting that hens nesting in selectively harvested areas moved shorter distances during recesses from incubation than hens nesting in unharvested forests. Seeds of forbs, grasses, and sedges, and herbivorous insects (Hemiptera, Homoptera, and Diptera) were important dietary components of wild turkey hens and poults during spring and summer (Korschgen 1967, 1973; Hurst 1992). Although we did not quantify insect availability in this study, previous researchers reported highest insect abundance and biomass in communities with well developed herbaceous understories (Hurst and Stringer 1975, Martin and McGinnes 1975). It appears that reduced overstory tree canopy cover and stimulated growth and development of herbaceous understory vegetation may have increased food availability and, thus, improved quality of wild turkey nesting and brood-rearing habitats.

In addition to increased herbaceous ground cover, harvested areas had taller understory vegetation than unharvested areas. Understory height in laying-incubation ranges averaged 65 ± 4.7 cm in harvested areas and 44 ± 2.9 cm in unharvested areas ($P = 0.01$) (Swanson 1993). Mean understory height of brood-rearing habitat was 77 ± 15.4 cm in harvested areas and 46 ± 5.2 cm in unharvested areas ($P = 0.01$) (Swanson 1993). Taller understory vegetation and a large amount of logging slash in harvested areas increased vertical structure indices and reduced horizontal visibility indices. Laying-incubation ranges in harvested areas had mean horizontal visibility indices of 1 ± 0.4 compared to 2 ± 0.4 in unharvested areas ($P = 0.05$) (Swanson 1993). Horizontal visibility indices of brood-rearing habitat averaged 19 ± 6.5 in harvested areas and 31 ± 5.3 in unharvested areas ($P = 0.02$) (Swanson 1993). Harvesting increased structural heterogeneity of understory vegetation and provided wild turkey hens with more concealed nest sites and poults with better escape cover than unharvested forest habitats.

Hens with poults used only a small portion of their summer home range in both unharvested and harvested areas. Gas and oil well access roads, logging roads, and skid trails were the primary habitats used within forested areas, especially in chestnut oak and bottomland hardwood stands; pipeline ROWs were the most frequently used nonforest habitat. Although brood ranges in selectively harvested forest had significantly higher amounts of herbaceous understory vegetation (Swanson 1993), home range size did not differ between unharvested and harvested areas because all hens with poults concentrated their use around linear herbaceous communities.

The only forest cover types selected by wild turkey hens on our study areas were unharvested chestnut oak and bottomland hardwood. Chestnut oak types were characterized by open, sparsely vegetated understories that provided little cover. In late summer (Jul and Aug), most hens, with and without a brood, were located most frequently in the chestnut oak type, coincident with the ripening of huckleberries (*Gaylussacia* spp.) and blueberries (*Vaccinium* spp.). Chestnut oak forests were not used by hens with poults in southeastern West Virginia (Pack et al. 1980) but were considered important brood habitat in Pennsylvania (Ross and Wunz 1990).

Bottomland hardwood forest types supported understories with vegetative characteristics described by Healy (1981) as "ideal" for wild turkey poults: 60%–100% total vegetative cover with >50% being herbaceous and an average canopy height of 20–60 cm (Swanson 1993). Bottomland hardwoods were important brood habitat in Mississippi (Phalen et al. 1986) and eastern Texas (Campo et al. 1989*b*) but were avoided by hens with broods in southeastern West Virginia (Pack et al. 1980), South Dakota (McCabe and Flake 1985), and Alabama (Exum et al. 1987) because of low insect populations and/or dense vegetation that impeded movement of poults.

Management Implications

Although selective timber harvesting may have increased availability of wild turkey foods and structural heterogeneity of the understory vegetation (Swanson 1993), the only forest types selected by wild turkey hens on the study areas were unharvested chestnut oak and bottomland hardwood. Additional research is needed to determine what forest management practices (selection cutting, thinning, prescribed burning, or a combination of cutting and burning) benefit wild turkey populations most over the long term. Wildlife biologists need sufficient, valid, quantitative data and models to predict effects of forest management practices on wild turkey populations (Dickson 1992). Future research should evaluate effects of forest management practices on the survival and reproductive success of wild turkey.

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