Seasonal and Annual Home Ranges of Female Eastern Wild Turkeys in a Managed Pine Landscape in Mississippi

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Abstract: Eastern wild turkeys (*Meleagris gallopavo silvestris*) are an important recreational resource throughout their range. Previous research has shown that intensively managed pine forests can sustain huntable populations of eastern wild turkeys. However, little research has examined patterns of spatial use of turkeys within these systems. An expected increase in acreage of intensively managed pine forests over the next half century requires a basic understanding of wild turkey ecology in these systems. Therefore, we used a long-term (1986–1993) data set to estimate annual and seasonal home range size of female eastern wild turkeys from a landscape dominated by intensively managed pine forests in east-central Mississippi. Mean seasonal home range size was 406 ha ± 20 ha (mean ± SE; $N = 268$). Home ranges were larger during fall–winter (524 ± 43.5 ha) than preincubation (326 ± 23.2 ha) and summer (392 ± 32.5 ha). Average annual home range size was 796 ha ± 46.0 ha and was smaller in 1993 ($P < 0.05$) than other years. We documented wide variability in seasonal and annual home ranges likely in response to localized resource availability and individual female behavior. For some females, home range size was affected by seasonal movements between intensively managed pine stands in spring and summer and a large bottomland hardwood and agriculture complex during fall–winter. Managers need to understand movements within home ranges to better understand spatial use by wild turkeys. We suggest managers consider spatial distribution of vegetation types, particularly mature hardwoods, important to turkeys when making management decisions.

Key words: home range, *Meleagris gallopavo silvestris,* Mississippi, pine silviculture, spatial use, wild turkey

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 59:89–99

Eastern wild turkeys (*Meleagris gallopavo silvestris;* hereafter, wild turkeys) are an important recreational resource throughout their range (Tapley et al. 2001). Prior to widespread restoration of this popular game bird, conventional wisdom held that wild turkeys required extensive tracts of older-aged forests (Porter 1992) and that intensively managed pine (*Pinus* spp.) landscapes were detrimental to turkeys (Mosby 1975). However, as wild turkey populations were successfully restored, they began inhabiting a wide range of vegetation types (Speake et al. 1975), including intensively managed pine landscapes (Exum et al. 1987). Subsequent research dem-

onstrated that wild turkeys were compatible with intensive pine management, particularly within a sawtimber silvicultural regime that incorporates thinnings and prescribed burning (e.g., Smith et al. 1990, Miller et al. 1995, Weinstein et al. 1995). Although several studies have examined wild turkeys in intensively managed pine landscapes (e.g., Kennamer et al. 1980, Holbrook et al. 1987, Smith et al. 1990), few have documented spatial use patterns of wild turkeys within these forested systems, even though understanding this can be important for management decisions (Smith et al. 1988, Godwin et al. 1990, Miller et al. 1997).

Hurst et al. (1991) documented seasonal home ranges of male wild turkeys on our current study area and Smith et al. (1990) and Burk (1989) examined seasonal home ranges for females on our study area during 1986–1988 and brood ranges were estimated during 1987–1990 (Burk et al. 1990*b*, Stys 1992). However, it is important to use long-term datasets in studies of wild turkeys to account for annual variance (Leopold et al. 1996, Miller et al. 2001) and these previous studies did not consider the totality of data from our study area.

Within the southeastern United States, intensively managed pine forests are a primary forest type with total area of these forests expected to increase from 12.9 million ha in 1999 to 21.8 million ha in 2040 (Wear and Greis 2002). Most of this increase will occur on private lands (Wear and Greis 2002), and, because of projected wood supply needs, will be under increasing pressure for maximizing wood production (Wagner et al. 2004). Effects of such intensification on wildlife, such as wild turkeys, is largely unknown, but may be negative. This large scale shift in forest type and possible intensification of forest management necessitates an understanding of wild turkey ecology in intensively managed pine landscapes. Therefore, our objective was to use a long-term dataset (1987–1993) to examine seasonal and annual home range sizes of female turkeys on a landscape dominated by even-aged, short rotation managed pine forests. This included data analyzed by Burk (1989), Smith et al. (1990), and Stys (1992). However, we included additional data not previously analyzed and examined all available data in totality to provide for consistent analyses for the entire study period.

Study Area

We conducted our study on approximately 20,158 ha of mostly contiguous forest in the Interior Flatwoods Resource Area (Pettry 1977) of the East Gulf Coastal Plain, approximately 6 km southwest of Scooba, Mississippi, in Kemper County. Topography was flat with numerous ephemeral, intermittent, and perennial streams. Dominate overstory tree species included loblolly pine (*Pinus taeda*), oaks (*Quercus* spp.) and hickory (*Carya* spp.). Common midstory species included oaks, hickory, maple (*Acer* spp.), sweetgum (*Liquidambar styraciflua*), and dogwood (*Cornus* spp.). The study area was composed of pine plantations (46%), mature pine-hardwood (28%), mature hardwood (15%), and agriculture (11%). Pine plantations were primarily owned and managed by Weyerhaeuser Company for production of pine sawtimber. Streamside management zones (SMZs), consisting of mature hard-

woods, were widely interspersed within the managed pine matrix. Plantations were composed of 73% thinned pine (35% of the study area), 17% unthinned pine (8% of study area), and 10% pine regeneration (3% of study area).

Typical silviculture for loblolly pine plantations included clearcut harvest at approximately 27–32 years of age followed by site preparation and planting, vegetation management (primarily herbicides), one or two commercial thinnings, pruning, and fertilization. During the study, prescribed burning was commonly conducted within plantations beginning at 9–10 years of age at intervals of 3–5 years (Smith et al. 1990).

Methods

Capture and Telemetry

We captured wild turkey females by cannon net (Bailey 1976) from the third week of January until the second week of March during 1986–1992 and from late June to mid-August during 1986–1989, using cracked corn for bait. We removed turkeys from the net and placed them into cardboard boxes sized for wild turkeys (76.2 x 35.6 x 61 cm). We classified turkeys as adults or juveniles (Williams and Austin 1988) and marked them with two patagial wing tags (Knowlton et al. 1964) and two metal, triple-lock leg bands. We used backpack harnesses to attach 108-g, motion-sensitive radiotransmitters (Wildlife Materials, Carbondale, Illinois). We released turkeys within 10–45 minutes of capture at the site of capture. All activities were approved by the Mississippi State University Institutional Animal Care and Use Committee Protocol 93–030.

We recorded turkey locations using triangulation (Cochran and Lord 1963) from two fixed telemetry stations ($N = 144$) if azimuths were <12 minutes apart and angles were between 60° and 120°. We used a hand-held, 3-element, directional Yagi antenna and either a Telonics (Mesa, Arizona) or Wildlife Materials (Carbondale, Illinois) receiver for triangulation. Mean error polygon size was approximately 0.26 ha (Smith et al. 1990). We located females three times per day and three times per week (nine locations per week) during spring (March–June). We located females as often as possible, generally twice daily and twice weekly (four locations per week), during the rest of the year (Weinstein 1994).

Home Range Analyses

We delineated biologically meaningful seasons based on the reproductive chronology of turkeys on our study area and previous research (Miller et al. 1997, Miller et al. 1999). For the seven years of our study, we used median date of nest initiation to define the start of a one-month nesting season. Therefore, we defined nesting season as 21 April–18 May, summer as 19 May–30 September, fall–winter as 1 October–28 February, and preincubation as 1 March–20 April. We did not estimate home ranges during nesting season as nesting females represent a point location (Miller et al. 1997) and because we did not obtain sufficient locations on non-nesting females during this time period to estimate home ranges.

We used Hawth's Analysis Tools 2.10 (http://www.spatialecology.com/htools) to derive seasonal and annual home range estimates using 100% minimum convex polygons (Mohr 1947). When calculating annual home ranges, we only used those females with ≥ 30 locations in analyses (e.g., Miller et al. 1997, Seaman et al. 1999). We used ≥ 20 locations when calculating seasonal home ranges. Other researchers have used as few as 10 locations per season to define MCP home ranges (Conner 2000). Additionally, we primarily calculated home range sizes as a relative measure of home range size to compare across seasons and years (Conner 2000). Finally, we felt a minimum of 20 locations was adequate compared to 30 locations for annual home range sizes as seasonal home ranges encompassed much shorter time frames than annual home ranges.

"Female-season" was defined as a home range for a turkey in a particular season. This was defined because we estimated home ranges for some females in more than one season. We used analysis of variance to determine if home ranges varied seasonally or annually (Steel and Torrie 1980). The main effect was either season or year and response variable was home range size. In the analysis of seasonal home ranges, we blocked (randomized complete block design with season as main effect) on year to remove annual variation. We used Student-Newman-Keuls' multiple range test to separate means (Steel and Torrie 1980) in both seasonal and annual analyses.

Results

Mean number of locations/hen/season used to calculate seasonal home range sizes ranged from 20–52.2 (Table 1). Mean number of locations/hen/year used to calculate annual home range sizes ranged from 62.4 – 81.0 (Table 2). There were insufficient locations obtained during 1991 to calculate annual home ranges.

We included 268 female-seasons in our analysis of seasonal home range size (Table 1). Averaging over all seasons, mean seasonal home range size was 406 ± 20 ha. Home range size varied seasonally ($F_{2,259} = 5.27$, $P = 0.006$). Mean separation indicated that home ranges were larger during fall–winter (524 ± 43.5 ha; mean ± SE) than during preincubation (326 ± 23.2 ha) and summer (392 ± 32.5 ha). Fall–winter home ranges varied from 37 to 2,639 ha (SE = 43.5, $N = 69$), preincubation home ranges varied from 64 to 1,085 ha (SE = 23.0, $N = 81$), and summer home ranges varied from 8 to 2,662 ha (SE = 32.0, $N = 118$).

We determined annual home ranges for 168 females (Table 2). The average annual home range was 796 ha ± 46.0 ha. However, home range sizes varied ($F_{5,162} = 3.39$, $P = 0.006$) among years. Mean separation indicated that annual home ranges were similar ($P > 0.05$) during all years, with one exception: home ranges were smaller (504 ± 54.0 ha; $P < 0.05$) during 1993 than during other years. Annual home ranges varied from 207 to 2,938 (Table 2).

Table 1. Number of wild turkey hens and mean number of telemetry locations used to calculate seasonal home ranges sizes in Kemper County, Mississippi, 1987–1993.

Season and year[a]	*N* hens	*N* locations (SE)
Fall–winter 1987	4	23.8 (0.3)
Preincubation 1987	8	21.4 (0.3)
Summer 1987	10	45.6 (4.5)
Fall–winter 1988	29	51.0 (2.3)
Preincubation 1988	29	23.2 (0.3)
Summer 1988	29	23.9 (0.5)
Fall–winter 1989	18	24.2 (0.7)
Preincubation 1989	3	20.0 (0.0)
Summer 1989	21	52.2 (3.7)
Fall–winter 1990	14	27.8 (0.6)
Preincubation 1990	21	26.4 (0.5)
Summer 1990	25	48.6 (2.5)
Fall–winter 1991	4	20.0 (0.0)
Preincubation 1992	18	23.1 (0.6)
Summer 1992	17	38.5 (2.1)
Preincubation 1993	2	20.0 (0.0)
Summer 1993	16	31.3 (0.9)

a. Seasons were defined as: fall-winter (1 Oct–28 Feb), preincubation (1 Mar–20 April), and summer (19 May–30 Sep)

Table 2. Number of wild turkey hens (hens), mean number of telemetry locations (locations) used to calculate annual home ranges and mean, minimum and maximum sizes of annual home ranges in Kemper County, Mississippi, 1987–1993.

			Annual Home Range Size (ha)		
Year	Hens	Locations (SE)	Mean (SE)	Minimum	Maximum
1987	15	64.9 (6.2)	1,153 (353.9) A[a]	294	5,665
1988	41	81.0 (4.9)	974 (90.3) A	260	2,938
1989	32	70.5 (4.7)	737 (56.3) AB	260	1,657
1990	35	76.4 (4.9)	722 (69.6) AB	217	2,263
1992	23	65.4 (4.0)	720 (73.7) AB	207	1,341
1993	22	62.4 (2.2)	504 (54.6) B	210	1,301

a. Mean home ranges with different letters were significantly different ($P < 0.05$).

Discussion

Past studies have documented wide variability in wild turkey home range sizes (Barwick and Speake 1973, Brown 1980, Kelley et al. 1988, Miller et al. 1997). Our study was no exception with wide variation in seasonal and annual home ranges. This variability may be due to individual behavior (Miller et al. 1997) or localized

differences in resource availability (Porter 1977, Exum et al. 1987, Godwin et al. 1996). It is unclear why annual home ranges were smaller during 1993 than other years.

Summer home ranges included females with and without broods. Unfortunately, data limitations prevented us from definitively determining which females had broods during summer. However, it is known that females with broods use smaller areas than females without broods (Porter 1977, Speake et al. 1975, Miller et al. 1997), explaining some of the variability in this season. On our area, home ranges for hens with broods < 2 weeks old averaged 102 ha during 1987 (Burk et al. 1990*b*). Larger fall–winter home ranges may be from turkeys traveling more to find limited food resources (Porter 1977) as compared to other times of the year. Larger fall–winter home ranges may also be partially due to migrational movements by some females on our study area (see below).

Interestingly, given the wide range in maximum size of annual home ranges (1,301–5,665 ha) and mean size of annual home ranges (504–1,153 ha), minimum size of annual home ranges was very consistent (210–294 ha). This suggests that on our area there may be a relatively consistent, minimum home range size. However, it is not clear if this is biologically meaningful or a spurious result. We suggest future research should examine the question of minimal spatial use requirement of female turkeys relative to stand sizes, landscape context and, if possible, demographic parameters.

Differences in home range calculation methods, sample sizes, biological phenomena, and inherent variability of home range estimates make comparisons among studies difficult (Boulanger and White 1990, Larkin and Halkin 1994, Miller et al. 1997). However, the general consensus is that wild turkey home ranges are smaller in better habitat (Brown 1980) and in areas with diverse habitats (Barwick and Speake 1973, Speake et al. 1975). Home range sizes in our study were similar to those reported by Miller et al. (1997) in mostly mature forests of central Mississippi. Home ranges in the current study and that of Miller et al. (1997) were larger than those reported in other southeastern studies. Miller et al. (1997) contended this was due to lack of interspersed openings in a mostly forested study area and exploitation of a variety of vegetation types by turkeys. Other researchers have also noted that home ranges of wild turkeys tend to be larger in areas with few interspersed forest openings (Everett et al. 1979, Wigley et al. 1986, Kelley et al. 1988, Smith et al. 1988).

Similar to the conclusions of Miller et al. (1997) and others (Barwick and Speake 1973, Speake et al. 1975, Everett et al. 1979, Wigley et al. 1986, Kelley et al. 1988, Smith et al. 1988), we contend that the larger home ranges in our study was not due to poor habitat quality on a stand level basis but due to lack of a diversity of vegetation types at a landscape level which, in some cases, required turkeys to move further to acquire needed resources. First, it is unlikely that stand level habitat quality was poor given that Weinstein et al. (1995) determined female density on our study area varied from 0.95/km^2–3.21/km^2 and noted that these densities were comparable to turkeys in other areas of the eastern United States and higher than densi-

ties in many areas (e.g., see Wunz and Pack 1992). Therefore, given these relatively high densities, it is unlikely that habitat quality was a primary driving factor in home range size in our study, with the possible exception of a lack of habitat interspersion.

Second, past studies on our area demonstrated that many radio-tagged females moved from upland, intensively managed pine forests to a large bottomland hardwood/soybean field complex during the fall–winter, returning to the intensively managed pine forests during flock breakup in the spring (Smith 1988, Smith et al. 1990, Stys 1992, Weinstein 1994). During 1987–1990, an average of 42.5% (16%–64%) of all radiotagged hens made this migrational movement (Stys 1992), which was likely associated with differential resource availability (Porter 1977, Exum et al. 1987, Godwin et al. 1996), particularly availability of hard mast in the bottomland hardwood stands and availability of desired nesting and brood habitat in intensively managed pine stands (Smith et al. 1990, Stys et al. 1992). Therefore, it appears that lack of habitat diversity (minimal areas of mature hardwoods interspersed within the managed pine landscape) may be an important aspect of home range size on our study area for a varying proportion of the hen population across years. A possible secondary factor may have been the general lack of large openings in our study areas, except for the large agricultural fields associated with the bottomland hardwood complex.

Given that some females displayed this movement pattern and others did not, and that the rate of females doing so varied considerably among years, reinforces the idea that variability in home range size is due to individual behavior (Miller et al. 1997) and variable resource availability (Porter 1977, Exum et al. 1987, Godwin et al. 1996). Streamside management zones on our study area were primarily older-aged hardwood forests and were used by hens on our study area (Burk 1989). However, density of SMZs within home ranges of female turkeys likely varied, as did ability of each individual SMZ to provide hard mast, especially across years (e.g., Burk et al. 1990*a*). Females that did not make the migrational movement may have had enough SMZs in their home range to avoid doing so. Influence of SMZ availability and relative mast production on female turkeys in managed forest landscapes should be further examined, expanding on the work of Burk et al. (1990*a*).

Management Implications

Given the annual movements of females on our area, which includes a migrational pattern for some individuals, it is important for managers to not only understand home range sizes, but also actual movement patterns within those home ranges to better understand spatial use patterns of wild turkeys (e.g., Godwin et al. 1990). Additionally, hard mast is generally considered an important food resource for wild turkeys during fall and winter (Hurst 1992). In some forested landscapes, such as those dominated by intensively managed pine, this important resource may necessitate relatively long movements by wild turkeys. Managers may want to consider availability and distribution of mature hardwood stands when planning for wild tur-

keys (e.g., Burk et al. 1990*a*). However, it should be understood that importance of SMZs for providing this need is not completely understood (Dickson 1989), nor the level of reliance wild turkeys have on hard mast for fall and winter food. For example, male wild turkeys in central Mississippi (Miller et al. 1999) and Louisiana (Lambert et al. 1990) consistently used mature pine during winter and turkeys in Arkansas (Wigley et al. 1985) and Louisiana (Dickson et al. 1978) used food resources other than hard mast (e.g., pine seeds) during winter.

This research was conducted on an intensively managed pine landscape that was dominated by midrotation pine forests subjected to frequent prescribed burning and in close proximity to a large bottomland hardwood complex. Therefore, our results should be viewed with this landscape context in mind (Miller et al. 1995). With the projected increase in acreage of intensively managed pine comes an expected decreased use of prescribed fire and an increased use of herbicides for vegetation management (Haines et al. 2001). Although herbicide use in pine forests can improve habitat conditions for many species (Guynn et al. 2004), prescribed burning is known to greatly improve habitat conditions for turkeys in pine forests (e.g., Hurst and Dickson 1992, Palmer et al. 1996). It is unknown how this shift away for prescribed burning will impact turkeys. Therefore, we recommend future research examine effects of changing vegetation management practices on wild turkeys on intensively managed pine landscapes.

Acknowledgments

This paper is a contribution to the Mississippi Cooperative Wild Turkey Research Project funded by Weyerhaeuser Company, Weyerhaeuser Company Foundation, National Wild Turkey Federation, USDA Forest Service, Gulf States Paper Company, East Mississippi Sportsmen Association, and the Mississippi Agricultural and Forestry Experiment Station. We thank J. Burk, J. Forbes, D. Smith, J. Stys, and M. Weinstein for their efforts as graduate students on this project. The Joseph W. Jones Ecological Research Center provided support for M. Conner during manuscript preparation. We thank M. Gray, M. Chamberlain, J. Brunjes, and an anonymous reviewer for many valuable comments. Special thanks to G. A. Hurst, B. D. Leopold, and the Forest and Wildlife Research Center at Mississippi State University.

Literature Cited

Bailey, R. W. 1976. Live-trapping wild turkeys in North Carolina. North Carolina Wildlife Resources Commission Publication. Raleigh, North Carolina.

Barwick, L. H. and D. W. Speake. 1973. Seasonal movements and activities of wild turkey gobblers in Alabama. Proceedings of the National Wild Turkey Symposium 2:125–134.

Boulanger, J. G. and G. C. White. 1990. A comparison of home-range estimators using Monte Carlo simulation. Journal of Wildlife Management 54:310–315.

Brown, E. K. 1980. Home range and movements of wild turkeys – a review. Proceedings of the National Wild Turkey Symposium 4:251–261.

Burk, J. D. 1989. Use of streamside management zones within midrotation-aged loblolly pine plantations by wild turkeys. Master's thesis. Mississippi State University, Mississippi State.

_____, G. A. Hurst, D. R. Smith, B. D. Leopold, and J. G. Dickson. 1990*a*. Wild turkey use of streamside management zones in loblolly pine plantations. Proceedings of the National Wild Turkey Symposium 6:84–89.

_____, D. R. Smith, G. A. Hurst, B. D. Leopold, and M. A. Melchiors. 1990*b*. Wild turkey use of loblolly pine plantations for nesting and brood rearing. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 44:163–170.

Cochran, W. W. and R. D. Lord. 1963. A radio-tracking system for wild animals. Journal of Wildlife Management 27:9–24.

Conner, L. M. 2000. Home range sizes of fox squirrels in southwest Georgia. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 54:400–406.

Dickson, J. G. 1989. Streamside management zones and wildlife in southern U.S. forests. Pages 131–133 *in* Practical approaches to riparian resource management. U.S. Bureau of Land Management, Billings, Montana.

_____, C. D. Adams, and S. H. Hanley. 1978. Response of turkey populations to habitat variables in Louisiana. Wildlife Society Bulletin 6:163–165.

Everett, D. D., Jr., D. W. Speake, and W. K. Maddox. 1979. Wild turkey ranges in Alabama mountain habitat. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 33:233–238.

Exum, J. H., J. A. McGlincy, D. W. Speake, J. L. Buckner, and F. M. Stanley. 1987. Ecology of the eastern wild turkey in an intensively managed pine forest in southern Alabama. Tall Timbers Research Station Bulletin 23. Tallahassee, Florida.

Godwin, K. D., G. A. Hurst, and B. D. Leopold. 1996. Size and percent overlap of gobbler home ranges and core-use areas in central Mississippi. Proceedings of the National Wild Turkey Symposium 7:45–52.

_____, W. E. Palmer, G. A. Hurst, and R. L. Kelly. 1990. Relationships of wild turkey gobbler movements and harvest rates to management area boundaries. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 44:260–267.

Guynn, D. C., S. T. Guynn, T. B. Wigley, and D. A. Miller. 2004. Herbicides and forest biodiversity—what do we know and where do we go from here? Wildlife Society Bulletin 32:1085–1092.

Haines, T. K., R. L. Busby, and D. A. Cleaves. 2001. Prescribed burning in the south: trends, purpose, and barriers. Southern Journal of Applied Forestry 25:149–153.

Holbrook, H. T., M. R. Vaughn, and P. T. Bromley. 1987. Wild turkey habitat preferences and recruitment in intensively managed piedmont forests. Journal of Wildlife Management 51:182–187.

Hurst, G. A. 1992. Foods and feeding. Pages 66–83 *in* J. G. Dickson, editor. The Wild Turkey, Biology and Management. Stackpole Books, Harrisburg, Pennsylvania.

_____ and J. G. Dickson. 1992. Eastern turkey in southern pine-oak forests. Pages 265–285 *in* J. G. Dickson, editor. The Wild Turkey, Biology and Management. Stackpole Books, Harrisburg, Pennsylvania.

_____ D. R. Smith, J. D. Burk, and B. D. Leopold. 1991. Wild turkey gobbler habitat use and home range in loblolly pine plantations. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 45:115–123.

Kelley, R. L., G. A. Hurst, and D. E. Steffen. 1988. Home ranges of wild turkey gobblers in central Mississippi. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 42:470–475.

Kennamer, J. E., J. R. Gwaltney, and R. K. Simms. 1980. Habitat preferences of the eastern wild turkey on an area intensively managed for pine in Alabama. Proceedings of the National Wild Turkey Symposium 4:240–245.

Knowlton, F. F., E. D. Michael, and W. C. Glazener. 1964. A marking technique for the field recognition of individual turkeys and deer. Journal of Wildlife Management 28:167–170.

Lambert, E. P., W. P. Smith, and R. D. Teitelbaum. 1990. Wild turkey use of dairy farm-timberland habitats in southeastern Louisiana. Proceedings of the National Wild Turkey Symposium 6:51–60.

Larkin, R. P. and D. Halkin. 1994. A review of software packages for estimating animal home ranges. Wildlife Society Bulletin 22:274–287.

Leopold, B. D., G. A. Hurst, and D. A. Miller. 1996. Long- versus short-term research and effective management: a case study using the wild turkey. North American Wildlife and Natural Resources Conference 61:477–487.

Miller, D. A., M. J. Chamberlain, B. D. Leopold, and G. A. Hurst. 2001. Lessons from Tallahala: What have we learned for turkey management into the 21st Century? Proceedings of the National Wild Turkey Symposium 8:23–33.

_____, G. A. Hurst, and B. D. Leopold. 1999. Habitat use of eastern wild turkeys in central Mississippi. Journal of Wildlife Management 63:210–222.

_____, B. D. Leopold, and G. A. Hurst. 1997. Seasonal home ranges of wild turkeys in central Mississippi. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 51:414–425.

_____, M. Weinstein, S. R. Priest, B. D. Leopold, and G. A. Hurst. 1995. Wild turkey reproductive parameters from two different forest ecosystems in central Mississippi. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 49:466–475.

Mohr, C. O. 1947. Table of equivalent populations of North American small mammals. American Midland Naturalist 37:223–249.

Mosby, H. S. 1975. The status of the wild turkey in 1974. Proceedings of the National Wild Turkey Symposium 3:22–26.

Palmer, W. E., G. A. Hurst, K. D. Godwin, and D. A. Miller. 1996. Effects of prescribed burning on wild turkeys. Transactions of the North American Wildlife and Natural Resources Conference 61:228–236.

Pettry, D. E. 1977. Soil resource areas of Mississippi. Mississippi Agricultural and Forestry Experiment Station Information Sheet 1278.

Porter, W. F. 1977. Utilization of agricultural habitats by wild turkeys in southeastern Minnesota. International Congress of Game Biologists 13:319–323.

_____. 1992. Habitat requirements. Pages 202–213 *in* J. Dickson, editor. The Wild Turkey: Biology and Management. Stackpole Books, Harrisburg, Pennsylvania.

Seaman D. E., J. J. Millspaugh, B. J. Kernohan, G. C. Brundige, K. J. Raedeke, and R. A. Gitzen. 1999. Effects of sample size on kernel home range estimates. Journal of Wildlife Management 63:739–747.

Smith, D. R. 1988. Use of midrotation-aged pine plantations by wild turkeys. Master's thesis. Mississippi State University, Mississippi State.

_____, G. A. Hurst, J. D. Burk, B. D. Leopold, and M. A. Melchiors. 1990. Use of loblolly pine plantations by wild turkey hens in east-central Mississippi. Proceedings of the National Wild Turkey Symposium 6:61–66.

Smith, W. P., E. P. Lambert, and R. D. Teitelbaum. 1988. Seasonal movements and home range differences among age and sex groups of eastern wild turkeys within southeastern Louisiana. Proceedings of the International Symposium on Biotelemetry 10:151–158.

Speake, D. W., T. E. Lynch, W. J. Fleming, G. A. Wright, and W. J. Hamrick. 1975. Habitat use and seasonal movements of wild turkeys in the Southeast. Proceedings of the National Wild Turkey Symposium 3:122–130.

Steel, G. D., and J. H. Torrie. 1980. Principles and procedures of statistics, a biometrical approach, second edition. McGraw-Hill Publishing, New York, New York.

Stys, J. E. 1992. Vegetative characteristics and wild turkey hen use of control-burned loblolly pine plantations. Master's thesis. Mississippi State University, Mississippi State.

_____, G. A. Hurst, B. D. Leopold, and M. A. Melchiors. 1992. Wild turkey use of control-burned loblolly pine plantations. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 46:37–45.

Tapley, J. L, W. H. Healy, R. K. Abernathy, and J. E. Kennamer. 2001. Status of wild turkey hunting in North America. Proceedings of the National Wild Turkey Symposium 8:257–268.

Wagner, R. G., M. Newton, E. C. Cole, J. H. Miller, and B. D. Shiver. 2004. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. Wildlife Society Bulletin 32:1028–1041.

Wear, D. N. and J. G. Greis. 2002. Southern forest resource assessment: summary report. USDA Forest Service General Technical Report SRS-54. Asheville, North Carolina.

Weinstein, M. D. 1994. Experimental designs for estimating wild turkey population size and reproduction using bait site counts and radio-telemetry. Master's thesis. Mississippi State University, Mississippi State.

_____, B. D. Leopold, and G. A. Hurst. 1995. Evaluation of wild turkey population estimation methods. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 49:476–487.

Wigley, T. B., J. M. Sweeney, M. E. Garner, and M. A. Melchiors. 1985. Forest habitat use by wild turkeys in the Ouachita Mountains. Proceedings of the National Wild Turkey Symposium 5:183–198

_____, _____, _____, and _____ 1986. Wild turkey home ranges in the Ouachita Mountains. Journal of Wildlife Management 50:540–544.

Williams, L. E., Jr., and D. H. Austin. 1988. Studies of the wild turkey in Florida. Florida Game and Freshwater Fish Commission, Technical Bulletin 10, Gainesville.

Wunz, G. A. and J. C. Pack. 1992. Eastern turkey in eastern oak-hickory and northern hardwood forests. Pages 232–264 *in* J. G. Dickson, editor. The Wild Turkey: Biology and Management. Stackpole Books, Harrisburg, Pennsylvania.