Eastern wild turkey brood habitat use in southern Iowa

by

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TABLE OF CONTENTS

ABSTRACT

Habitat use by wild turkey (Meleagris gallopavo silvestris) broods was studied during the summers of 1978 and 1979 in south-central Iowa. The study area represented some of Iowa's best wild turkey habitat and was composed of a patchwork of agricultural openings (55%) and mid-seral oak-hickory timber (45%). Radio telemetry was used to collect information from 17 hens with broods which was compared to a sample of 28 hens without broods and 6 males. Home range for hens with broods averaged 146 ha and increased significantly ($P < 0.01$) through the summer. Pastures were preferred brood habitats with the peak use occurring 7-8 weeks posthatching. Survival was 53% for the poults at 4 weeks of age. Hens without broods and males had significantly ($P < 0.05$) smaller home ranges than hens with broods and utilized timbered habitats more extensively. Forested areas interspersed with as much as 50% in openings appear to be good brood rearing habitat in southern Iowa.

INTRODUCTION

The eastern wild turkey (*Meleagris gallopavo silvestris*) was relatively abundant in Iowa during the early years of settlement (Sherman 1913, Musgrove et al. 1941, Haugen 1961), but populations declined and were extirpated shortly after 1900. As early as 1920 the Iowa Conservation Commission experimented with releasing pen-reared turkeys, but these failed to establish self-propagating populations. Then in the 1960s, the Commission obtained Rio Grand turkeys (*M. g. intermedia*) from Texas and Merriam's turkeys (*M. g. merriami*) from Nebraska. Releases of these turkeys were only marginally successful, probably because reproduction was poor and populations remained low or dwindled away. However, encouraged by limited success and by reports of successes with restocking efforts in other states such as Missouri, 11 turkeys were obtained from Missouri in 1966 and released in Shimek State Forest in Lee County in southeast Iowa. Survival and reproduction were excellent as the turkeys expanded their range and increased in numbers. In 1968, 20 eastern wild turkeys were released in Stephens State Forest in Lucas County. The results duplicated the success at Shimek and by 1974 the population in Stephens Forest was estimated at 400 to 500 birds (Little 1980 and Iowa Conservation Commission unpublished reports).

The rapid growth of turkey populations in Iowa, following restocking efforts, meant that conditions were favorable in southern Iowa for the eastern wild turkey to survive and reproduce. It was also clear that information about the factors contributing to this population growth would

be basic to the future management of these populations as well as to identifying additional areas in the state for restocking. Lindzey (1967) and Korschgen (1967) felt that the brood rearing season was the most critical period for wild turkeys and studies of this period would be of most importance. Open grassy areas and forest clearings have been identified as important brood rearing habitat (Mosby and Handley 1943, Lewis 1964, Hillestad and Speake 1970, and Williams et al. 1973). Speake et al. (1975) recommended that spring and summer habitat should include 12-25% of well dispersed openings. Porter (1978) found that broods spent as much as 50% of their time in agricultural openings. Insects were found to be more abundant in clearings than under forest canopy (Martin and McGinnes 1975). Both potential arthropod and vegetative poult food items were found to be more abundant in grassy openings than in forested habitats by Blackburn et al. (1975).

The interspersion of farmland and forest habitats in Iowa apparently provides ideal conditions for turkey survival, otherwise the observed rapid population growth could not have occurred. This study was undertaken to collect information relating to the structure and composition of Iowa's best wild turkey brood habitat. Additional objectives were to relate turkey brood movements and survival to habitat selection, and to develop habitat management recommendations.

STUDY AREA

The 34 km^2 (13 mi^2) study area was located in Jackson and Union townships of Lucas County, Iowa. Stephens State Forest, which composed about 40% of the study area, is a public, multiple-use area open to hunting. Access was by gravel road and dirt fire lane. The wild turkey population density on the area was estimated at 30 birds per km^2 of timber (T. Little, ICC, personal communication). The human population density was about 8 people per km^2.

The study area was a patchwork ecotone consisting of about 45% timber and 55% agricultural openings. Upland timber, which composed 32% of the study area, consisted mostly of oak-hickory poletimber but also included conifer plantations (5%) and oak sawtimber (3%). White oak (Quercus alba), bur oak (Q. macrocarpa), shagbark hickory (Carya ovata), and red oak (Q. rubra) were the principal trees in pole and sawtimber stands. Red pine (Pinus resinosa), jack pine (P. banksiana) and white pine (P. strobus) were the principal species in conifer plantations ranging in age from seedlings to 50-year-old trees. Lowland hardwood timber, brush and grazed hardwood timber comprised 8%, 3%, and 2% of the study area, respectively. Most of the openings consisted of row crops and pasture and covered 22% and 29% of the study area, respectively. Hay and old field habitats each comprised 7% of the study area. For more detailed information on vegetation, see the Appendix.

An 8 km^2 area was added the second summer of the study to accommodate some of the hens with broods that moved off the study area defined in 1978.

This adjacent area consisted of 59% pasture, 11% timber, 14% hay, 19% row crop, 3% bottomland, 2% brush and 1% old field habitats.

Soil types, topographic features and land-use practices for south central Iowa are discussed by Oschwald et al. (1965) and Prior (1976), economy and climate by Collins (1974).

METHODS

Habitat classification was determined by making ground surveys and consulting forest survey maps and aerial photos. Habitats were delineated on a study area map drawn from U. S. Geological Survey topographic maps. This map was overlayed with a grid containing 2.6 ha per grid cell. Each cell was classified according to vegetation type and assigned a unique number based on an X-Y coordinate system. Habitat percentages were determined by totalling the number of cells of each type.

Capture and Tagging

Wild turkeys were baited with shelled, whole kernel corn, and were trapped with rocket nets from October to March of 1977-78 and 1978-79. All captured birds were sexed, aged, weighed, and fitted with 0.8 x 2.9 cm aluminum numbered wing bands and 5 x 14 cm numbered patagial tags color-coded by age and sex. Solar powered or lithium-battery powered radio transmitters operating on individual frequencies were harnessed to selected birds. All birds were released at the point of capture.

Locations of radio-tagged turkeys were determined by triangulating simultaneous azimuths taken by 2 vehicles, each mounted with dual yagi antennas using a null-peak receiver system. Each vehicle was equipped with a citizens band, 2-way radio for communication between observers, one of whom plotted telemetry fixes on a map of the study area. Telemetry fixes were then coded for computer analysis using the grid numbers and specific habitat types used for habitat classification. All habitat use and home range information was based on data recorded by this system.

A conservative probability level of 0.01 or less was selected for determining statistical differences in habitat use and home range size. All differences referred to hereafter are significant at that level unless otherwise stated.

Poult Survival

Brood sizes at hatching were considered to be the same as the number of successfully hatched eggshells found in the nest. Poult survival rates at the end of each 2-week interval are expressed as a percentage of the total number of poults alive at the beginning of each 2-week interval for all broods combined. Only broods that were accounted for both at the start and end of a 2-week interval were included.

Poult survival was determined by counting the number of poults in each brood at 2-week intervals. Occasionally hens with broods were telemetrically located in habitats where an accurate flush count could be made. However, counts were usually made by remotely locating roosting hens in the evening. The next morning, an hour or more before sunrise, two observers used a hand held antenna and receiver to approach as close to the roosting hen as possible. The concealed observers then counted the poults as the hen left the roost. This technique was not always successful, but it permitted many counts without disturbing the brood.

Habitat Use

Habitat use was considered to be the percentage of the total number of telemetry fixes for each period recorded for each of 8 habitats. A

generalized Wald Statistic (Rao and Scott 1979) was used to determine statistically significant differences in habitat use between age and sex classes, monthly and biweekly intervals, and between years. Repeated telemetry fixes of the same individuals over time created a lack of independence between time periods which may lead to finding too many significant results. The Wald Statistic adjusts chi-square values downward to account for this lack of independence and provides a more conservative test. The procedure of Neu et al. (1974) was used to determine if the observed use of habitats was proportional to the occurrence of habitats on the study area.

Home Range

Home range was defined as the specific area covered during a particular time period (Brown and Orians 1970) and was delineated based on the modified minimum area method (Harvey and Barbour 1965). Biweekly ranges were calculated for turkeys that had 5 or more telemetry fixes in the 2-week period. Monthly ranges were calculated for turkeys that had 10 or more telemetry fixes for that month. The number of telemetry fixes for a particular time period for each bird was entered as a covariate in the General Linear Model Procedure of the Statistical Analysis System (Helwig and Council 1979). This procedure yielded mean home range size estimates that were weighted according to the number of telemetry fixes. Differences between means for age and sex classes, biweekly periods, months and years were tested for statistical significance. Least Squares Means are presented for each time period to account for the effect that differences in the number of telemetry fixes had on home range estimates.

Arthropod Sampling

Pitfall traps were used to obtain an index of arthropod abundance in different habitats throughout the summer of 1978. Traps were placed along transects that ran perpendicular to the edge between forest and field habitats. Each transect consisted of 5 pitfall traps spaced 15 m apart, with the middle trap placed at the timber-field edge. Nine field edges were sampled, 3 fields each of corn, hay and old field. Two transect lines were placed in each field, giving a total of 90 sampling points. Samples were collected each day for 3 days (not always consecutively, depending on weather conditions) within each of 6 sampling periods spaced at 2-week intervals from the beginning of June to the end of August.

Each pitfall trap consisted of an unused quart paint can recessed into the ground so that the top of the can was flush with the ground surface. Insects were directed into a small jar of 95% ethanol by a plastic funnel with a diameter of 108 mm. Each time the funnel was placed on the can, the soil surface was smoothed to prevent barriers to insect movement. Funnels were removed and lids were placed on the cans between sampling periods. The pitfall traps were similar to those described by Pedigo et al. (1972).

The arthropods in each sample were sorted, counted and volumetric measurements of each major taxonomic group taken by alcohol displacement in glass syringes. The 3, 24-hour samples were pooled for each sampling period. A log transformation was used on count data and a cube root transformation was used on volume data before using analysis of variance procedures to test for statistical differences among time periods and habitats.

RESULTS

A total of 224 wild turkeys were captured and marked during the study. Of these, 99 were fitted with radio transmitters. Twenty-three of 37 and 26 of 58 turkeys carrying radios in April were followed throughout the summers of 1978 and 1979 respectively.

Arthropod Abundance

No significant differences ($P > 0.05$) were detected in mean numbers and volumes of arthropods collected with pitfall traps in the selected habitats and time periods (Table 1). The volume of arthropods collected in cornfields nearly doubled in each succeeding time period while numbers of arthropods increased in two of the periods. Numbers of arthropods collected in ecotone, hayfield, old field and timber habitats declined over the sampling periods. Volumes collected in each of the habitats excluding corn, fluctuated erratically with no clear trends evident.

Poult Survival

Data were collected on 6 broods in 1978 and 11 in 1979. Poult mortality rates for both years combined averaged 44% for the first 2 weeks after hatching and 15% for the second 2 weeks. Cumulative mortality at the end of the first 4 weeks after hatching was 53%. Mortality rates could not be calculated beyond 4 weeks after hatching because of the tendency for broods to form creches. This made it difficult to accurately count poults in a creche of 20 or more, or to assign poults to their original hen. Also, the composition of the creches fluctuated from

Table 1. Average numbers and volumes (cc) of arthropods collected in pitfall traps during June-August 1978. A sampling period consisted of 3 days every 2 weeks. Sample size (n) is the number of pitfall trap samples analyzed in that period

Sampling Period	Old Field			Hay			Corn			Ecotone			Timber		
	n	No.	Vol.	n	No.	Vol.	n	No.	Vol.	n	No.	Vol.	n	No.	Vol.
5/30- 6/5	36	17.6	0.87	24	16.0	0.57	--	--	--	23	32.9	0.85	52	35.5	0.92
6/20-6/22	35	16.7	0.60	21	27.3	1.46	18	8.6	0.12	40	21.1	0.91	81	18.2	0.73
7/11-7/14	32	17.4	0.63	21	26.3	0.83	31	12.4	0.32	42	23.5	0.68	87	20.6	0.73
7/25-7/27	29	14.1	0.63	32	17.1	0.91	32	12.2	0.57	47	24.2	1.10	93	21.6	1.05
8/7 - 8/9	34	9.9	0.41	25	12.0	0.50	31	12.3	1.32	51	16.5	0.75	99	15.2	0.82
8/22-8/24	36	11.8	0.94	35	10.6	0.73	34	19.7	2.71	50	14.8	1.29	98	11.0	0.70

observation to observation. Sample sizes were too small to relate habitat use to poult survival.

Home Range

Home range sizes for males did not differ significantly from those for females without broods so data for these two groups were pooled for tests. Subsequently, differences between years were not significant so both years were also pooled.

Biweekly home range sizes for hens with broods increased significantly during the 10-week period after hatching and were significantly different ($P < 0.05$) from the relatively stable biweekly home range sizes for the broodless females and males (Table 2). Mean home range size for the entire 10-week period was 146 ha for hens with broods and 139 ha for broodless hens.

When telemetry location data were grouped on a monthly basis, home range sizes followed similar patterns observed for biweekly periods (Table 3). Home range sizes for females with broods doubled (56 to 112 ha) from June to August while home ranges for broodless females and males declined (70 to 54 ha). This difference between groups was statistically significant.

Habitat Use

Habitat use data compiled by biweekly periods were significantly different between females with broods and females without broods (Table 4). Females with broods used open habitats such as pasture and hay more than the females without broods. Row crops were the only habitat both groups

Table 2. Biweekly estimated mean home range sizes (ha) for radio-tagged eastern wild turkey hens with broods, and male and female eastern wild turkeys without broods, in south-central Iowa. Estimates are for the first 10 weeks of age of the poults for the summers of 1978 and 1979. Estimates are made using the modified minimum area method for individual birds

Age (weeks)	Females with Broods				Broodless Females and Males			
	$\bar{x}$	± SE	n	Range	$\bar{x}$	± SE	n	Range
0-2	39	4.1	16	10-101	39	3.0	26(2)[a]	13-85
3-4	51	4.5	12	36-91	27	3.0	28(3)	5-49
5-6	37	4.8	10	23-78	32	2.8	33(6)	10-60
7-8	51	4.9	9	28-130	30	2.9	32(5)	10-57
9-10	55	5.1	8	26-124	31	3.3	20(1)	8-80
0-10	146	20.2	9	117-357	139	14.7	17(1)	47-212

[a] Numbers in parentheses are the number of males included in "n".

Table 3. Monthly estimated mean home range sizes (ha) for radio-tagged eastern wild turkey hens with broods, and male and female turkeys without broods, in south-central Iowa. Estimates are made using the modified minimum area method for individual birds

	Females with Broods				Broodless Females and Males			
Month	$\bar{x}$	± SE	n	Range	$\bar{x}$	± SE	n	Range
June	56	8.6	16	10-132	70	6.0	32(3)[a]	8-176
July	83	10.1	11	49-228	55	5.9	34(6)	21-109
August	112	11.0	9	80-287	54	6.7	25(3)	21-106

[a] Numbers in parentheses are the number of males included in "n".

Table 4. Biweekly habitat utilization by radio-tagged female wild turkeys with and without broods in south-central Iowa during each brood's first 10 weeks posthatch, 1978 and 1979. Each value for habitat use in the table is a percentage of the total telemetry fixes for each period and habitat type. Modified chi-square tests were used for detecting significant differences at $P < 0.01$. When the habitat use percentage is significantly different from the expected, the value is underlined. The percent of the study area for either 1978 or 1979 was used in determining significance; the higher of the two values was used to compare observed values greater than expected, the lower value for those less than expected

	Percent of Study Area		Observed Percentage of Habitat Use									
			Females with Broods					Females without Broods				
Habitat Type	1978	1979	0-2	3-4	5-6	7-8	9-10	0-2	3-4	5-6	7-8	9-10
Upland timber	32	28	28.1	24.3	21.3	15.7	18.0	57.9	50.9	53.1	43.7	44.1
Row crop	22	18	4.7	2.9	5.4	4.2	12.8	1.9	5.4	3.4	3.6	7.3
Pasture	19	27	20.6	42.5	47.3	58.5	47.7	9.1	14.3	21.4	22.7	23.9
Lowland timber	8	7	3.9	1.4	0.8	0.9	4.1	6.8	7.1	4.2	5.7	4.1
Hay	7	9	17.2	16.1	11.7	10.6	8.1	5.3	4.9	8.0	8.1	8.1
Old field	7	6	6.4	7.9	9.6	7.8	4.1	3.8	5.4	2.7	4.1	3.2
Brush	3	3	1.4	0.7	0.4	0.5	0.6	8.3	7.6	4.2	8.5	7.3
Grazed timber	2	2	17.8	4.3	3.4	1.8	4.7	6.8	4.5	3.1	3.6	2.0
Total No. Fixes			360	280	239	217	172	264	224	262	247	247

avoided. Upland timber, lowland timber and brush were each used almost twice as much by females without broods as by females with broods.

Females with broods shifted their use of habitats within biweekly periods. During the first 4 weeks, use of pasture habitat increased almost 22% while the use of grazed timber declined about 13%. This shift towards more open habitats continued through the 7-8 week period. Pasture habitat was evidently more attractive than hayfields since there is an inverse relationship between the two through the summer.

Similar trends in estimates of habitat use were noted with data grouped into monthly periods (Table 5). However, with this grouping, sufficient locations were obtained for males to treat them separately in the comparisons. Monthly habitat use by males was significantly different from females with broods and females without broods. Males, for some unknown reason, used row crop habitats almost 3 times more often than either hens with broods or hens without broods. Most of the other habitats were used in proportion to their occurrence on the study area except that hay and pasture were used somewhat less and upland timber much more.

Females without broods used row crops and old field habitats much less than expected and upland timber more than expected. Their use of pasture increased from June through August, but was half that of females with broods.

Open habitats such as pasture, hay and old field accounted for about 46%, 64% and 61% of all habitat use by females with broods during June, July and August, respectively. For the same time periods, hens without broods used open habitats at rates of only 15%, 32% and 34%, respectively.

Table 5. Monthly habitat utilization by radio-tagged eastern wild turkeys in south-central Iowa during June, July, and August, 1978 and 1979. Each value for habitat use in the table is a percentage of the total telemetry fixes for each period and habitat type. Modified chi-square tests were used for detecting significant differences at $P \geq 0.01$. When the habitat use percentage is significantly different from the expected, the value is underlined. The percent of the study area for either 1978 or 1979 was used in determining significance; the higher of the two values was used to compare observed values greater than expected, the lower value for those less than expected

Habitat Type	Percent of Study Area		Observed Percentage of Habitat Use								
			Males			Females without Broods			Females with Broods		
	1978	1979	June	July	Aug.	June	July	Aug.	June	July	Aug.
Upland timber	32	28	68.7	54.9	40.5	62.0	51.4	46.8	29.8	23.4	24.2
Row crop	22	18	10.9	17.6	18.9	3.4	3.1	4.6	4.4	5.2	8.4
Pasture	19	27	4.7	8.8	14.9	8.7	19.9	22.8	27.6	40.9	43.1
Lowland timber	8	7	6.3	5.5	4.1	5.8	5.1	4.1	4.4	1.6	2.3
Hay	7	9	1.6	2.2	8.1	3.2	8.4	8.3	13.2	15.1	12.0
Old field	7	6	6.3	7.7	4.1	3.2	3.7	2.5	5.1	8.0	5.7
Brush	3	3	1.6	0.0	0.0	7.7	5.3	8.3	0.7	1.3	0.2
Grazed timber	2	2	0.0	3.3	9.5	6.0	3.1	2.5	14.9	4.5	4.1
Total No. Fixes			64	91	74	586	547	517	410	637	441

Females with broods used brush and lowland timber very little and their use of grazed timber declined after June.

DISCUSSION

Iowa's timber resource lacks the extensive tracts of continuous forest interspersed with infrequent openings or grassy understory which game managers traditionally have considered important for brood habitat (Mosby and Handley 1943 and Martin and McGinnes 1975). The study area in Iowa was comprised of about a 50-50 open/timber mix. This ratio is much different than the 30% open, 70% timber found to support high turkey populations in Missouri (Lewis 1964) or recommended by Porter (1980). Given the rapid population growth observed in Iowa and the high densities reported in Stephens Forest and elsewhere in the state it is probable that extensive unbroken tracts of timber are not as necessary as previously thought.

Poult mortality rates observed during the study are lower than the 74.5% reported in Alabama (Speake 1980) or nearly 80% reported from New York (Glidden and Austin 1975). Mortality is low enough to infer that the habitat on the study area is suitable for brood raising.

The early formation of creches may further enhance brood survival. In conducting brood counts by flushing, I found that the presence of a second hen with the brood made an accurate count almost impossible. It was much easier to get close to a brood with only one hen. The second hen may provide an extra margin of protection by helping to detect predators earlier.

Brood rearing habitat in Iowa is apparently of good quality as home range sizes are relatively small. Only one other study, in Alabama (Speake et al. 1975), has reported an average range size for hens with

broods that was less than the 146 ha found here. In Minnesota, average home range size was 250 ha over 12 weeks (Porter 1980). In an extensively timbered area in West Virginia, the home range size of broods was 455 ha (Pack et al. 1980). Although 10 weeks may not be the total brood rearing period, it is doubtful that a longer monitoring period would have substantially changed home range sizes. Home ranges calculated for September of 1978 for hens with broods were smaller than those for August, indicating peak movement probably occurred within the 10-week period.

While the pitfall trap samples did not substantiate any differences in the arthropod component of the different habitats, other studies have found grassy habitats to contain a higher abundance of arthropods (Healy and Nenno 1978, Hurst and Stringer 1975, and Martin and McGinnes 1975). Pitfall traps are designed to sample soil surface arthropods more efficiently than arthropods inhabiting vegetation which could account for the differences in results obtained by other workers who used other sampling techniques. Both groups of arthropods are available to the turkeys, but arthropods may be more abundant in the denser grasslands.

Turkeys in Iowa use agricultural openings and field-woodland edge instead of woodland openings. Other studies have documented this exchange of habitat use (Lewis 1964, Ellis and Lewis 1967, and Speake et al. 1975). The use of openings in Iowa appears to be much greater than has been reported elsewhere; however, the habitat is much more open also. Openings were used very extensively in Minnesota (Porter 1980) and the peak use of agricultural habitats occurred in the seventh week after hatching. This corresponds to the peak use seen in the 7-8 week period in this study.

While alfalfa hayfields were used extensively in Minnesota (Porter 1980), it appears that pastures are preferred in Iowa. Hayfields were available but not as abundant as pastures on the study area. Moreover, as the season progressed, use of pastures increased while use of hayfields decreased.

The physical structure of the flora in agricultural habitats, particularly pastures, appears well suited to brood raising. Grazing reduces the density of the vegetation and provides a greater variety of vegetative development stages ranging from closely cropped grass sod to clumps of grass and forbs of varying heights. Other workers have also found that moderate grazing is not necessarily a deterrent to turkey use (Hillestad and Speake 1970 and Dickson et al. 1978). Escape cover was supplied by cornfield strips in Minnesota (Porter 1980); however, the pastures on the study area in Iowa that were used by turkeys contained wooded drainages that provided adequate escape cover.

RECOMMENDATIONS

Based on observations of turkey behavior and information collected during this study, the following management recommendations can be made:

1. Recent experience with wild turkey restocking programs in Iowa has shown that large unbroken tracts of timber are not necessary for successful turkey management. Interspersion of cropland and timber appears to provide ideal habitat. It is difficult to assign sizes to either the minimum amount of timber required or to the patches of agricultural openings. Configurations of a timber stand may determine suitability more than the amount of timber involved. Current wild turkey stocking programs are including smaller and smaller blocks of timber and eventually a minimum size may be established. The size of agricultural openings within the timber may be determined more by what is economically attractive to farm or physically possible given the restraints imposed by terrain than by the requirements of turkeys. Ideally, at least 50% of good turkey habitat should be in timber.
2. For brood-rearing considerations the timber need only be upland pole stage; however, winter survival may be enhanced by older, mast producing timber with a variety of species.
3. A high percentage of openings should be in pasture or hay; however, any management plans should consider a balance to meet turkey needs at other times of the year.
4. Brood habitat can be in an area apart from that which supplies winter needs. Turkeys will move as far as 2 or 3 miles to areas that provide appropriate brood-rearing habitat.

5. Since openings represent such an important part of the habitat for turkey broods, they are exposed to human disturbance. Any management plans that reduce exposure to human activity will further optimize turkey habitat.

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APPENDIX

Table A.1. Species composition and stocking of 3 timber types on the study area. Common names follow the checklist of North American plants for wildlife biologists (Scott and Wasser 1980)

	Oak-Hickory Poletimber		Oak-Hickory Sawtimber		Lowland Timber	
	> 10 cm DBH	≤ 10 cm DBH	> 10 cm DBH	≤ 10 cm DBH	> 10 cm DBH	≤ 10 cm DBH
Trees/ha	610.8	563.4	375.2	372.0	422.1	660.8
Basal Area/ha (m^2)	20.8	1.6	19.5	0.6	19.4	1.1
Species	Percent Occurrence	Percent Occurrence	Percent Occurrence	Percent Occurrence	Percent Occurrence	Percent Occurrence
Shagbark Hickory	23.7	34.0	25.0	28.7	17.5	0.0
White Oak	23.0	6.5	42.9	13.4	1.3	0.0
Bur Oak	18.9	5.5	10.6	0.0	13.7	1.3
Northern Red Oak and Black Oak	17.3	3.8	13.1	4.4	12.5	0.0
American Elm	5.7	27.8	1.9	10.6	11.2	52.5
Bitternut Hickory	4.3	10.7	0.0	0.0	13.7	23.7
Pin Oak	1.9	0.0	0.0	0.0	0.0	0.0
Ash	1.3	4.5	1.3	0.0	1.3	0.0
White Basswood	0.7	3.0	0.0	3.1	5.0	1.3
Plum, Cherry	0.6	1.8	0.0	3.0	2.5	1.3

Table A.1. Continued

	Oak-Hickory Poletimber		Oak-Hickory Sawtimber		Lowland Timber	
	> 10 cm DBH	≤ 10 cm DBH	> 10 cm DBH	≤ 10 cm DBH	> 10 cm DBH	≤ 10 cm DBH
Trees/ha	610.8	563.4	375.2	372.0	422.1	660.8
Basal Area/ha (m^2)	20.8	1.6	19.5	0.6	19.4	1.1
Species	Percent Occurrence	Percent Occurrence	Percent Occurrence	Percent Occurrence	Percent Occurrence	Percent Occurrence
American Hophornbeam	0.5	8.2	0.0	0.0	0.0	0.0
Black Walnut	0.5	0.5	0.6	1.9	0.0	0.0
Hawthorn	0.3	0.8	0.0	0.0	0.0	1.3
Mulberry	0.3	0.0	0.0	0.0	0.0	0.0
Common Hackberry	0.3	5.7	0.6	0.6	21.2	13.7
Boxelder Maple	0.0	0.5	0.0	0.0	0.0	2.5
Ohio Buckeye	0.0	0.5	3.1	11.2	0.0	0.0
Dogwood	0.0	0.5	0.0	0.0	0.0	2.5
Eastern Juniper	0.0	0.0	0.6	0.0	0.0	0.0
Common Honey Locust	0.0	0.0	0.0	0.6	0.0	0.0
Number of Stands Sampled	5		2		1	