

STRUCTURAL ASPECTS OF THE BREEDING HABITAT OF
THREE OKLAHOMA SYMPATRIC FLYCATCHERS

By

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PREFACE

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TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
II. REVIEW OF LITERATURE	4
III. DESCRIPTION OF STUDY AREA	7
IV. MATERIALS AND METHODS	10
V. RESULTS	13
Tree Height	18
Tree Circumference Breast Height	18
Tree Distance	19
Sapling Height	19
Sapling Circumference Breast Height	19
Sapling Distance	20
Shrub Height	20
Shrub Distance	20
Vegetation Indicator Species	22
VI. DISCUSSION	25
Tree Characteristics	25
Sapling Characteristics	26
Shrub Characteristics	27
Indicator Species	28
Eastern Kingbird	29
Scissor-tailed Flycatcher	29
Western Kingbird	30
VII. SUMMARY	31
LITERATURE CITED	33
APPENDIX	35

LIST OF TABLES

Table	Page
I. Mean, Standard Deviation, Minimum Distance, and Maximum Distance of Non-vegetation Habitat Characteristics Measured in Meters	14
II. Mean, Standard Deviation, Minimum Distance, and Maximum Distance of Non-vegetation Habitat Characteristics Adjusted For Relative Comparisons in Meters	16
III. Individual Species' Means of Vegetation Habitat Characteristics	17
IV. Individual Species' Means of Vegetation Habitat Characteristics at Points One, Two, and Three	21
V. Percentage and Significance Value of Vegetation Indicator Species For Each Bird Species	23

LIST OF FIGURES

Figure	Page
1. Ranges of Eastern Kingbird, Western Kingbird, and Scissor-tailed Flycatcher	3
2. Oklahoma Counties	8

CHAPTER I

INTRODUCTION

Vegetational structural diversity is a major habitat factor affecting faunal community diversity (MacArthur and MacArthur 1961; Pianka 1966; Rosenzweig and Winakur 1969; Karr and Roth 1971; Murdoch et al 1972; and Wiens 1973, 1974). Horizontal variability or patchiness may be more important in determining bird species diversity than vertical heterogeneity (MacArthur et al. 1962). Individual species may react differently to patch dispersion within a habitat (Wiens 1969, 1974a, 1974b), and closely related species may utilize different variations of patches as one mechanism to partition habitats in areas of sympatry. The more closely related two species are, the more likely it is that they will have similar needs. Sympatric congeners, then, become logical subjects of study in inquiries on resource partitioning. Hespenehede (1964, p. 275) suggests that competition for space among species may occur on three levels: ". . . the geographic ranges of the species, the types of communities within a given geographical area, and the particular microhabitats within a given community." This study describes structural aspects of different types of communities used by geographically sympatric species.

The Scissor-tailed Flycatcher (Muscivora forficata), Eastern Kingbird (Tyrannus tyrannus), and Western Kingbird (T. verticalis) occur in structurally similar open habitats (Bent 1942) in north

central Oklahoma. The Scissor-tailed Flycatcher prefers open country, occurring in trees along the roadside and in open prairies dotted with small trees. The Western Kingbird prefers open country, ranches, and timber belts along the streams. The Eastern Kingbird lives in the open country, orchards, borders of fields and highways, open woodlands, and riparian habitat.

The Western Kingbird's breeding range extends into eastern Oklahoma, but it is more commonly found in western Oklahoma. The western edge of the breeding range of the Eastern Kingbird extends into western Oklahoma (Sutton 1967). The resulting area of overlap of ranges provides an opportunity to compare the horizontal variability in vegetation within the breeding habitat of two largely allopatric congeneric species in an area of sympatry. These two kingbirds are similar in foraging behavior and size (Western Kingbird's length is 7 in., Eastern Kingbird's length is 6 3/4 in.). Breeding range of the Scissor-tailed Flycatcher is limited to Texas, Oklahoma and southern Kansas, thus overlapping the breeding range of both kingbirds in Oklahoma (Figure 1). The flycatcher is similar in size to the kingbirds (except for its unusually long tail) and uses a similar foraging behavior (Smith 1966). As a result of the occurrence of an intergeneric hybrid (Davis and Webster 1970) and similar behavior it has been proposed by Smith that M. forficata be included in the genus Tyrannus.

The objectives of this investigation were to quantify and compare the structural characteristics of the woody vegetation within the breeding habitats of the Scissor-tailed Flycatcher, Eastern Kingbird, and Western Kingbird.

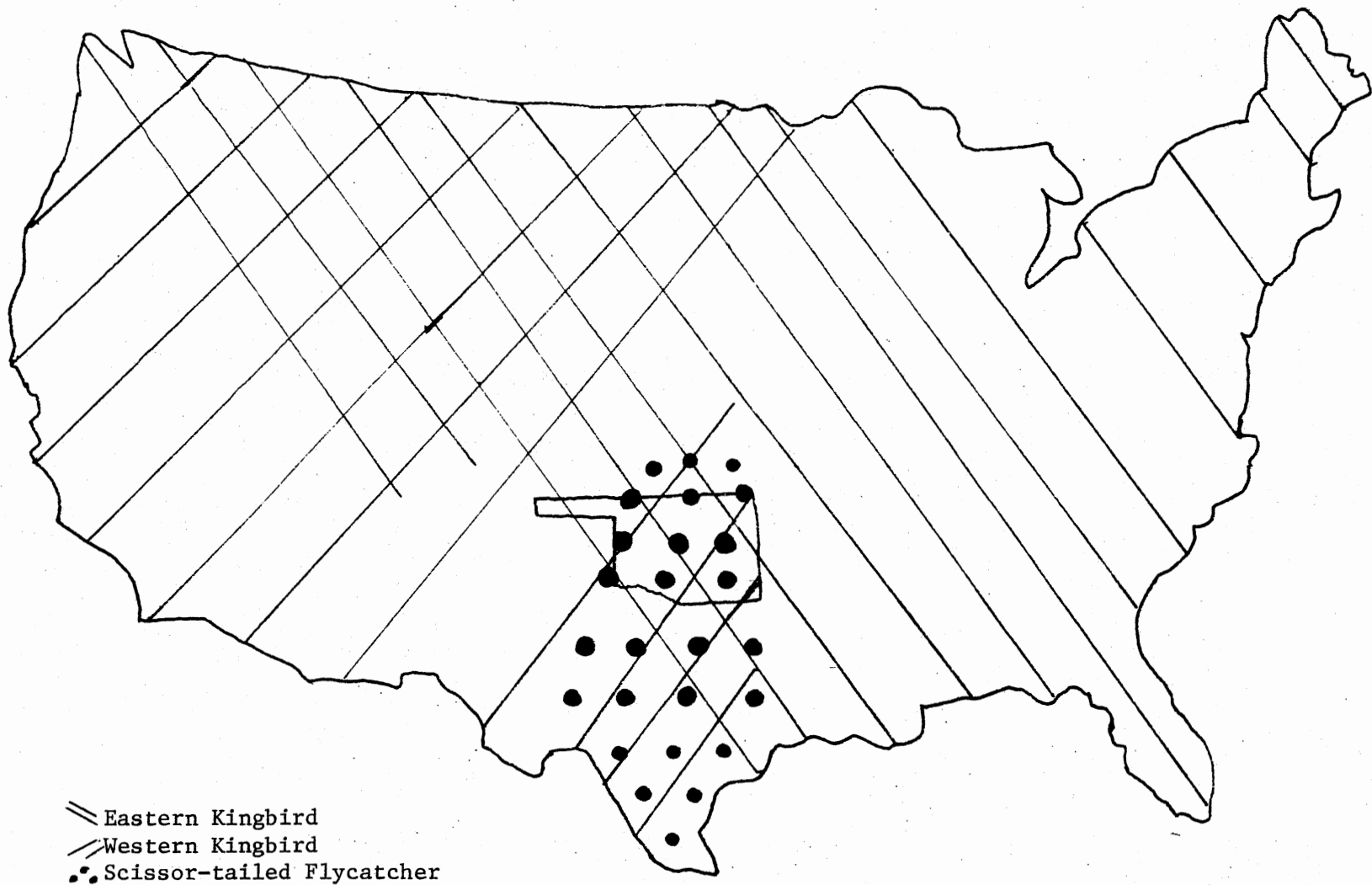


Figure 1. Ranges of Eastern Kingbird, Western Kingbird, and Scissor-tailed Flycatcher.

CHAPTER II

REVIEW OF LITERATURE

Ohlendorf (1974) studied resource partitioning in the Western Kingbird and Cassin's Kingbird (T. vociferans) in Texas. He found habitat variations in nesting areas based on elevation. T. vociferans was found predominantly in the pine-oak-juniper, grassland, and riparian habitats at elevations exceeding 1524 m. T. verticalis occurred alone at elevations less than 1067 m. in the desert shrub and farmland. The Western Kingbird utilized man-made structures to a greater extent than the Cassin's Kingbird. Ohlendorf found that the two species had similar diets. Diet overlap was 72.7 percent in families of insects and other prey taxa and 100 percent at the order level. In areas of sympatry there was no interspecific defense of feeding areas but nest sites were defended interspecifically, suggesting that nesting sites were the resource most limited in availability. Due to the altitudinal segregation of the kingbirds throughout most of the region, potential competition for nest sites appeared reduced.

Johnston (1971) found vertical stratification in nesting and feeding zone preferences and differences in vegetation densities used among deciduous forest flycatchers. He observed five geographically sympatric flycatchers, each from a different genus. The flycatchers exhibited a nearly perfect ordered sequence of size, bill length, territory size, and food size. The sequence was Eastern Kingbird,

Crested Flycatcher (Myiarchus crinitus), Eastern Phoebe (Sayornis phoebe), Eastern Wood Pewee (Contopus virens) and Least Flycatcher (Empidonax minimus).

Hespenheide (1964) found that nest site selection differences between Cassin's Kingbird and Western Kingbird in Arizona were related to vegetation types. Western Kingbirds were found nesting predominantly in desert localities. Most of the pairs of desert birds were found in riparian, roadside, and man-created habitats. Cassin's Kingbird nested wherever tall trees were available. Interspecific territoriality was not observed.

Beaver and Baldwin (1975) studied Hammond's Flycatcher (Empidonax hammondi), Western Flycatcher (E. difficilis) and the Western Wood Pewee (Contopus sordidulus) in southern Colorado, looking at habitat selection in relation to competition in areas of sympatry. They found each species had a slightly different habitat preference within the ranges of overlap. E. hammondi bred in aspen (Populus tremuloides) and coniferous forest. E. difficilis was found breeding in coniferous forests along streams. These species are similar in body size and foraging behavior. C. sordidulus bred in aspen forest. C. sordidulus is about 40 percent heavier than the E. hammondi, suggesting the possibility that competitive interactions were significantly reduced between these two species, even though both bred in aspen forest.

Hespenheide (1971) measured vertical and horizontal vegetation densities in the nesting habitat of the Least Flycatcher and the Acadian Flycatcher (E. virescens). The two species occur in similar deciduous forest habitat, but E. virescens was found to nest in denser habitat than E. minimus.

Fitch (1950) reported on the life history and ecology of the Scissor-tailed Flycatcher in Texas, but did not study breeding habitat.

No comparison of horizontal vegetational variability of breeding habitat had been made in Oklahoma for the three species presently studied.

CHAPTER III

DESCRIPTION OF STUDY AREA

The study area was in north-central Oklahoma in Payne and Noble counties (Figure 2). The area is a crosstimbers mosaic of tall grass prairie and post oak (Quercus stellata) and black jack oak (Q. marilandica) woodlands, locally converted to cultivation. Human habitation is sparse in the rural and farming areas. The large and diverse study area provided four main habitat types whose characteristics and vegetation are discussed below.

1. Pasture and cultivated field: The cultivated fields included wheat or hay with few or no trees. Pastures typically had man-made ponds (with few trees) to support the cattle, and the most commonly found tree was eastern red cedar (Juniperus virginiana). Various elms (Ulmus spp.) and hackberry (Celtis occidentalis) were also found. Common shrubs included sumac (Rhus spp.) and sand plum (Prunus angustifolia).

2. Riparian habitat: These areas contained numerous creeks, ponds and four impounded lakes (Boomer, Sanborn, Carl Blackwell and McMurtry). Trees common to this habitat were cottonwood (Populus deltoides), black willow (Salix nigra), pecan (Carya illinoensis), persimmon (Diospyros virginian), honeylocust (Gleditsia triacanthos), baldcypress (Taxodium distichum), and various oaks (Q. spp.). Common shrubs included buckbrush (Symphoricarpus orbiculatus), poison ivy

(Rhus radicans), and grape (Vitis spp.).

3. Roadside-edge: Many county roads and roadside habitats were included in the study. Trees found most commonly between roads and fences were various oaks and elms. The common shrubs were sumac, poison ivy, and sand plum.

4. Residential habitat: Residential habitat included Oklahoma State University campus, private houses, and park areas surrounding Boomer Lake. Most lawns were kept closely mowed and ornamental shrubs and trees were common. Among the scattered trees and saplings were redbud (Cercis canadensis), eastern red cedar, sycamore (Platanus occidentalis), pinoak (Q. palustris), elms, pines (Pinus spp.), magnolia (Magnolia spp.), and mimosa (Mimosa borealis). Shrubs were typically ornamentals.

CHAPTER IV

MATERIALS AND METHODS

Singing, displaying males of each species were located from April 21 until May 27, 1978. Advertising song is given by territorial males mainly during the breeding season and functions as a part of territory defense (Peek 1972). Therefore, the presence of singing males was used to identify areas being chosen as suitable breeding habitats. The flycatchers studied, along with several other bird species, take advantage of telephone wires and fences that run parallel to county section lines and serve as suitable perches both for displaying and foraging. For ease of searching a large area and obtaining a large sample size of different breeding sites of each species, most of the sightings were gathered from driving along section lines, beginning at dawn and continuing for several hours each day. Additional sightings were obtained from walking into fields and along lakes.

The location of each male was described in a field notebook, marked with red flagging material, and noted on a county highway map. Map locations were numbered in purple, red, and yellow for Eastern Kingbirds, Scissor-tailed Flycatchers, and Western Kingbirds, respectively. Qualitative observations of the area were made at this time, along with identification of nearest bird neighbor. A total of 100 Scissor-tailed Flycatchers, 68 Eastern Kingbirds and 32 Western Kingbirds were sighted.

On June 23 vegetational analyses began, using 25 sample areas for each species. The sites were randomly chosen from the possible locations. The author returned to the area of sighting, which became the focal point for a sampling of the habitat using a modification of the point-centered quarter technique (Cottam and Curtis 1956). A wooden stake with an attached 50 meter transect line was secured at the point of sighting. Three transect lines were used, radiating from the location of each displaying male. The first line's direction was determined by a randomly selected compass bearing. The following two lines were oriented at 120° intervals. Three sampling points on each line were located at 10, 25, and 50 meters, respectively. The area around each sample point was divided into four equal parts or quadrants by using the transect line and a second imaginary line perpendicular to the transect line at the sampling point.

Vegetation was categorized by growth forms: tree, sapling and shrub. The plant representing each growth form nearest the sample point in each quadrant was located and the following characteristics were recorded on data sheets: point to plant distance, height, circumference breast height (CBH), and species. Distance was measured to the center of the shrubs, trees and saplings. A sapling was considered to have a CBH of 7 cm or less. Distance to and compass orientation of water, telephone or fence wires, and buildings were also recorded, when present within 500 m. The information gathered was utilized to indicate relative dispersion of each growth form and provide an index of horizontal patchiness within the habitat (Roth 1976).

Field data were transferred onto computer cards for statistical analyses using the Statistical Analysis System (Barr et al. 1976).

The data from points on all transect lines were compared intraspecifically, using the means for each category of measurement (e.g., tree ht, tree CBH, tree distance). A mean value for each measurement category was obtained for each bird species. Interspecific comparisons were then made utilizing the means for compiling Analysis of Variance Tables to identify significant differences between species for each category. Chi-square tables were constructed for each species of tree, sapling, and shrub to see if there existed any patterns in the distribution of each vegetation species relative to the distance from the bird. Also the vegetation species Chi-square table data were used to determine tree, sapling and shrub indicator species for each bird species' habitat.

CHAPTER V

RESULTS

Table I lists the means, standard deviations, minimum and maximum values for the distance to non-vegetation variables measured. The values for each different species are given separately. The four variables--distance to water, buildings, phone wire, and fence wire--were not always present for each of the 75 birds studied. The table presents summary statistics only for those data points where the variable occurred within 500 m. of the location of the bird. No variable occurred within 500 m. for all of the birds sampled.

As the table indicates, 23 of 25 Eastern Kingbirds were found near water. The distances ranged from 1-350 m. with an average of 74.78 m. Fifteen of 25 Eastern Kingbirds were located near buildings. The mean distance to buildings, however, was greater--147.17 m. The majority of the buildings were farm houses.

The 20 sightings of Scissor-tailed Flycatchers near buildings were also on farm land associated with accompanying farm houses and out-buildings. Presence of water does not appear as important a habitat characteristic to the Scissor-tailed Flycatchers as it is to the Eastern Kingbirds, since only 9 of the 25 studied were found near water. It is possible that a pond or stream was present nearby some of the sample areas, but this seems unlikely, since the land was flat and open and binoculars were used to extend viewing distances.

TABLE I
 MEAN, STANDARD DEVIATION, MINIMUM DISTANCE, AND MAXIMUM DISTANCE
 OF NON-VEGETATION HABITAT CHARACTERISTICS
 MEASURED IN METERS

Species	Variable	N*	Mean	Standard Deviation	Minimum Distance	Maximum Distance
Eastern Kingbird	Water distance	23	74.78	95.42	1.00	350.00
	Building distance	15	147.17	138.47	.55	500.00
	Phone wire distance	16	28.12	26.08	0.00	95.00
	Fence wire distance	12	32.12	78.18	0.00	275.00
Scissor-tailed Fly-catcher	Water distance	9	105.69	106.83	1.00	310.00
	Building distance	20	106.17	82.14	1.00	300.00
	Phone wire distance	18	20.47	31.13	0.00	130.00
	Fence wire distance	17	1.79	5.19	0.00	21.00
Western Kingbird	Water distance	12	64.67	36.92	5.00	120.00
	Building distance	24	37.75	27.41	6.00	121.00
	Phone wire distance	12	33.75	34.12	0.00	100.00
	Fence wire distance	0	-	-	-	-

*Indicates how many birds sampled of each species had the variable within 500 m. of their location.

Of the Western Kingbirds studied, 24 of 25 were found near buildings, with a range of distance from 6 to 121 m. The buildings were usually Oklahoma State University campus structures, home in residential areas, or shelters and restrooms at Boomer Lake and Lake Carl Blackwell. Almost half (12 of 25) of the Western Kingbirds studied occurred near water. The water sources were Boomer Lake and Lake Carl Blackwell. Water does not appear as important to the Western Kingbird as it is to the Eastern Kingbird for determining suitable breeding habitat.

To facilitate comparison of the two Tyrannus the data from Table I was used to construct Table II. Table II lists the same variables as Table I, but the N value has been changed to 25 for each variable. The means were adjusted by using the following formula:

$$\frac{N_1(501) + N_2(\bar{X})}{N}$$

N_1 is the number of birds that did not have that variable present within 500 m, N_2 is the N value and \bar{X} is the mean from the original data (Table I), and N is 25. This permits relative comparisons of mean distances among the flycatchers. Significant differences of the adjusted means using the Student's t test show the relative importance of water to the Eastern Kingbird as opposed to the Scissor-tailed Flycatcher ($t=3.632; P<.01$) and Western Kingbird ($t=2.447; P<.05$). Relative importance of buildings to Western Kingbirds is illustrated in comparison to Scissor-tailed Flycatchers ($t=2.36; P<.05$) and Eastern Kingbirds ($t=3.84; P<.01$).

Table III lists the means of each vegetation variable recorded for each of the three bird species' habitat. For each variable, e.g., tree height, tree CBH, tree distance, the mean is calculated from 900

TABLE II

MEAN, STANDARD DEVIATION, MINIMUM DISTANCE, AND MAXIMUM DISTANCE OF
NON-VEGETATION HABITAT CHARACTERISTICS ADJUSTED FOR
RELATIVE COMPARISONS IN METERS

Species	Variable	N	Mean	Standard Deviation	Minimum Distance	Maximum Distance
Eastern Kingbird	Water distance	25	108.88	149.24	1.00	501.00
	Building distance	25	288.70	206.11	.55	501.00
	Phone wire distance	25	198.36	232.58	0.00	501.00
	Fence wire distance	25	275.94	244.87	0.00	501.00
Scissor- tailed Fly- catcher	Water distance	25	358.69	195.90	1.00	501.00
	Building distance	25	185.14	176.95	1.00	501.00
	Phone wire distance	25	155.02	222.28	0.00	501.00
	Fence wire distance	25	161.54	237.71	0.00	501.00
Western Kingbird	Water distance	25	291.56	223.89	5.00	501.00
	Building distance	25	56.28	96.46	6.00	501.00
	Phone wire distance	25	276.72	239.37	0.00	501.00
	Fence wire distance	25	501.00	0.00	-	501.00

TABLE III

INDIVIDUAL SPECIES' MEANS OF VEGETATION HABITAT CHARACTERISTICS

Species	Tree Height	Tree CBH*	Tree Distance	Sapling Height	Sapling CBH*	Sapling Distance	Shrub Height	Shrub Distance
Eastern King-bird	8.43	69.87	27.22	2.05	4.20	19.05	1.15	20.21
Scissor-tailed Fly-catcher	7.13	55.50	79.76	1.82	3.79	47.99	1.26	45.52
Western King-bird	7.34	63.08	31.62	2.28	5.01	71.28	1.41	43.69

*Measurements in centimeters; all others in meters

measurements. The results of the Analysis of Variance (AOV) tests using the means given in Table III gave significant differences in each of the data categories, as follows.

Tree Height (THT)

Tree height was highly significant among species ($F = 39.50$; $P < .0001$). The value of the least significant difference (LSD) for the .01 level was .40431 m. By comparing the differences of the mean values (given in Table III) of tree height for each species to the LSD, the tree height for the Eastern Kingbird exhibits a significant difference from that of both the Scissor-tailed Flycatcher and Western Kingbird. The tree heights associated with the Western Kingbird and Scissor-tailed Flycatcher, however, were not significantly different at the .05 level. Data on the average height of trees associated with each bird species show that the Eastern Kingbirds were found most often in the tallest trees.

Tree Circumference Breast Height (TCBH)

The tree CBH was highly significant among species ($F = 30.13$; $P < .0001$). Tree CBH for each bird species was significantly different when compared to each of the other two bird species.

Eastern Kingbirds were commonly found with trees of the largest mean CBH. Scissor-tailed Flycatchers were associated with trees with the smallest CBH, and Western Kingbirds predominated among trees of a relatively intermediate CBH.

Tree Distance (TD)

The mean values for tree distance were highly significant at the .0001 level ($F = 279.11$). Scissor-tailed Flycatchers' mean distance to trees was significantly different from both the Eastern Kingbirds' and Western Kingbirds'. The TD mean values for the two Tyrannus were not significant from each other at the .05 level of probability. Scissor-tailed Flycatchers were associated most often with large distances to trees.

Sapling Height (SHT)

Differences in height of saplings were highly significant among species ($F = 104.93$; $P < .0001$). SHT was significantly different for all species comparisons.

The mean values of Table III show the Eastern Kingbird associated with saplings of a relatively medium height, the Scissor-tailed Flycatcher most frequently with saplings of the shortest height, and the Western Kingbird with saplings of the greatest height.

Sapling Circumference Breast Height (SCBH)

Sapling CBH was highly significant among species ($F = 145.84$; $P < .0001$). Again, SCBH for each bird species showed a significant difference from that of the other two species.

Eastern Kingbirds occurred most often with saplings of an intermediate CBH, Scissor-tailed Flycatchers with the smallest CBH saplings, and Western Kingbirds with saplings of the largest CBH.

Sapling Distance (SD)

The distance to saplings was highly significant among species ($F = 140.30$; $P < .0001$) and each of the three species proved to be significantly different from each of the other species.

Eastern Kingbirds were found in areas with the shortest distance to saplings, Scissor-tailed Flycatchers in areas with an intermediate distance to saplings, and Western Kingbirds in areas with the greatest distance to saplings.

Shrub Height (SHHT)

Shrub height was highly significant among species ($F = 54.03$; $P < .0001$), and each species was significantly different from the other two species.

The Eastern Kingbirds were found most often in areas of low shrubs, Scissor-tailed Flycatchers with shrubs of an intermediate height, and Western Kingbirds with taller shrubs.

Shrub Distance (SHD)

Shrub distance was highly significant among species ($F = 67.77$; $P < .0001$). The mean value for Eastern Kingbirds' SHD was significantly different from those of both other species. Scissor-tailed Flycatchers' and Western Kingbirds' SHD were not significant to each other at the .05 level. Eastern Kingbirds most often had shrubs close to them.

Table IV lists the means for each variable measured, separating each species' means into the sample points 1, 2, and 3, representing 10, 25, and 50 m. on the transect lines, respectively. Height of trees

TABLE IV
 INDIVIDUAL SPECIES' MEANS OF VEGETATION HABITAT CHARACTERISTICS
 AT POINTS ONE, TWO, AND THREE

Species	Point	Tree Height	Tree CBH*	Tree Distance	Sapling Height	Sapling CBH*	Sapling Distance	Shrub Height	Shrub Distance
Eastern Kingbird	1	8.66	69.83	24.52	2.01	4.29	19.25	1.18	17.66
	2	8.44	69.07	27.45	2.04	4.12	18.75	1.16	19.34
	3	8.20	70.74	29.71	2.09	4.19	19.17	1.12	23.63
Scissor-tailed Fly-catcher	1	7.15	54.90	74.12	1.80	3.75	47.96	1.26	39.86
	2	7.15	56.53	81.27	1.81	3.76	45.30	1.27	45.28
	3	7.11	55.08	83.91	1.85	3.84	50.73	1.25	51.60
Western Kingbird	1	7.26	63.88	30.86	2.27	5.06	71.75	1.38	41.01
	2	7.60	64.17	30.27	2.29	5.02	70.68	1.41	45.22
	3	7.16	61.19	33.75	2.27	4.93	71.41	1.44	44.87

*Measurements in centimeters; all others in meters

and shrubs becomes smaller and distance to trees and shrubs becomes greater as distance from point of sighting of Eastern Kingbird increases. Distance to trees and shrubs, and CBH of trees and saplings become greater as distance from Scissor-tailed Flycatcher increases. Height of shrubs increases and CBH of saplings decreases as distance to Western Kingbird increases.

Vegetation Indicator Species

Results of the Chi-square analysis indicated no statistical difference in the frequency of occurrence of various tree species between the three different distances on the transect lines within each species. Using the Chi-square test results, potential "indicator species" of tree, sapling and shrub were identified for the different bird species (Table V). When representatives of a plant species were present for each of the three bird species, a χ^2 probability level was determined by using the following formula:

$$\chi^2 = \left(\frac{3\sum n_1^2}{n} - n \right).$$

Significance was tested at the .05 level ($\chi^2 \geq 5.99147$). For plant species that were found in two of the bird species' habitats the .05 probability level was determined by using the following formula:

$$Z = \frac{n_1 - n_2}{\sqrt{\frac{2}{n}(n_1 + n_2)}}.$$

A value of $Z \geq 1.96$ was necessary for significance.

Table V lists the plant species that could be considered indicators, or preferences, for the three different bird species. The percentage of each plant species that was found with the corresponding flycatcher

TABLE V
 PERCENTAGE AND SIGNIFICANCE VALUE OF VEGETATION INDICATOR
 SPECIES FOR EACH BIRD SPECIES

Eastern Kingbird	Scissor-tailed Flycatcher	Western Kingbird
<u>Tree</u>	<u>Tree</u>	<u>Tree</u>
Willow 73.64% $X^2=188.65$	Elm 41.78% $X^2=34.45$	Sycamore 84.09% $X^2=5.86$
Cottonwood 54.69% $X^2=13.34$	Cedar 43.30% $X^2=10.08$	Magnolia 100% Mimosa 71.43% Z=1.13 Pine 90.52% $X^2=341.80$
<u>Sapling</u>	<u>Sapling</u>	<u>Sapling</u>
Oak 61.45% $X^2=60.34$	Cedar 73.85% Z=12.37	Cypress 69.70% Z=2.26
Willow 65.75% $X^2=111.97$		Sycamore 70.37% $X^2=34.33$
Cottonwood 80.49% Z=3.90		Magnolia 96.77% Z=5.71
<u>Shrub</u>	<u>Shrub</u>	<u>Shrub</u>
Buckbrush 37.71 $X^2=12.95$	Poison ivy 46.88% $X^2=6.44$	Ornamental 99.28%
	Sumac 48.61% $X^2=286.51$	

is indicated by the percentage values. Indicator species become useful as a means of depicting a certain habitat that is in some way preferred by each of the bird species, but does not imply that the birds are "choosing" the vegetation by species. The possible significance of these indicator species is discussed in the following chapter. The appendix contains illustrations of the relative importance of the vegetation indicator species for each of the birds' habitat. The drawings were created from significance values in Table V.

CHAPTER VI

DISCUSSION

Tree Characteristics

Eastern Kingbirds preferred larger trees, both in height and CBH. Also, they preferred to be near areas where trees were in a stand close together. The cluster of trees often open to a clearing in which the trees were more scattered as one travels farther from the location where the bird was sighted. The pattern of larger trees found closer to the sighting point of the Eastern Kingbird and the increased distance to trees as distance from the bird increases can be seen in Table IV.

Eastern Kingbirds were most often found near water, as Table I indicates. The trees found near streams, ponds and lakes tend to be larger and in denser clusters than trees away from water. Whether the Eastern Kingbirds actually preferred the presence of water or the presence of many large trees in their breeding habitat cannot be answered by this study.

Scissor-tailed Flycatchers were found most often among trees small in CBH. Distance from the bird to trees was the greatest of the three species studied, indicating their presence in open areas with few scattered trees. Often they were sighted on fence wires, where the nearest trees were small and growing in the roadside-edge habitat.

The surrounding area was often open pasture or fields with trees occurring at opposite ends of the acreage. If trees were present in the pastures, they were typically cedar trees of small size.

Trees found in Western Kingbird breeding habitat were intermediate in CBH, when compared with the two extremes of Eastern Kingbird and Scissor-tailed Flycatcher habitats. In the residential area around Boomer Lake and the OSU campus the trees usually were not growing in clusters, but spaced around buildings to provide a decorative effect and shade. Few of the trees were large.

Sapling Characteristics

When considering the sapling data, one must bear in mind that the Western Kingbirds in the study area were found most often near human habitation. The park and residential areas surrounding Boomer Lake and the Oklahoma State University campus, where the majority of the Western Kingbird observations occurred, are part of a human manipulated and intensively maintained environment. The young trees in this category are well tended and strategically planted. Often the saplings recorded were nearly 7 centimeters in CBH, which was the maximum CBH for saplings with an accompanying large height. The saplings were widely spaced in the residential environment. Any naturally occurring saplings are usually destroyed when lawns are mowed.

Saplings in the Eastern Kingbird and Scissor-tailed Flycatcher breeding habitat would be naturally occurring young trees. In the riparian or pond habitat of the Eastern Kingbird effects of competition and crowding by mature trees and other saplings would tend to produce trees smaller in CBH and height than those found in the Western King-

bird habitat. The shortest distance to saplings was found in the Eastern Kingbird habitat, which is consistent with the data that this species is sighted nearest to trees.

Scissor-tailed Flycatchers were found in areas with saplings smallest in CBH and height. Cedar saplings were the small trees found most often near Scissor-tailed Flycatchers (see Table V). Cedars can be very small and numerous, scattered throughout pastures and open areas. The distances to the many scattered saplings were larger than the distances from Eastern Kingbirds to saplings, but smaller than in the human-maintained environment of the Western Kingbirds.

Shrub Characteristics

In the habitat of the Eastern Kingbirds (which usually includes a close stand of trees) competition could prevent shrubs from attaining large heights. Shrubs typically were found growing among trees, thus the short distance from bird to shrub and bird to tree are consistent.

The relatively open habitat of the Scissor-tailed Flycatchers has few shrubs, so the distance is great from bird to shrub. Shrubs in the open are not in competition with other woody plants and attain a larger height.

The relatively large height of shrubs in Western Kingbird habitat results from human maintenance, since they are usually planted as ornamentals and encouraged to grow to a large height. Shrubs were not clumped, as in the Eastern Kingbird environment, because of their arrangement for decorative purposes around buildings. Any naturally occurring shrub would likely be destroyed in the maintenance of lawns.

When data from each of the three species was used to compare mean

values at the three different points, or distances, along transect lines, shrub distance was the only category in which a significant difference occurred among points at the .05 level. The statistically significant difference in distance occurred between point 1 and point 3. At point 1 the point-to-plant distance to shrubs was smaller than at point 3. Thus, among all the birds studied, the shrubs tended to be concentrated nearer the bird. As one travels to 50 m. beyond the point of sighting of a bird shrubs are found at a greater distance. This could be explained by looking at each species' habitat separately. Shrubs commonly were found growing along fences in the roadside habitat. Scissor-tailed Flycatchers were usually found on fence or telephone wires at the edge of pastures with shrubs nearby, but the open pastures had few scattered shrubs, as discussed on page 29. Eastern Kingbirds also were found on fence and telephone wires with shrubs growing along the fence rows but scattered in the open fields. Easterns were often sighted in trees, and shrubs were commonly associated with the trees (pp. 27, 29). The Western Kingbirds were often sighted in trees in a residential habitat with shrubs growing nearby. Due to maintaining lawns and play areas shrubs were scattered at large distances from the bird (p. 27).

Indicator Species

The indicator species listed in Table V provide additional information of the breeding habitat characteristics for the three flycatchers. (The utility of indicator species was discussed on page 24.)

Eastern Kingbird

Willow and cottonwood trees and saplings were most common in the breeding habitat of the Eastern Kingbirds, which usually were found associated with water--either streams, lakes or ponds. In the study area the trees most abundant near a water source were willows and cottonwoods, with oak saplings also common. A further characteristic of Eastern Kingbird habitats is the absence of nearby human habitation. Oaks are very common species found in the natural woods of the study area, but they are not used as often in residential planting, hence the absence of oaks as indicators of Western Kingbird habitat. Scissor-tailed Flycatcher habitats also include fewer oaks and oak saplings, which may not survive the effects of grazing in the open pastures associated with that species.

Buckbrush is the shrub most often found near the Eastern Kingbird. The denser woodland associated with the Eastern Kingbird habitat provides suitable growing habitat for buckbrush.

Scissor-tailed Flycatcher

Scattered elm and cedar trees and saplings characterize the Scissor-tailed Flycatcher open pastureland breeding habitat. The young cedar is often the only kind of sapling to be found in pastures and open fields.

Poison ivy and sumac common in roadside-edge habitat occurred most often with the Scissor-tailed Flycatcher. Scissor-tails were usually sighted on fence or telephone wires on section-line roads. Few shrubs actually grow within the pastures, due to grazing pressure.

Western Kingbird

The array of Western Kingbird indicator plant species can be explained by the fact that in this study most westerns were found in residential habitats where introduced ornamentals and only the most desirable native species constitute the vegetation. Magnolia and mimosa are ornamental trees around houses and on the Oklahoma State University campus. The conifer group designated as pine were almost exclusively found on campus. Sycamore trees and saplings and cypress saplings were most common in the park surrounding Boomer Lake. Boomer Lake is located in a residential area, which probably explains why more Western Kingbird sites were located there than Eastern Kingbird sites. The eastern preferred lakes farther away from human dwellings. It is interesting to note that in western Oklahoma, where the Eastern Kingbirds are not as prevalent as in Payne County, the Western Kingbirds also may be found in the riparian habitat associated with Eastern Kingbirds in this area (Helen Miller, pers. comm.). According to Bent (1942) in southwestern Saskatchewan the Western Kingbird's breeding habitat occurs at times in trees along streams, but the species is not found as frequently in the riparian habitat as the Eastern Kingbird. Instead, the Western Kingbird is more commonly found around ranch buildings and railroad stations. In Minnesota the Western Kingbird avoids the natural groves of timber and instead seeks the vicinity of habitations and is commonly found in towns.

CHAPTER VII

SUMMARY

1. Displaying Scissor-tailed Flycatcher, Eastern Kingbird, and Western Kingbird males were located during April and May, 1978. A vegetation analysis of the breeding habitat of 25 individuals of each species was conducted June through August, 1978.
2. The data gathered for the analysis was used to determine vegetational heterogeneity of each species' habitat. Characteristics studied were the height, CBH, distance to, and species of tree and sapling, and height, distance to and species of shrub, using a modification of the point-centered quarter technique. Distance to and compass orientation to water, buildings, phone and fence wires were also recorded when present.
3. Each variable studied was statistically significant between at least two of the bird species. Most variables were significant among all three species.
4. The habitat of the Eastern Kingbird can be described from this study as riparian, with the bird found near a cluster of large trees which open to clearings as distance from the bird increases. Intermediate size saplings and small shrubs are found close to the birds.
5. Scissor-tailed Flycatcher habitat can best be described as prairie edge adjacent to open pastures or fields with a few scattered small

trees. Saplings present are small and scattered. Shrubs are intermediate in size and few in number.

6. Breeding habitat of the Western Kingbird can be described as containing trees of intermediate height and CBH associated with buildings. The saplings present are large, widely scattered ornamentals. Shrubs are also ornamentals and large in size.
7. The three species studied are in an area of geographic sympatry but differ in structural aspects of habitat type used. Ability to successfully partition resources based on differential habitat preference would reduce competition among the species.

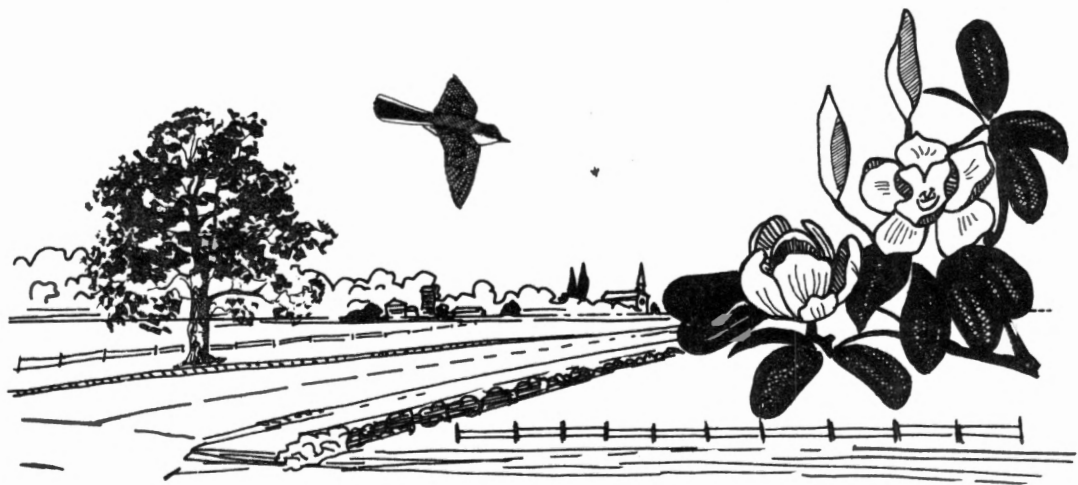
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APPENDIX

STRUCTURAL ASPECTS AND VEGETATION INDICATOR SPECIES
OF SCISSOR-TAILED FLYCATCHER, EASTERN KINGBIRD,
AND WESTERN KINGBIRD



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