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ASSOCIATION OF SCISSOR-TAILED FLYCATCHERS (*TYRANNUS FORFICATUS*) WITH SPECIFIC LAND-COVER TYPES IN SOUTH-CENTRAL TEXAS

ERIN E. FEICHTINGER[1,3] AND JOSEPH A. VEECH[2]

ABSTRACT.—Scissor-tailed Flycatchers (*Tyrannus forficatus*) are insectivorous Neotropical migrants that breed in the south-central United States. We examined their fine-scale (circles 300 m in radius centered on observed flycatcher locations) associations with different land cover types in south-central Texas. Scissor-tailed Flycatchers use a sit-and-scan foraging strategy; therefore, we expected the species would be positively associated with open land cover types (vegetation with little or no canopy) such as grassland, pasture/hayfield and cropland, and negatively associated with forest and shrubland given that the latter could obstruct visual scanning. We conducted 44 surveys from 9 May 2011 to 15 December 2011 by slowly driving (30 km/h) rural roads throughout 15 counties in south-central Texas and 3 near the coast of the Gulf of Mexico. Using ArcGIS, we quantified the percent cover of four general land cover types (urban/developed land, forest/shrub, grassland/pasture/hay, and cropland) within 300 m of each flycatcher location. Statistical analysis involved comparing the land cover of the flycatcher locations to a set of random points along the same routes. On average, flycatcher locations had significantly more grassland/pasture/hay than did random points (38.8 vs. 31.2%) and significantly less forest/shrub (29.9 vs. 36.7%). Therefore, although flycatchers may associate with open land cover at a rate greater than its overall availability, they generally occupy locations that have a mix of open and closed land cover. Knowledge of flycatcher habitat use at a fine-scale could be useful to the successful conservation of this species. *Received 4 June 2012. Accepted 24 October 2012.*

Key words: bird habitat, National Land Cover Database, North American Breeding Bird Survey, remote sensing, *Tyrannus forficatus*.

Scissor-tailed Flycatchers (*Tyrannus forficatus*) are Neotropical migrants that breed throughout the south-central United States with the highest breeding densities in southern Oklahoma and northern Texas, corresponding to the core of the breeding range (Fitch 1950, Regosin 1998). In their breeding range, they occupy open areas that provide adequate hunting perches and nesting sites including savannahs, prairies, brush patches, agricultural fields and pastures (e.g., Nolte and Fulbright 1996, Regosin 1998). Scissor-tailed Flycatchers require trees for nesting and hunting perches to support their foraging strategy given that they are sit-and-scan foragers that utilize perches such as shrubs, trees, utility wires and fences, while they scan for insect prey (Fitch 1950, Regosin 1998). Most prey are captured in the air a short distance from the perch (Fitch 1950) which further indicates the need for open habitat to facilitate foraging.

Although common wisdom is that Scissor-tailed Flycatchers require open habitats, there are few studies that have quantitatively examined habitat associations, particularly at spatial scales of territories or the land area potentially used by an individual in the course of a day. Nolte and Fulbright (1996) studied the vegetative characteristics of nest sites and found that honey mesquite (*Prosopis glandulosa*) was the tree species selected most often (92% of nests) and selected shrubs were on average taller and farther away from other shrubs or trees than random points (Nolte and Fulbright 1996). These results suggest that areas with scattered woody vegetation (shrubs or trees) are suitable habitats for Scissor-tailed Flycatchers, but Nolte and Fulbright (1996) did not examine the habitat associations at a scale beyond the nest site. Using a multi-scale approach, Brennan and Schnell (2007) found that Scissor-tailed Flycatchers were significantly more abundant in landscapes (linear transects 0.8–40.2 km in length and 2.4 km wide) with a mix of ''open country and closed forest'' than in landscapes comprised mostly of either of these two general cover types.

We chose to quantify land cover composition at a small spatial extent (300 m radius circles centered on observed flycatcher locations) given that associations with land cover types at this scale are not well documented for Scissor-tailed Flycatchers, other than Brennan and Schnell

[1] Department of Integrative Biology, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL 33620, USA.
[2] Department of Biology, Texas State University, 601 University Drive, San Marcos, TX 78666, USA.
[3] Corresponding author; e-mail: efeichtinger@usf.edu

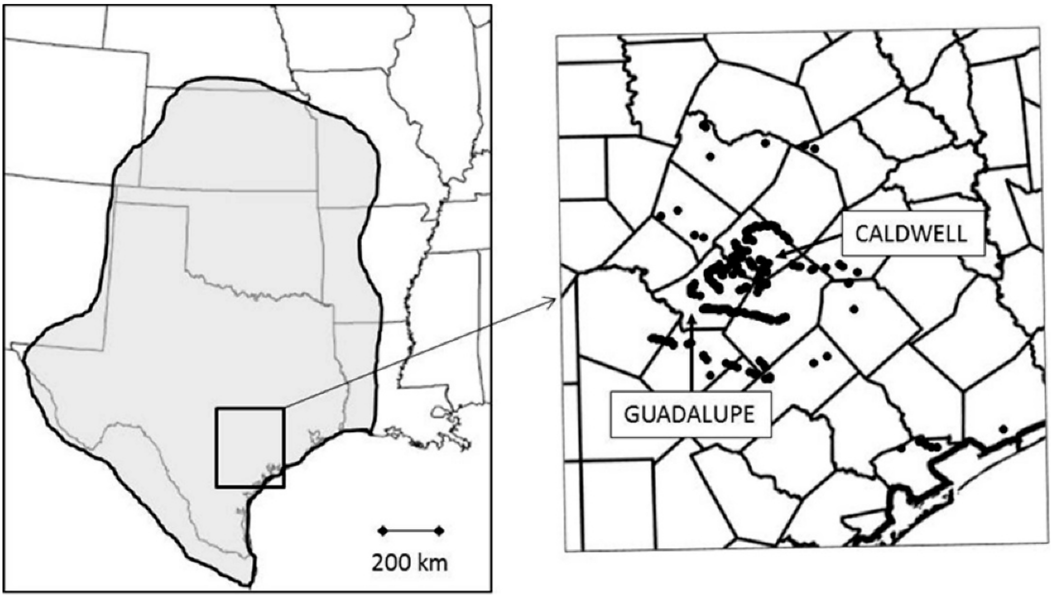

FIG. 1. Breeding range (gray shaded area) of Scissor-tailed Flycatchers in south-central USA and northern Mexico. Area surveyed by the routes extended from the coast into central Texas. Map inset shows the locations of the 369 Scissor-tailed Flycatcher observations (with substantial overlap of points). The greatest numbers of observations were in Caldwell and Guadalupe counties.

(2007) who used data from the North American Breeding Bird Survey. Scissor-tailed Flycatchers are recognized by the U.S. federal government as a ''species of conservation concern'' throughout their breeding range (Bird Conservation Regions 19 and 21) (USFWS 2008). Analysis of data from the North American Breeding Bird Survey showed that Scissor-tailed Flycatchers were declining at a statistically significant rate of 0.6% per year in their entire breeding range from 1966–2008, with more severe declines (2.2% per year) from 2003–2008 (Ziolkowski et al. 2010). They experienced a general population crash during the mid-1970s but apparently recovered during the 1980s (Sauer 1990). Birds, such as Scissor-tailed Flycatchers, may respond to habitat structure at different spatial scales (landscape, territory, nest site) (Cody 1981, Brennan and Schnell 2007) and knowledge of the distribution, characteristics, and spatial arrangement of required habitats is essential for species conservation (Winter et al. 2005, Brambilla et al. 2009, Ribic et al. 2009).

The objective of this study was to examine the fine-scale associations of Scissor-tailed Flycatchers with specific land cover types in south-central Texas. We predicted that flycatchers would be positively associated with ''open-habitat'' land cover types such as grassland, pasture, and cropland, and negatively associated with closed-canopy cover types such as forest and shrubland.

METHODS

Our survey protocol was designed to locate individual birds in a time-efficient way while also allowing the surveying of broad geographic areas. We conducted 44 surveys between 9 May 2011 and 15 December 2011 along rural roads throughout 15 counties in central Texas (Fig. 1). We used 10 Breeding Bird Survey (BBS) routes including Indianola (83013), Muldoon (83026), Lockhart (83027), Lone Oak (83029), Walburg (83139), Dripping Springs (83140), Leander (83238), Oyster Lake (83306), Yoakum (83314), and Creedmore (83324), all of which were the standard 39.2 km length typical of BBS routes. Similar to the BBS routes, the other 17 routes were also along rural roads, but had lengths of 12.8–88.3 km. In this study, routes were considered only as convenient ways to implement the surveying protocol (see below) to get thorough coverage of the study region (Fig. 1). Prior to surveying, the routes were ''scouted'' by viewing ground-level images from Google Earth and sometimes by driving all or part of the route. This was done to ensure that the route was suitable for surveying in the sense of having perching structures (utility wires, barbed wire fences) along most (> 90%) of its length. The entire route did not have to be characterized as open countryside; not, some routes had wooded areas but at least part of each route included cover types such as grassland, pasture, and shrubland. Four of the routes (Creedmore, Lockhart, Luling, and Gonzales) were surveyed on four different occasions (about 1 month apart) to test for temporal differences in land cover association during the course of the summer. Because of time constraints, we could not resurvey all the routes.

We drove each route at low speeds (30 km/hr) while an observer and the driver scanned the roadside perching structures and vegetation for perched birds or birds flying and/or hovering near the road. This continual-driving protocol of surveying birds has been used previously (e.g., Gawlik and Bildstein 1993, Esley and Bollinger 2001). We scanned the structures closest to the road and other structures within 100 m of the vehicle. Birds detected within 100 m of the road were counted (most were very near the road). This included birds that were perched, flying, hovering or on the ground near the road. When a Scissor-tailed Flycatcher was detected, we parked the vehicle within 30 m of the bird's location and recorded the time and GPS coordinates. Some observations of flycatchers included multiple individuals (2–8) at the same location (within 50 m) and sometimes interacting with one another. For statistical analyses, these were considered as one observation given that the flycatchers were obviously not acting or being observed independently of one another.

We mapped all survey routes on Google Earth, and then we chose random points along each route to compare to the observed locations of flycatchers. The number of random points selected for each route was equal to the number of observations recorded for the route. The random points facilitated testing whether flycatchers associate with certain land cover types either more or less than expected based on their availability (to be selected by flycatchers) on the broader landscape. We entered the coordinates for all observations and random points into ArcGIS 10.0 (ESRI, Redlands, CA, USA). Land cover data were obtained from the 2006 version of the National Land Cover Database (NLCD). Within the continental USA, the NLCD classifies land cover in 30 × 30 m pixels to one of 15 main land cover types. We used the ''Tabulate Area'' tool in ArcGIS 10.0 to quantify the proportions (or percent cover) of each of these land cover types in 300 m radius circular buffers surrounding each flycatcher observation and random point. We considered a 300-m radius circle (28.26 ha) to be the maximum area that a breeding pair of flycatchers could be using as a territory. At a study site in east-central Texas, Fitch (1950) reported minimum territory sizes of 6.07-ha per breeding pair. Land cover data were combined into the following broad categories (numbers in parentheses represent NLCD codes for the land cover types): urban/developed land (21–24), forest/shrub (41, 42, 43, 52), grassland/pasture/hay (71, 81), and cropland (82). The urban/developed cover types represent different intensities of ''urbanization'' that we combined into one cover type for our analyses. The three forest cover types were combined with shrubland because all four types have canopy cover > 20%, the only difference is in the height of the woody vegetation. In addition, a preliminary analysis revealed that the difference in shrub cover between flycatcher locations and random points was in the same direction and magnitude as the difference for forest; this further justified combining shrub and forest. Grassland and pasture/hay were combined because all represent areas of grass ground cover with very little (< 20%) woody vegetation.

For statistical analysis, the unit of replication was the observation of a single flycatcher (or occasionally multiple flycatchers) at a given location (along with the replicates representing random points). The first step in the statistical analysis involved conducting a one-factor multivariate analysis of variance (MANOVA) to test for a difference between the observed flycatcher locations and the random points for the land cover variables: percent cover of urban/developed land, forest/shrubland, and grassland/pasture/hay. These variables were normally-distributed (without any transformation) even though all three were percentage data. Cropland was not included in any statistical analyses because of a high percentage (64%) of zero values for the flycatcher locations and the random points. The MANOVA helped control for study-wide Type I error (incorrect rejection of a true null hypothesis) that can arise when many separate univariate statistical

TABLE 1. Results of the univariate ANOVAs testing for differences between locations where flycatchers were perched or flying and random points for the land cover variables quantified within 300 m buffer zones. Values in table are means with standard deviations in parentheses.

Land cover variable	Flycatcher locations	Random points	$F_{1,736}$	P
Urban/developed land (% cover)	16.5 (7.7)	18.5 (9.8)	8.83	0.003
Forest/shrubland (% cover)	29.9 (21.7)	36.7 (25.2)	15.25	<0.001
Grassland/pasture/hay (% cover)	38.8 (23.6)	31.2 (22.9)	19.53	<0.001

tests are applied to a suite of related variables (Quinn and Keough 2002). Obtaining significance in the MANOVA then warrants univariate significance testing.

Based on results of the MANOVA, we then performed four one-way analyses of variance (ANOVAs) on each land cover variable separately testing for a difference between flycatcher locations and random points. These analyses were conducted in R (www.r-project.org). To test whether flycatchers associate with different land cover types over time (beginning to end of summer), we used two-factor ANOVA with survey occasion (four levels) nested within route (four routes). The nested ANOVAs were conducted with the General Linear Model procedure in SYSTAT 12.

We also examined land-cover associations of Scissor-tailed Flycatchers at a landscape scale to compare to the patterns revealed at the fine scale and also to facilitate comparison to the results obtained by a previous study (Brennan and Schnell 2007). For each of the 10 BBS routes, we used ArcGIS 10.0 to quantify the percent cover of each of the four NLCD cover types (urban/developed, forest/shrub, grassland/pasture/hay, and cropland) within a 0.4 km buffer along both sides of the entire length of the route. Brennan and Schnell (2007) used a similar landscape size but a different land cover database. We then performed a separate regression on each cover type and the total number of flycatchers that we recorded on the route. Because the Creedmore and Lockhart routes were repeated four times, we used the average number of flycatchers recorded over all survey occasions. We also performed a regression for each cover type versus flycatcher abundance as recorded in the BBS data from 2011 and the five-year mean for the period 2007–2011. Three (Leander, Lockhart, and Oyster Lake) of the 10 routes were not surveyed in 2011 and are not included in the regressions based on 2011 BBS data.

RESULTS

We obtained 369 flycatcher observations; 272 (73.7%) of single individuals, 65 (17.6%) with two individuals, and 32 (8.7%) with three or more individuals. The MANOVA revealed a significant difference between the flycatcher locations and the random points (Pillai trace statistic = 0.043, $F_{4,733} = 8.15$, $P < 0.001$). The 300 m buffer zones centered on flycatcher locations had significantly less urban/developed land and forest/shrubland and significantly more grassland/pasture/hay than the buffer zones of random points (Table 1). There was about the same percentage of cropland at the flycatcher locations as at the random points (mean = 12.6, SD = 22.8; mean = 10.3, SD = 19.4, respectively).

There was no temporal effect on percent cover of urban/developed land, and percent cover of forest/shrubland in the 300 m buffer zones centered on flycatcher locations. However, there was a temporal effect on percent cover of grassland/pasture/hay (Table 2), although this effect was not manifested as any clear directional trend (Fig. 2). Percent cover of grassland/pasture/hay varied significantly among the routes (i.e., the main effect of ''route'' within the ANOVA, Table 2) with flycatchers associating with this cover type more so on the Lockhart route than the other three routes (Fig. 3). There was also a significant main effect of forest/shrubland cover (Table 2) which mostly arose from flycatcher locations on the Lockhart route having less of this cover type than locations on the other routes (Fig. 3).

At the landscape scale (0.4-km buffers along the entire route), there were not any significant relationships between flycatcher abundance and percent cover for any of the four cover types, regardless of whether abundance estimates were from our surveys or the 2011 BBS or BBS mean from 2007–2011 ($R^2 < 0.1$, $P > 0.05$). There were substantial differences among the 10 BBS

TABLE 2. Results of the nested ANOVAs testing for temporal differences (survey occasion nested within route) in each of the land cover variables quantified within the 300-m buffer zones.

Habitat variable	Effect	F^a	*P*
Urban/developed land (% cover)	Among routes	1.27	0.29
	Survey occasion within route	0.63	0.81
Forest/shrubland (% cover)	Among routes	5.03	0.002
	Survey occasion within route	1.65	0.08
Grassland/pasture/hay (% cover)	Among routes	3.69	0.013
	Survey occasion within route	3.00	0.001

[a] For each of the nested ANOVAs, the degrees of freedom are 3, 12, and 210 for the among route effect, survey occasion nested within route, and error, respectively.

routes in percent cover of the four main land cover types and differences in flycatcher abundance; nonetheless, this variation in the land cover variables did not correlate with the variation in flycatcher abundance (Fig. 4).

DISCUSSION

The results supported our prediction that Scissor-tailed Flycatchers associate with open (no canopy) cover types such as grasslands, pasture, and hay fields more than with closed-canopy vegetation (forest and shrubland) or areas of intense human presence (urban land cover). Compared to random points on the landscape, flycatchers were observed at locations that had significantly more grassland/pasture/hay and significantly less forest/shrubland and urban land within a 300 m radius. Along with Brennan and Schnell (2007), our study is one of the first to examine the fine-scale habitat associations of Scissor-tailed Flycatchers. We quantified the land cover composition of perched birds (some that were seen swooping after insects) that presumably were engaged in sit-and-scan foraging and/or territory surveillance. A main distinction between our study and Brennan and Schnell (2007) is that we examined land cover associations of observed individuals (or small groups), whereas the previous study examined relationships between land cover types and bird abundance.

Brennan and Schnell (2007) used aerial photography and BBS data to study multi-scale habitat associations of seven tyrannid species, including Scissor-tailed Flycatchers, in the south-central U.S. They analyzed bird abundance and landscape variables at 16 spatial scales from a local (0.8 km) to regional (40.2 km) scale along 198 BBS routes. The smallest scale corresponded to a BBS stop and the largest scale represented an entire survey route. For each route segment, bird abundance was estimated using the average number of birds per stop per year (1985–1994). Brennan and Schnell (2007) used PCA to reduce a set of 10 landscape variables (measuring landscape composition and spatial configuration) to two composite variables (PC axes I and II). The composition variables were percent cover of open

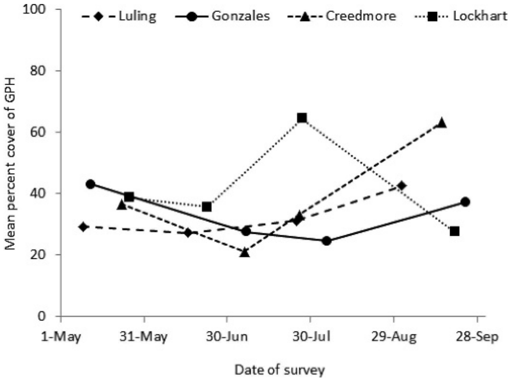

FIG. 2. The mean percent cover of grassland/pasture/hay (GPH) in the 300 m buffer zones centered on flycatcher locations over the survey period for the four routes that were surveyed four times each.

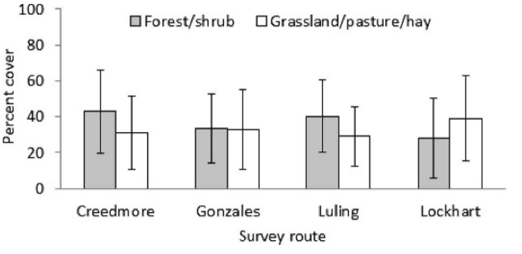

FIG. 3. A comparison of the mean percent cover of forest/shrubland and grassland/pasture/hay in the 300-m buffer zones centered on flycatcher locations for the four routes that were repeatedly surveyed. Error bars represent ± 1 SD.

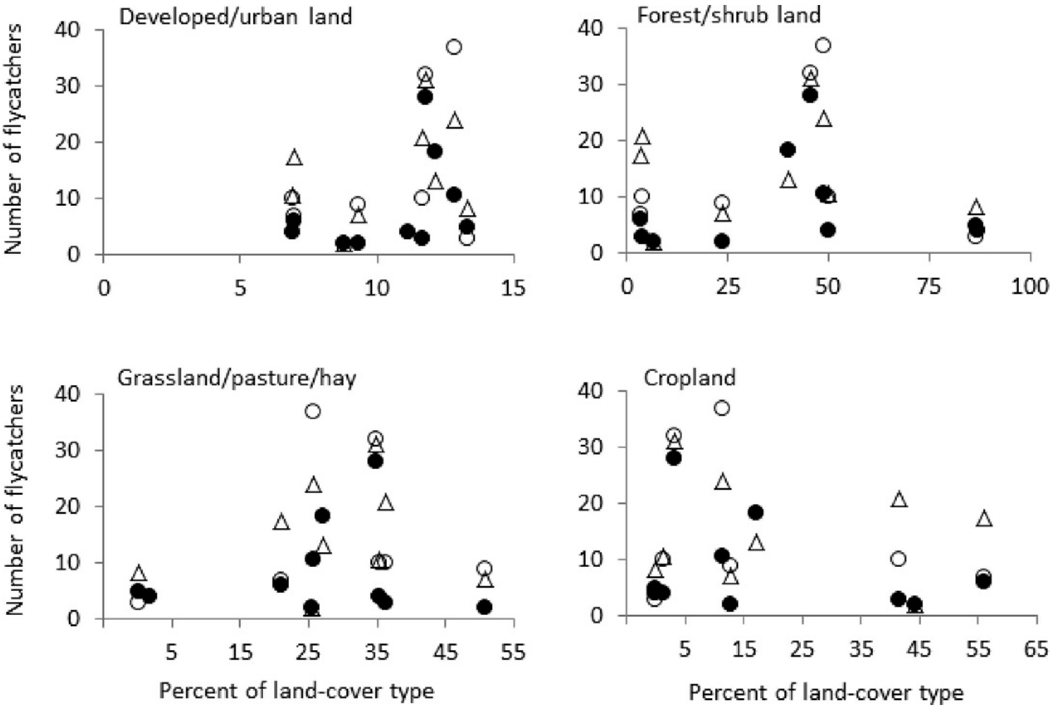

FIG. 4. Number of Scissor-tailed Flycatchers recorded on the 10 Breeding Bird Survey routes versus the percent cover of each of the four main land cover types in 0.4-km buffers along the length of the route. Solid circles represent flycatchers recorded during our surveys. Open circles represent flycatchers recorded during the 2011 BBS (three of the routes were not surveyed by the BBS in 2011). Open triangles represent mean flycatcher abundance from BBS data 2007–2011. In our study, two of the BBS routes were each surveyed four times; for these routes, figure shows mean number of birds recorded over the four survey periods.

country, closed forest, and intermediate forest which were classified from a previous study (Brennan and Schnell 2005). Their most notable result for Scissor-tailed Flycatchers was the significant ($P < 0.05$) correlation between abundance and PC axis II at all spatial scales. PC axis II represented an intermediate mix of open and closed habitats or what Brennan and Schnell (2007) referred to as a ''savannah-like'' landscape. This association was particularly strong at larger spatial scales (> 8 km segment length).

Our study is not directly comparable to Brennan and Schnell (2007) because of differences in the type of land cover data used, different sources or methods for surveying flycatchers, and somewhat different analyses. However, similar to Brennan and Schnell (2007), we found that Scissor-tailed Flycatchers associate with a savannah-type of landscape and at a smaller spatial scale (15% the area of the smallest extent of Brennan and Schnell [2007]) than that examined in their study. In the present study, flycatcher locations had on average 38.8% grassland/pasture/hay and 29.9% forest/shrubland, a mix that also can be described as savannah. Our study revealed that flycatchers forage in areas that have meaningful amounts of open and closed ''habitats,'' instead of predominantly one or the other. On average nearly 30% of the land within flycatcher buffer zones was composed of forest or shrub, indicating that flycatchers do not require landscapes that are totally devoid of closed-canopy habitats. Most (246 of 369) flycatcher buffer zones had more than 10% forest/shrub cover and more than 10% grassland/pasture/hay cover. Only 136 of 369 random locations were composed in this way. Regosin (1998) describes Scissor-tailed Flycatchers habitat associations as open areas such as prairies and savannahs, but he also notes that they will utilize forest edges on the wintering grounds. Forest habitats and edges may provide abundant insect prey. Lastly, some interspersed trees are required in Scissor-tailed

Flycatcher habitat since they utilize trees and some shrubs for nesting and perching (Regosin and Pruett-Jones 1995, Regosin 1998).

Few studies have been conducted on this species, particularly with regard to examining habitat or land cover associations. However, there are general descriptions of the habitat and ecology of Scissor-tailed Flycatchers that date back over 100 years. Bailey (1902) described their behavior and distribution on the mesquite prairies of South Texas. Fitch (1950) reviewed the distribution of Scissor-tailed Flycatchers and describes them as associated with prairies and open lands. He mentions the prairie habitat of Scissor-tailed Flycatchers in Brazos County, TX ''as the preferred habitat'' (Fitch 1950). He also examined nest site selection and reported that they prefer mesquite trees, thus providing early evidence that Scissor-tailed Flycatchers prefer open habitat with interspersed trees and shrubs (Fitch 1950). Warner (1966) describes their breeding range in Oklahoma as encompassing most of the state except for the oak-hickory forests of the eastern edge of the state. Therefore, the Scissor-tailed Flycatcher has long been known as a species that exists in savannah-like landscapes, even though few studies have quantitatively documented this habitat association, particularly at relatively small spatial scales typical of the habitat that an individual bird actually uses on a daily basis.

Scissor-tailed Flycatchers have experienced declines throughout their range, but there are areas that hold stable and/or increasing populations (Ziolkowski et al. 2010). Knowledge of flycatcher habitat associations can help guide conservation plans and population monitoring for this species (Regosin 1998), including possibly grassland and hayfield management conducive to flycatchers. Effective conservation of Scissor-tailed Flycatchers will require precise knowledge of nest-site selection and responses to processes (e.g., livestock grazing and fire) that can make a landscape more (or less) savannah-like.

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LITERATURE CITED

BAILEY, F. M. 1902. The Scissor-tailed Flycatcher in Texas. Condor 4:30–31.

BRAMBILLA, M., F. CASALE, V. BERGERO, G. M. CROVETTO, R. FALCO, I. NEGRI, P. SICCARDI, AND G. BOGLIANI. 2009. GIS-models work well, but are not enough: habitat preferences of *Lanius collurio* at multiple levels and conservation implications. Biological Conservation 142:2033–2042.

BRENNAN, S. P. AND G. D. SCHNELL. 2005. Relationships between bird abundances and landscape characteristics: the influence of scale. Environmental Monitoring and Assessment 105:209–228.

BRENNAN, S. P. AND G. D. SCHNELL. 2007. Multiscale analysis of tyrannid abundances and landscape variables in the Central Plains, USA. Wilson Journal of Ornithology 119:631–647.

CODY, M. L. 1981. Habitat selection in birds: the roles of vegetation structure, competitors, and productivity. BioScience 31:107–113.

ESLEY, J. D. AND E. K. BOLLINGER. 2001. Habitat selection and reproductive success of loggerhead shrikes in northwest Missouri: a hierarchical approach. Wilson Bulletin 113:290–296.

FITCH JR., F. W. 1950. Life history and ecology of the Scissor-tailed Flycatcher, *Muscivora forficata*. Auk 67:145–168.

GAWLIK, D. E. AND K. L. BILDSTEIN. 1993. Seasonal habitat use and abundance of Loggerhead Shrikes in South Carolina. Journal of Wildlife Management 57:353–357.

NOLTE, K. R. AND T. E. FULBRIGHT. 1996. Nesting ecology of Scissor-tailed Flycatchers in South Texas. Wilson Bulletin 108:302–316.

QUINN, G. P. AND M. J. KEOUGH. 2002. Experimental design and data analysis for biologists. Cambridge University Press, New York, USA.

REGOSIN, J. V. 1998. Scissor-tailed Flycatcher (*Tyrannus forficatus*). The birds of North America. Number 342.

REGOSIN, J. V. AND S. PRUETT-JONES. 1995. Aspects of breeding biology and social organization in the Scissor-tailed Flycatcher. Condor 97:154–164.

RIBIC, C. A., R. R. KOFORD, J. R. HERKERT, D. H. JOHNSON, N. D. NIEMUTH, D. E. NAUGLE, K. K. BAKKER, D. W. SAMPLE, AND R. B. RENFREW. 2009. Area sensitivity in North American grassland birds: patterns and processes. Auk 126:233–244.

SAUER, J. R. 1990. Route-regression analysis of Scissor-tailed Flycatcher population trends. Pages 160–163 *in* Survey designs and statistical methods for the estimation of avian population trends (J. R. Sauer and S. Droege, Editors). USDI, Fish and Wildlife Service, Biological Report 90(1).

U.S. FISH AND WILDLIFE SERVICE. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia, USA. 85 pp. www.fws.gov/migratorybirds (accessed 1 May 2012).

WARNER, A. C. 1966. Breeding range expansion of the Scissor-tailed Flycatcher into Missouri and other states. Wilson Bulletin 78:289–300.

WINTER, M., D. H. JOHNSON, AND J. A. SHAFFER. 2005. Variability in vegetation effects on density and nesting success of grassland birds. Journal of Wildlife Management 69:185–197.

ZIOLKOWSKI JR., D. J., K. L. PARDIECK, AND J. R. SAUER. 2010. The 2003–2008 summary of the North American Breeding Bird Survey. Bird Populations 10:90–109.