

NEST SITE SELECTION BY WESTERN KINGBIRDS (*TYRANNUS VERTICALIS*)  
IN AN URBAN ENVIRONMENT

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## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	vii
ABSTRACT.....	viii
CHAPTER	
1. INTRODUCTION .....	1
2. METHODS .....	5
Study Area .....	5
Location of Nest Sites .....	6
Data Collection .....	6
Data Analysis .....	8
3. RESULTS .....	10
Nesting Structures and Locations .....	10
Nest Site Selection .....	13
4. DISCUSSION .....	17
Nesting Structures and Locations .....	17
Nest Site Selection .....	19
Future Studies .....	20
Conclusion .....	21
APPENDICES .....	23
Appendix 1. Map outline of study area.....	24
Appendix 2. Map of sites used for logistic regression.....	25

Appendix 3. Data used for logistic regression .....	26
Appendix 4. Map of unused sites.....	30
Appendix 5. Map of 2005 nest sites.....	31
Appendix 6a. Part 1 of data recorded for 2005 nest sites .....	32
Appendix 6b. Part 2 of data recorded for 2005 nest sites .....	35
Appendix 7. Map of 2006 nest sites.....	40
Appendix 8a. Part 1 of data recorded for 2006 nest sites .....	41
Appendix 8b. Part 2 of data recorded for 2006 nest sites .....	45
Appendix 9. Nest site ID, UTM coordinates (WGS 84 map datums), nest site name, nest placement, and number of fledglings .....	56
Appendix 10. Unused site ID, UTM coordinates (WGS 84 map datums), and site description .....	62
Appendix 11a. Anecdotes – Interesting Observations of Western Kingbirds in 2005 .....	67
Appendix 11b. Anecdotes – Interesting Observations of Western Kingbirds in 2006 .....	70
LITERATURE CITED .....	76

## LIST OF TABLES

Table	Page
1. Means $\pm$ SE and ranges of the measured variables for nest sites ( $n = 43$ ) and unused sites ( $n = 41$ ) .....	12
2. Model ID, predictors, and AIC <sub>c</sub> results for models tested with logistic regression.....	14
3. Results for logistic regression of Model 17 .....	16
4. Results for log likelihood ratio tests of variables contained in Model 17 .....	16

## **ABSTRACT**

### **NEST SITE SELECTION BY WESTERN KINGBIRDS (*TYRANNUS VERTICALIS*) IN AN URBAN ENVIRONMENT**

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#### **SUPERVISING PROFESSOR: T. R. SIMPSON**

Urban nest site selection by Western Kingbirds (*Tyrannus verticalis*) was examined over two breeding seasons in San Marcos, Texas. Within the study area of approximately 70 ha, 45 and 63 nests were identified in 2005 and 2006, respectively. In 2005, 18% of nests were in trees, 75% on utility poles, and 7% on other manmade structures. In 2006, 46% of nests were in trees, 51% on utility poles, and 3% on other manmade structures. To identify environmental variables associated with nest site selection, I recorded nest height, structure height and type (tree or manmade), diameter at breast height (dbh), presence or absence of ground cover or understory vegetation, distances to the nearest street, building, light, tree, and distance to the nearest neighboring Western Kingbird nest. The same variables were recorded at randomly selected unused nest structures within the study area. Logistic regression was performed on 20 *a priori*



models and Akaike Information Criterion corrected for small sample size ( $AIC_c$ ) was used to determine which model was best at balancing parsimony and the fit of the data to the models. The reduced dataset ( $n = 84$ ) used for statistical analyses included 43 nest sites and 41 unused sites. Mean nest height was 8.33 m (SE = 2.30). Mean nest structure height was 11.21 m (SE = 2.10). Mean nearest neighboring distance for a Western Kingbird nest was 68.21 m (SE = 32.52). The selected model had an Akaike weight of 0.1762, Nagelkerke's  $r^2$  of 0.26, and included variables for structure height, presence or absence of ground cover or understory vegetation, distances to the nearest street, building, and tree, and distance to the nearest neighboring Western Kingbird nest. Parameter estimates indicated that nest sites tend to have taller structure heights and no ground cover or understory vegetation, were closer to streets but farther from neighboring Western Kingbird nests, tree canopy edges, and buildings. Understanding the ecological requirements of Western Kingbirds may aid in understanding the success or failure of other avian species in urban habitats.

## CHAPTER 1

### INTRODUCTION

Urban environments generally have poor bird diversity (Emlen 1974, DeGraaf 1987, Blair 1996). As an area becomes more urbanized, many niches are removed, others are changed, and new ones are formed. Several studies have documented that as areas become increasingly developed, species richness decreases even though bird density increases (Emlen 1974, DeGraaf 1987, Blair 1996). At the same time, invasive or exotic species increase at the expense of native bird species (Emlen 1974, DeGraaf 1987, Blair 1996). One exception is the Western Kingbird (*Tyrannus verticalis*) which is abundant in some urban settings (Cuesta 1974, Honig 1992). The breeding range of the Western Kingbird has been gradually expanding since the early 1800s as settlers moved across North America altering the landscape (Dobkin 1994, Clark 2001). One reason for the expansion may be their proficiency at adapting their breeding and nesting behaviors to changing landscapes and presence of humans.

Western Kingbirds are Neotropical migrants belonging to the family Tyrannidae. Agile and aerobatic flyers they are primarily insectivorous birds that usually hawk passing insects from high perches. Western Kingbirds are noticeable by their distinct, loud vocalizations and characteristic coloration (yellow belly; pale gray breast, head and back; and black tail with white outer rectrices). They migrate north spending summers in

western North America from northern Mexico to southern Canada, where mating and nesting occur. Western Kingbirds are generally associated with open habitats that contain trees, tall shrubs, or tall manmade structures used for perching and nesting. They are often found in edge areas (Dobkin 1994, Degraaf and Rappole 1995) that can occur naturally or in urbanized environments.

Western Kingbirds generally arrive in Texas in mid-April (Ohlendorf 1974, Gamble 1985, Lockwood and Freeman 2004). Males usually arrive earlier than females and establish loosely defined territories. After pairing, the male has a nest-site-showing display (Smith 1966, Gamble and Bergin 1996); however, once a site is chosen, the female builds the nest (Smith 1966, Goldberg 1979, Gamble and Bergin 1996). Only females incubate and brood eggs (Bent 1942, Smith 1966, Goldberg 1979, Gamble and Bergin 1996), but both parents feed their young (Smith 1966, Goldberg 1979, Gamble and Bergin 1996). The hatchlings remain in the nest for about two and a half weeks (Cuesta 1974, Goldberg 1979, Gamble 1985, Gamble and Bergin 1996). After fledging of young, the family may remain together for several weeks (Gamble and Bergin 1996) and the parents continue to feed their offspring for two to three weeks (Johnson 1970, Gamble and Bergin 1996). Within the southern breeding range, Western Kingbirds generally depart for the fall migration by mid-August (Gamble and Bergin 1996, Lockwood and Freeman 2004).

Studies of nest site selection and breeding ecology for Western Kingbirds have been mostly conducted in rural, natural environments (Ohlendorf 1974, MacKenzie and Sealy 1981, Blancher and Robertson 1984, Gamble 1985, Bergin 1992). Western Kingbirds chose nest sites non-randomly; nest height, nest tree height, and relative nest

height were three of the most significant factors in determining nest trees (MacKenzie and Sealy 1981). Used and unused trees were significantly different within study sites (Bergin 1992). Western Kingbirds were discerning at the microhabitat level and only used trees for nesting that were generally larger, taller, and contained more accessible perches than unused surrounding trees (Bergin 1992).

Research on breeding and nesting ecology by Western Kingbirds in urban landscapes has been limited. In Las Cruces, New Mexico, Cuesta (1974) documented basic nesting ecology of Western Kingbirds and reported nest height, location, and success. In Houston, Texas, Honig (1992) documented Western Kingbirds at electric power substations where they frequently nested on transformers or related equipment. Some nests were found on electric transmission line towers within substations or immediately outside the premises. Honig (1992) hypothesized that Western Kingbirds were attracted to the large, open, grassy areas within substations. However, several nest sites were found at smaller substations with little or no grassy areas. Another suggestion was that lights at power substations attract more insects, allowing for extended foraging time. Western Kingbirds have been reported foraging under lights at night (Houston Audubon Society 1990); however, Honig (1992) was unable to find evidence of foraging after dark.

Although urban nesting of Western Kingbirds was documented (Cuesta 1974, Honig 1992), and there has been some speculation as to why Western Kingbirds might select certain nesting sites (Honig 1992), it had not yet been explored quantitatively. Therefore, I examined relationships between urban habitat and nest site selection by Western Kingbirds during two breeding seasons in a small city in central Texas.

My objective was to identify variables influencing choice of nest site by Western Kingbirds within the urban study area. Understanding nest site selection of Western Kingbirds in urban environments might provide valuable information and insight for management of urban environments for other species.

## **CHAPTER 2**

### **METHODS**

#### **Study Area**

The approximately 70-ha study area was located in downtown San Marcos, Hays County, Texas, and a portion of Texas State University-San Marcos campus. This area was chosen because of the abundance of nesting Western Kingbirds discovered in years prior to my study. The city of San Marcos is located in central Texas on the eastern edge of the Edwards Plateau astride the Balcones Escarpment bordering the Blackland Prairie to the East. The elevation of the city increases slightly from east to west ranging from 177 to 213 m (U.S. Geological Survey 1964). The average annual rainfall for the area is 94.46 cm (Alvarez and Plocheck 2006). January mean minimum temperature is 3.67° C and July mean maximum temperature is 35.06° C (Alvarez and Plocheck 2006). San Marcos has a resident human population of approximately 42,102 (Alvarez and Plocheck 2006).

San Marcos is typical of many small cities in central Texas having a courthouse as the center of town surrounded by two-story buildings in a square configuration. The downtown area is mostly set up on a north-south, east-west grid of streets. Buildings are typically one to two-stories, many with adjacent parking lots. The Texas State campus

has much more variation in street layout and building height. Vegetation in the study area varies from landscaped ornamental trees and shrubs to small stands of endemic trees such as live oak (*Quercus fusiformis*) and cedar elm (*Ulmus crassifolia*).

### Location of Nest Sites

Shortly after the first appearance of Western Kingbirds in San Marcos, I located their nests via foot surveys beginning 24 April 2005 and 23 April 2006. I searched for birds at least once a week. As birds began to form mating pairs, I looked for nests on utility poles, light poles and towers, trees, and other possible nesting structures. When a Western Kingbird nest was found, I recorded Universal Transverse Mercator (UTM) coordinates using a Global Positioning System (GPS) unit and later mapped the locations using Google Earth Plus (Google Earth™ mapping service 2007). I continued to look for new nests until none were located. Observations were terminated on 15 August 2005 and 19 August 2006 when Western Kingbirds were no longer found in the study area.

### Data Collection

I observed and collected data on nesting behavior and nest sites for two mating and nesting seasons in 2005 and 2006. After nests had either failed or fledged, data were collected from each nest site to determine factors influencing nest site choice by Western Kingbirds. Variables I examined were chosen based on those used in previous studies (Ohlendorf 1974, MacKenzie and Sealy 1981, Blancher and Robertson 1984,

Gamble 1985, Bergin 1992), as well as some that I determined to be of interest based on the urban setting. Height of structure containing the nest (Struct Height) and nest height (Nest Height) were measured using a clinometer. Type of structure (Struct Type) containing the nest was noted as either a tree or manmade. Circumference of nest structure was measured for calculating diameter at breast height (dbh). Presence or absence of any ground cover or understory vegetation (Ground Cov) at each site was noted. Distances to the nearest street (Street), building (Building), artificial light source (Light), tree trunk (Tree Trunk), and tree canopy edge (Tree Canopy) were measured. Distance measurements were horizontal and made using a tape measure for close range distances and a laser range finder (precision to nearest meter) for long range distances  $\geq 16$  m. However, the nearest neighboring distance for a Western Kingbird nest (NND) was measured after plotting the nest sites on a map using Google Earth Plus (Google Earth™ mapping service 2007). For nest sites in trees, I identified the genera and species when possible. Distances from the nest to the tree's trunk and canopy edge were also measured. I defined nest success or productivity as the number of fledglings per nest attempt (Cuesta 1974, Gamble 1985). I counted the number of juveniles that fledged from each nest. For each season, total number of fledglings was divided by number of nest attempts.

Similar data were collected from randomly chosen sites within the study area that did not contain Western Kingbird nests. To obtain random GPS coordinates, a latitude-longitude grid was laid over the study area map using Google Earth Plus (Google Earth™ mapping service 2007). The grid intersections were sequentially numbered and then randomly selected. If no potential unused site (e.g., utility pole or tree) was present at the



randomly chosen site, then the nearest potential nesting structure was chosen. The approximate number of randomly measured unused sites ( $n = 110$ ) was determined by the number of nest sites found ( $n = 108$ ).

## Data Analysis

I used logistic regression to identify variables that best discriminated between nest sites and unused sites (Sieg and Becker 1990, Boal and Mannan 1998, McLeod et al. 2000, Holloran et al. 2005). To insure independent data, sites were only included in analyses when measured variables were unique to that site. When multiple sites had one or more variable measurements in common (e.g., NND, Tree Canopy), I randomly selected one site for use in analyses. Ten variables were considered for inclusion in models for logistic regression analyses: (1) Struct Height, (2) Struct Type, (3) dbh, (4) Ground Cov, (5) NND, (6) Light, (7) Building, (8) Street, (9) Tree Canopy, and (10) Tree Trunk. Means were reported  $\pm$  SE with value range in parentheses.

A correlation matrix was constructed to check for strong correlations ( $r > 0.70$ ) among variables. Tree Canopy and Tree Trunk were highly correlated ( $r = 0.985$ ). I chose to keep the Tree Canopy variable because I believed it was more relevant in choice of nest site related to open habitat preferences by Western Kingbirds. It also had a slightly smaller residual standard deviation and a slightly higher Nagelkerke's  $r^2$  (Nagelkerke 1991) when analyzed in a logistic regression model by itself. To check the degree of multicollinearity between the remaining nine variables, I calculated Variance

Inflation Factors (VIFs) (Quinn and Keough 2002). All VIFs ( $< 2$ ) indicated little problem with multicollinearity.

Data on nine variables related to nest sites resulted in a large number of potential models from which to select the best model. Therefore, the Akaike Information Criterion was used to determine which model was best at balancing parsimony and the fit of data to the models. The size of my dataset required use of the Akaike Information Criterion formula adjusted for small sample size ( $AIC_c$ ) (Burnham and Anderson 2002).

A number of *a priori* models were identified based on results of previous studies and personal observation. To ascertain if there was an adequate fit to the data, I ran a logistic regression of the global model, used a log likelihood ratio test (Burnham and Anderson 2002, Insightful Corporation 2005), and calculated Nagelkerke's  $r^2$  coefficient of determination. Logistic regression was then performed for *a priori* models, and 20 models were evaluated using  $AIC_c$ . A log likelihood ratio test was performed on the model chosen as best to determine if that model was significantly better than a reduced model containing only the y-intercept. Nagelkerke's  $r^2$  was again calculated as a coefficient of determination. Results for logistic regression of the chosen model were interpreted. For each variable in the chosen model, a derived statistic called an odds ratio was calculated as a measure of how a 1-unit change in each of the model's variables influences a multiplicative factor that increases or decreases the odds of a site being a nest site (Quinn and Keogh 2002). In addition, log likelihood ratio tests were performed on all variables within that model (Insightful Corporation 2005).

## CHAPTER 3

### RESULTS

#### Nesting Structures and Locations

Within the study area, I located 45 Western Kingbird nests in 2005 and 63 nests in 2006. In 2005, 18% of nests were in trees, 75% on utility poles, and 7% on other manmade structures. Of trees used for nests, the most common species was live oak. Nests were also found in cedar elm and American elm (*Ulmus americana*) trees. In 2005, the distance of nest location in trees to the trunk averaged  $3.49 \text{ m} \pm 2.29$  (0.20 – 7.00) and distance to the canopy edge averaged  $1.39 \text{ m} \pm 0.78$  (0.30 – 2.50). The most common nest placement on utility poles included the uppermost cross arm connectors called DA bolts ( $n = 8$ ), against the pole using wire attachment brackets as platforms ( $n = 7$ ), and in transformer attachment brackets ( $n = 5$ ). For 2005, there were 45 nest attempts and a total of 89 fledglings, resulting in a productivity rate of 1.98 fledglings per nest attempt  $\pm 1.29$  (0 – 5).

In 2006, 46% of nests were in trees, 51% on utility poles, and 3% on other manmade structures. Of trees used for nests, the most common species was again live oak. Nests were also located in cedar elm, American elm, pecan (*Carya illinoensis*), netleaf hackberry (*Celtis reticulata*), southern magnolia (*Magnolia grandiflora*),

catalpa (*Catalpa* sp.), and mulberry (*Morus* sp.) trees. In 2006, the distance of nest location in trees to the trunk averaged  $3.41 \text{ m} \pm 1.87$  ( $0.25 - 7.35$ ) and distance to the canopy edge averaged  $2.96 \text{ m} \pm 1.89$  ( $0.40 - 7.40$ ). The most common nest placement locations on utility poles included the DA bolts ( $n = 8$ ), against the pole using wire attachment brackets as platforms ( $n = 8$ ), in transformer attachment brackets ( $n = 5$ ), and on cross arms ( $n = 5$ ). For 2006, there were 65 nest attempts (including 2 cases of nest reuse) and a total of 142 fledglings, resulting in a productivity rate of 2.18 fledglings per nest attempt  $\pm 1.49$  ( $0 - 5$ ).

The reduced dataset ( $n = 84$ ) used for logistic regression and related analyses included 43 nest sites (14 from 2005 and 29 from 2006); 41 unused sites were retained. Summary descriptive statistics (i.e., mean, SE, range) were calculated for measured variables by nest sites and unused sites (Table 1).

Table 1. Means  $\pm$  SE and ranges of the measured variables for nest sites ( $n = 43$ ) and unused sites ( $n = 41$ ). See methods for definitions of variables.

Measured Variable	Nest Sites		Unused Sites	
	Mean $\pm$ SE	Range	Mean $\pm$ SE	Range
Struct Height (m)	11.21 $\pm$ 2.10	4.93 – 16.15	10.19 $\pm$ 2.18	5.28 – 16.80
dbh (m)	0.44 $\pm$ 0.21	0.18 – 1.05	0.38 $\pm$ 0.22	0.21 – 1.40
Light (m)	9.11 $\pm$ 8.82	0.00 – 27.80	8.28 $\pm$ 9.25	0.80 – 35.00
Building (m)	17.17 $\pm$ 12.71	0.65 – 57.00	13.19 $\pm$ 10.94	0.35 – 43.00
NND (m)	68.21 $\pm$ 32.52	19.68 – 192.69	55.19 $\pm$ 37.70	17.34 – 163.32
Street (m)	6.60 $\pm$ 9.25	0.00 – 41.70	11.00 $\pm$ 15.96	0.25 – 65.86
Tree Canopy (m)	14.23 $\pm$ 16.68	0.00 – 83.50	9.58 $\pm$ 12.45	0.00 – 57.00

## Nest Site Selection

The global model, ID 1 (Table 2), was tested with a log likelihood ratio test ( $df = 9$ ,  $\chi^2 = 26.20$ ,  $0.0025 < P < 0.001$ ). A Nagelkerke's  $r^2$  of 0.31 indicated that 31% of the variation of the response variable (nest site/unused site) was accounted for by the global model. Therefore the global model was deemed as an acceptable fit to the data so I proceeded with  $AIC_c$ .

Model 17 (Table 2) had the lowest selection criterion value ( $AIC_c = 109.9597$ ) and the highest Akaike weight ( $w_i = 0.1762$ ). I considered Model 17 to be the best at balancing parsimony and the fit of the data to the models. It was tested with a log likelihood ratio test ( $df = 6$ ,  $\chi^2 = 21.92$ ,  $0.0025 < P < 0.001$ ) and found to be significantly better than a reduced model containing only the y-intercept. The Nagelkerke's  $r^2$  of 0.26 indicated that 26% of the variation of the response variable was accounted for by Model 17.

Table 2. Model ID, predictors, and  $AIC_c$  results for models tested with logistic regression. (LL = log likelihood,  $K$  = number of parameters estimated,  $AIC_c$  = selection criterion,  $\Delta_i$  =  $AIC_c$  differences between given model and smallest  $AIC_c$ , and  $w_i$  = Akaike weights) Models are ordered by descending  $w_i$ .

ID	Predictors	Deviance (-2*LL)	$K$	$AIC_c$	$\Delta_i$	$w_i$
17	StructHeight + GroundCov + NND + Building + Street + TreeCanopy	94.4861	7	109.9597	0.0000	0.1762
20	StructHeight + GroundCov + NND + Street + TreeCanopy	97.1238	6	110.2147	0.2550	0.1551
15	StructHeight + GroundCov + NND + Street	99.5210	5	110.2902	0.3305	0.1494
16	StructHeight + GroundCov + NND + Building + Street	97.3846	6	110.4755	0.5158	0.1362
14	StructHeight + GroundCov + NND	102.6678	4	111.1741	1.2144	0.0960
13	StructHeight + GroundCov	105.8828	3	112.1828	2.2231	0.0580
1	StructHeight + StructType + dbh + GroundCov + NND + Light + Building + Street + TreeCanopy	90.2043	10	113.2179	3.2582	0.0346
5	StructHeight + StructType + dbh + GroundCov + NND	100.1318	6	113.2227	3.2630	0.0345
18	StructHeight + NND + Street	104.8487	4	113.3550	3.3953	0.0323
2	StructHeight + StructType + dbh + GroundCov + NND + Light + Building + Street	93.0507	9	113.4831	3.5234	0.0303
3	StructHeight + StructType + dbh + GroundCov + NND + Light + Building	96.6140	8	114.5340	4.5743	0.0179
6	StructHeight + StructType + dbh + GroundCov	104.0743	5	114.8435	4.8838	0.0153
4	StructHeight + StructType + dbh + GroundCov + NND + Light	99.3992	7	114.8728	4.9131	0.0151
19	StructHeight + StructType + dbh + NND + Street	101.9711	6	115.0620	5.1023	0.0137
10	GroundCov	111.0824	2	115.2305	5.2708	0.0126
9	StructHeight	111.6213	2	115.7694	5.8097	0.0096
11	NND	113.4637	2	117.6118	7.6521	0.0038
8	StructHeight + StructType	111.3667	3	117.6667	7.7070	0.0037
12	Street	113.8886	2	118.0367	8.0770	0.0031
7	StructHeight + StructType + dbh	109.9203	4	118.4266	8.4669	0.0026

The interpretations of the logistic regression results for Model 17 and their resultant odds ratios (Table 3) are a little different than with the familiar linear regression models. The y-intercept coefficient can be interpreted by considering all variables set equal to zero, resulting in a 0.0285 chance that a site will be a nest site versus an unused site. Interpretation of the coefficient values is done through derived variables called odds ratios. The odds ratio is a measure of how multiplicative changes affect the odds of a site being a nest site for each 1-unit increase or decrease in the corresponding predictor variable (Quinn and Keough 2002). For example, with a 1 m increase in Struct Height, the odds of a site being a nest site increase by a factor of 1.2925. The odds of a site being a nest site decrease by a factor of 0.3018 if there is Ground Cov present. For each 1 m increase in NND, the odds of a site being a nest site increase by a factor of 1.0180. The remaining odds ratios can be interpreted like the three previous examples.

Results from the log likelihood ratio tests performed on the variables contained in Model 17 were significant at a level of  $\alpha = 0.10$  with the exception of one (Table 4). Building was not technically significant ( $P = 0.1122$ ) but is very close to the significance level. The most significant variable was Ground Cov ( $P = 0.0166$ ), closely followed by Struct Height ( $P = 0.0288$ ) (Table 4).



Table 3. Results for logistic regression of Model 17.

Variable	Coefficient Value	SE	Odds Ratio
Y-intercept	-3.5566	1.6128	0.0285
Struct Height	0.2566	0.1241	1.2925
Ground Cov	-1.1980	0.5851	0.3018
NND	0.0178	0.0082	1.0180
Building	0.0377	0.0239	1.0384
Street	-0.0383	0.0269	0.9624
Tree Canopy	0.0326	0.0209	1.0331

Table 4. Results for log likelihood ratio tests of variables contained in Model 17.

Variable	df	Deviance ( $\chi^2$ )	Residual df	Residual Deviance	<i>P</i>
Null			83	116.4011	
Struct Height	1	4.7798	82	111.6213	0.0288*
Ground Cov	1	5.7385	81	105.8828	0.0166*
NND	1	3.2150	80	102.6678	0.0730*
Building	1	2.5236	79	100.1442	0.1122
Street	1	2.7597	78	97.3846	0.0967*
Tree Canopy	1	2.8985	77	94.4861	0.0887*

\* Variable significant at  $\alpha = 0.10$

## **CHAPTER 4**

### **DISCUSSION**

#### **Nesting Structures and Locations**

There was a 40% increase in Western Kingbird nests from 2005 to 2006. In both years, the majority of Western Kingbird nests were located on utility poles. However, in 2006 the percentages of nests in trees and on utility poles were more evenly split.

Western Kingbirds typically nest in the most commonly available trees in a particular area (Ohlendorf 1974, Gamble 1985, Bergin 1987). Therefore, it is not surprising that the majority of tree nests were located in endemic live oaks. Bergin (1992, 1993) reported ranges for average horizontal distance of nest to tree trunk (3.55 – 4.60 m) and tree canopy edge (3.15 – 3.65 m). In this study, the average distances from nest to tree trunk (3.49 m in 2005 and 3.41 m in 2006) and nest to tree canopy edge (1.39 m in 2005 and 2.96 m in 2006) were less than the previously reported ranges.

Gamble (1985) and Cuesta (1974) reported that the majority of nests on utility poles were located on the lower transformer attachment bracket. Though transformer attachment brackets were used for nesting in my study area, they were not the most common location. Nests were frequently placed against the pole, using either cross wires

or wire attachment brackets as platforms. The DA bolts that connect the upper cross arms on the utility poles were also often used as nest platforms.

Nest productivity rates (number of fledglings per nest attempt) from my study (1.98 in 2005 and 2.18 in 2006) were comparable with those of other studies (Cuesta 1974, Gamble 1985). Cuesta (1974) separated productivity rates by habitat type: 2.52 for urban, 1.69 for riparian, and 1.28 for desert. Gamble (1985) reported only one productivity rate of 1.21 (range 0 – 4 fledglings). It is apparent that urban productivity rates are typically higher than non-urban.

The range of means previously reported for height of nests in trees varied from 3.6 m to 16.9 m (Goldberg 1979, MacKenzie and Sealy 1981, Gamble 1985, Bergin 1987, 1992, 1993). For this study, the mean nest height in all structures of  $8.33 \text{ m} \pm 2.30$  (4.20 – 14.07) and the mean for height of nests in trees of  $8.11 \text{ m} \pm 2.25$  (4.32 – 12.32) were well within ranges previously reported. Gamble (1985) reported the mean height for nests located on manmade structures as 7.8 m. The overall mean height for nests located on manmade structures in my study was slightly higher at  $8.46 \text{ m} \pm 2.36$  (4.20 – 14.07).

The range from previous studies of mean height of trees that contained nests was 5.0 to 23.4 m (Goldberg 1979, MacKenzie and Sealy 1981, Blancher and Robertson 1984, Bergin 1987, 1992, 1993). In this study, the mean height of trees containing nests was  $12.00 \text{ m} \pm 2.73$  (4.93 – 16.15), whereas the mean height of manmade structures containing nests was  $10.75 \text{ m} \pm 1.49$  (8.32 – 14.91). Both means are well within the previously reported range for trees.

The NNDs from previous studies varied. The shortest distance was 12 m in Trans-Pecos Texas (Gamble 1985); whereas, southeastern Arizona had only a few NNDs under 60 m (Blancher and Robertson 1984). The least NND from the reduced dataset in my study (19.68 m) falls between the two previous measurements; however, the least NND of the original dataset was 9.19 m.

### Nest Site Selection

Model 17 is considered to be the model that was best at balancing parsimony and the fit of the data to models. However, it could be argued that there were a few other models (15, 16, and 20) that may also have some validity (Table 2). In fact, the first three variables are the same for the top four highest  $w_i$  models. The deviances and  $AIC_c$  for those models are also very similar. Model 17 logistic regression results (Table 3) may be summarized in the following manner: nest sites tend to have taller Struct Heights and no Ground Cov, are closer to Streets but farther from the nearest neighboring Western Kingbird nest, Tree Canopy, and Buildings.

In my urban study area, there were more Western Kingbird nests on utility poles than in trees. In downtown San Marcos the utility lines are placed at the edge of streets. This accounts for many of the relationships between nest sites and measured variables, such as why nest sites tend to be closer to streets than unused sites. It also explains why nest sites tend not to have Ground Cov since street-side city utility poles are within paved rights-of-way. The fact that Building was close to being significant may also be explained with this logic because some buildings are separated from the street by parking

lots and sidewalks, so they tend to be slightly farther from nest sites. The remaining variables can be justified with habitat preferences and foraging tactics of Western Kingbirds in mind. Tree Canopy tends to be farther from nest sites allowing more open habitat that Western Kingbirds favor. A number of nest sites were located at street intersections or adjacent to parking lots, both of which provide open areas. Western Kingbirds are known to select high nesting and perching sites (MacKenzie and Sealy 1981, Bergin 1992), thus nest sites having a higher Struct Height makes sense. High, exposed perches allow the Western Kingbirds to sit and wait for passing insects, which they then aerobically pursue. These hawking flights require ample, unobstructed space for the birds to follow the movements of insects. The nearest neighboring Western Kingbird nest being farther from nest sites than unused sites was also expected, as there would be less competition for resources such as insects and adequate space for hawking, especially at the critical time of raising young.

### Future Studies

Ideas that could be considered for future analyses include separate regressions for tree sites and manmade sites; they may fit the data better. Some variables that I measured in this study, such as presence of ground cover or understory vegetation, could be broken into classifications (e.g., low, medium, high) for more detail. Also, streets could be classified as low, medium, or high traffic. Perhaps I have missed something that a more detailed habitat study would elucidate.

Other things to consider for future studies of Western Kingbirds in urban areas include the amount of food (insect abundance) and nest site fidelity and reuse. Also, whether or not nesting timeline differences affect urban nest site choice or productivity. For example, one nest may be fledging just as an adjacent nest is being built. In this instance the NND may become less important in nest site selection. An urban gradient study in San Marcos may also be useful to examine differences in nesting at varying scales of development.

## Conclusion

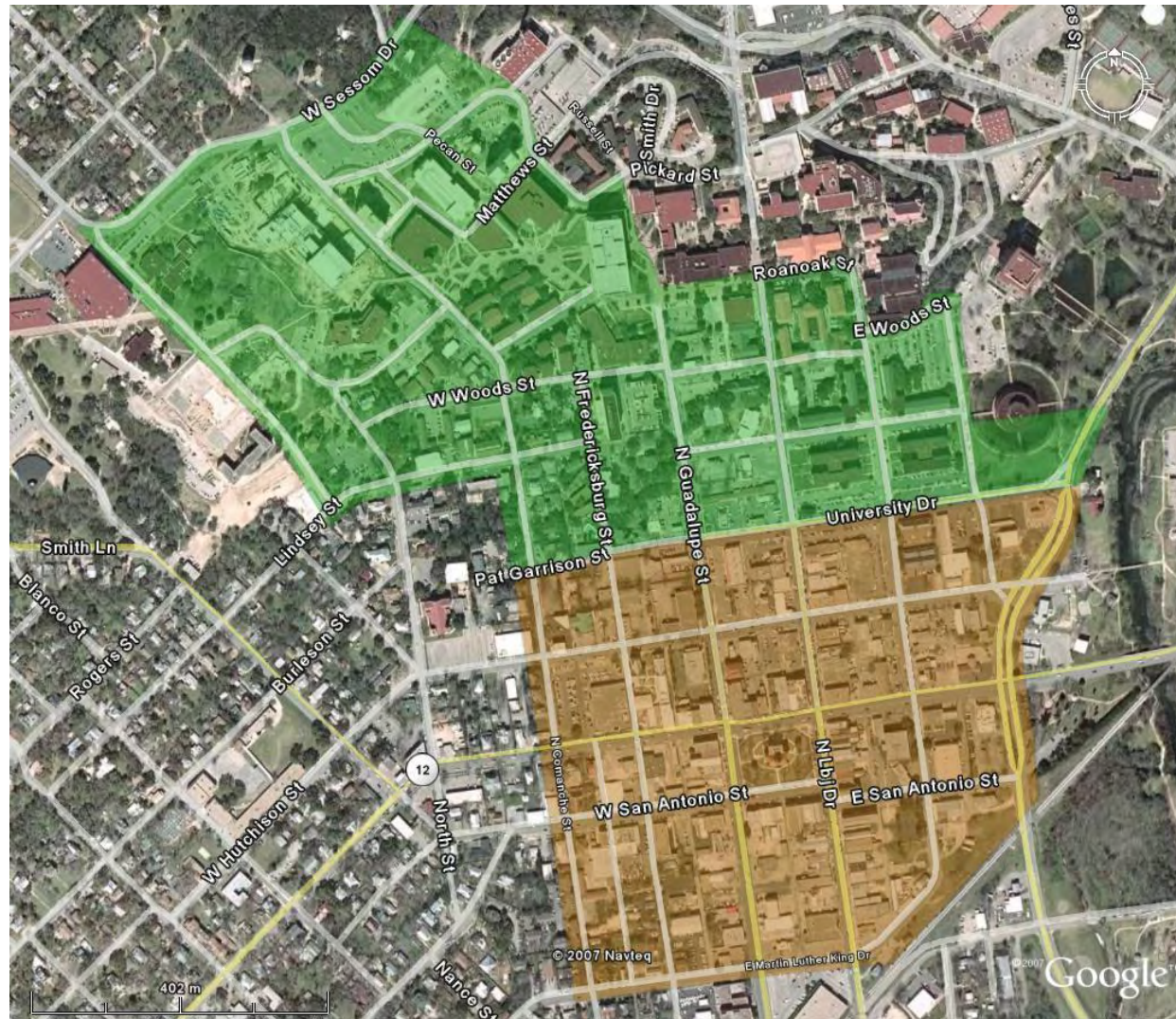
Inferences can be made about the basics of urban nest site selection by Western Kingbirds; but, the why and how are far from being understood. From the significant log likelihood test result, I know that Model 17 reasonably fits the data. However, since the logistic regression accounted for only 26% of the variation of the response variable, it is clear that there is more to study and learn. From a methodological point of view, the variables chosen and the measurement techniques of this study had sufficient discriminative strength to serve as a measure in identifying potential nest sites. Also, descriptive findings related to nesting structures and locations are mostly congruent with findings from previous studies. These measurements, statistical techniques, and subsequent results add to the body of research related to nest site selection.

Western Kingbirds are becoming successful in many urban areas, as evidenced by the one-year 40% increase of nests in my study area. Understanding the ecological requirements of Western Kingbirds more fully may aid in understanding the success or failure of other avian species in urban habitats. This knowledge could influence new development design to be tailored for avian needs, and possibly enhance currently developed areas. Helping birds to become successful in urban areas may lead to increased species richness.

## **APPENDICES**



Appendix 1. Map outline of study area (Google Earth™ mapping service 2007).

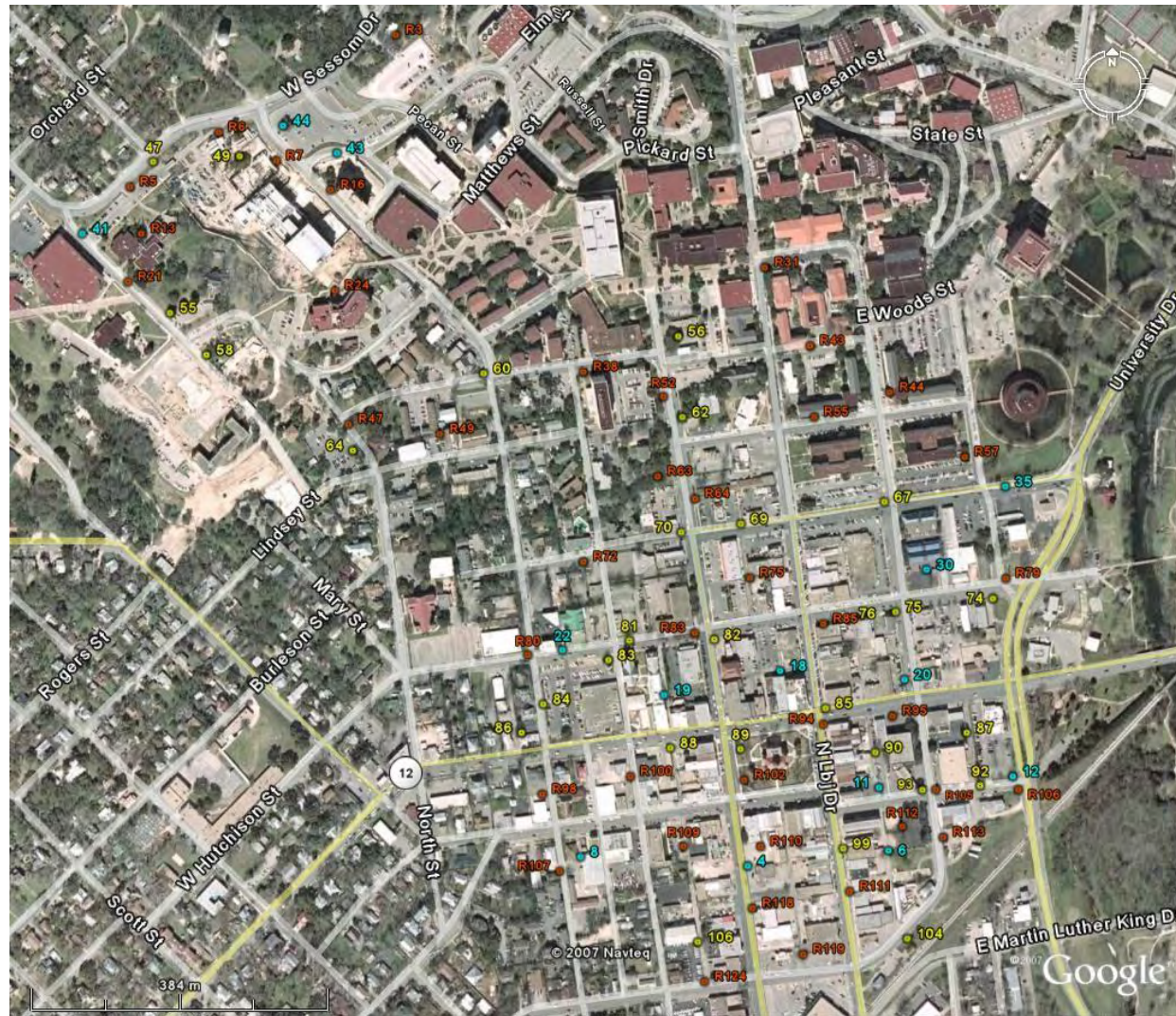


Green = Texas State University-San Marcos

Orange = downtown San Marcos



Appendix 2. Map of sites used for logistic regression (Google Earth™ mapping service 2007).



Blue circle = 2005 nest sites

Yellow circle = 2006 nest sites

Orange circle = unused sites

Appendix 3. Data used for logistic regression.

Site ID	Nest Site	Struct Type	Struct Height	dbh	Light	Building	NND	Ground Cov	Tree Canopy	Street
4	1	1	9.60	0.29	2.40	10.90	29.41	0	30.00	1.00
6	1	1	11.73	0.32	0.00	5.40	82.41	1	0.00	0.00
8	1	1	8.32	0.27	27.00	0.65	83.33	0	25.00	23.00
11	1	1	11.27	0.30	3.80	17.00	82.41	0	21.00	0.00
12	1	1	10.88	0.30	0.00	29.00	70.21	1	1.00	4.60
18	1	1	11.00	0.32	1.40	9.80	75.31	0	83.50	33.00
19	1	1	13.00	0.37	14.20	1.50	83.10	0	4.25	0.00
20	1	1	11.55	0.27	0.00	18.00	51.64	1	15.95	0.00
22	1	1	9.72	0.29	0.80	9.00	62.55	1	18.00	1.00
30	1	1	9.84	0.18	0.50	6.40	85.14	0	5.50	19.00
35	1	1	11.52	0.30	20.00	36.00	146.70	1	4.70	0.70
41	1	1	10.62	0.29	3.70	28.00	192.69	1	5.10	10.10
43	1	0	4.93	0.29	11.10	34.00	77.49	1	21.00	1.00
44	1	0	11.36	0.51	3.60	45.00	77.49	0	52.00	12.50
47	1	1	14.91	0.29	1.60	30.00	38.14	1	1.10	1.60
49	1	0	11.20	0.59	16.00	16.00	32.66	1	3.70	41.70
55	1	0	14.25	0.61	6.70	57.00	71.84	1	9.30	9.10
56	1	0	10.40	0.74	8.90	18.00	83.03	1	3.45	16.00
58	1	0	14.88	0.65	21.00	40.00	21.63	1	4.90	11.05
60	1	0	11.28	0.85	16.00	23.00	19.68	0	3.23	4.50
62	1	0	11.60	1.05	27.00	27.00	92.71	0	0.00	1.15
64	1	0	12.35	0.46	19.00	29.00	99.18	0	5.91	7.37
67	1	1	11.52	0.30	2.80	23.00	103.04	0	1.50	0.90

Appendix 3. Continued.

Site ID	Nest Site	Struct Type	Struct Height	dbh	Light	Building	NND	Ground Cov	Tree Canopy	Street
69	1	1	11.60	0.30	5.20	8.50	73.99	1	18.50	2.50
70	1	1	10.92	0.28	4.90	25.00	53.76	1	22.00	1.60
74	1	0	10.07	0.67	27.80	12.95	64.93	1	10.70	3.10
75	1	1	12.39	0.29	0.70	3.50	27.86	0	16.04	4.80
76	1	1	12.24	0.33	6.10	10.90	61.24	1	27.00	6.90
81	1	1	10.88	0.35	0.50	11.95	37.89	1	5.50	0.75
82	1	1	9.50	0.30	2.00	13.40	25.91	0	19.50	1.40
83	1	0	12.16	0.53	23.00	19.00	37.89	1	10.70	9.15
84	1	1	10.24	0.30	22.00	13.75	46.38	1	1.90	0.95
85	1	1	8.58	0.25	2.40	1.20	85.98	0	24.00	3.10
86	1	0	15.52	0.80	3.50	0.93	46.38	1	10.20	22.00
87	1	0	9.28	0.86	12.60	14.15	70.46	1	6.20	0.60
88	1	1	11.16	0.41	10.30	14.85	57.32	1	59.00	0.65
89	1	0	16.15	0.62	11.10	25.00	91.33	1	12.00	14.50
90	1	0	13.09	0.44	5.70	8.30	63.19	0	4.90	0.00
92	1	1	10.44	0.31	4.95	15.65	70.46	1	0.70	1.80
93	1	0	13.50	0.84	8.20	8.20	26.03	1	16.85	1.60
99	1	1	8.33	0.25	2.90	3.70	61.88	0	17.00	5.80
104	1	1	8.96	0.40	27.00	10.40	88.06	1	6.05	2.15
106	1	1	9.44	0.50	3.50	3.50	80.15	0	3.10	1.20
R3	0	0	11.36	0.41	18.00	22.00	83.53	0	2.15	29.00
R5	0	1	12.06	0.29	1.20	25.00	44.51	1	4.90	2.50
R6	0	1	9.44	0.29	32.00	41.00	41.21	1	4.70	7.00

Appendix 3. Continued.

Site ID	Nest Site	Struct Type	Struct Height	dbh	Light	Building	NND	Ground Cov	Tree Canopy	Street
R7	0	1	8.74	0.28	35.00	10.45	44.47	1	32.00	6.40
R13	0	0	11.20	1.40	11.70	9.85	76.64	1	10.40	62.00
R16	0	0	7.52	0.25	28.00	8.70	18.75	1	2.00	8.40
R21	0	1	11.36	0.29	5.75	21.00	67.50	1	4.80	5.05
R24	0	0	5.28	0.21	9.25	14.95	108.68	1	0.50	65.86
R31	0	0	10.45	0.59	28.00	7.70	143.08	1	4.38	7.45
R38	0	0	5.94	0.27	16.00	6.90	129.59	1	2.50	2.70
R43	0	0	13.86	0.66	5.80	4.85	163.32	1	3.10	10.25
R44	0	0	9.18	0.48	5.80	7.45	142.08	1	5.90	12.45
R47	0	0	16.80	0.56	16.20	36.00	34.53	1	2.30	2.00
R49	0	0	12.80	0.45	3.90	2.40	72.74	1	0.00	31.00
R52	0	1	8.36	0.23	13.10	11.25	35.91	1	0.80	4.30
R55	0	0	12.32	0.47	5.45	4.40	94.53	1	5.30	9.90
R57	0	0	10.40	0.54	15.40	13.85	64.19	1	3.92	9.35
R63	0	0	10.37	1.00	10.75	21.00	78.05	1	2.70	21.00
R64	0	1	10.72	0.30	1.95	2.84	33.83	1	7.80	5.50
R72	0	1	10.71	0.25	17.00	10.84	73.73	1	0.00	1.28
R75	0	1	9.54	0.28	12.40	1.65	70.94	1	0.00	51.00
R79	0	1	8.33	0.30	2.40	43.00	30.17	1	13.54	1.30
R80	0	1	9.28	0.28	2.60	13.35	45.64	1	5.30	1.85
R83	0	1	11.39	0.30	2.50	8.56	27.67	0	1.89	1.20
R85	0	1	13.60	0.33	1.53	2.50	34.47	0	35.60	6.83
R94	0	1	9.52	0.25	2.55	2.00	20.62	1	4.25	1.45

Appendix 3. Continued.

Site ID	Nest Site	Struct Type	Struct Height	dbh	Light	Building	NND	Ground Cov	Tree Canopy	Street
R95	0	0	10.40	0.44	3.37	2.28	49.93	0	19.00	6.58
R98	0	1	10.80	0.28	0.95	10.33	18.74	1	16.00	1.10
R100	0	1	9.60	0.26	1.12	7.67	19.37	1	57.00	0.70
R102	0	0	13.43	0.53	12.80	30.00	40.60	1	2.90	16.00
R105	0	1	11.52	0.30	2.80	14.70	17.34	1	2.30	1.12
R106	0	1	9.76	0.29	2.25	23.00	18.47	1	21.00	2.20
R107	0	1	10.40	0.27	1.42	1.06	32.75	1	5.20	1.50
R109	0	1	7.22	0.25	1.43	13.00	57.84	0	16.00	0.82
R110	0	1	7.52	0.25	1.22	6.90	30.02	1	20.00	20.00
R111	0	1	8.50	0.25	0.80	3.80	22.25	0	35.00	4.90
R112	0	1	9.12	0.25	0.80	32.00	20.28	1	0.00	24.00
R113	0	1	8.00	0.27	1.40	14.70	27.47	1	1.50	2.65
R118	0	1	9.86	0.29	1.47	11.60	52.62	1	1.00	0.71
R119	0	1	10.71	0.30	1.40	0.35	22.84	1	28.00	0.25
R124	0	1	10.62	0.30	2.00	16.00	52.07	0	6.99	1.51

Site ID: refers to nest site location

Nest Site: unused site = 0, nest site = 1

Struct Type: tree = 0, manmade = 1

Struct Height: height (m) of structure at site

dbh: diameter at breast height of structure (m)

Light: distance (m) to nearest artificial light source

Building: distance (m) to nearest building

NND: nearest neighboring distance of Western Kingbird nest (m)

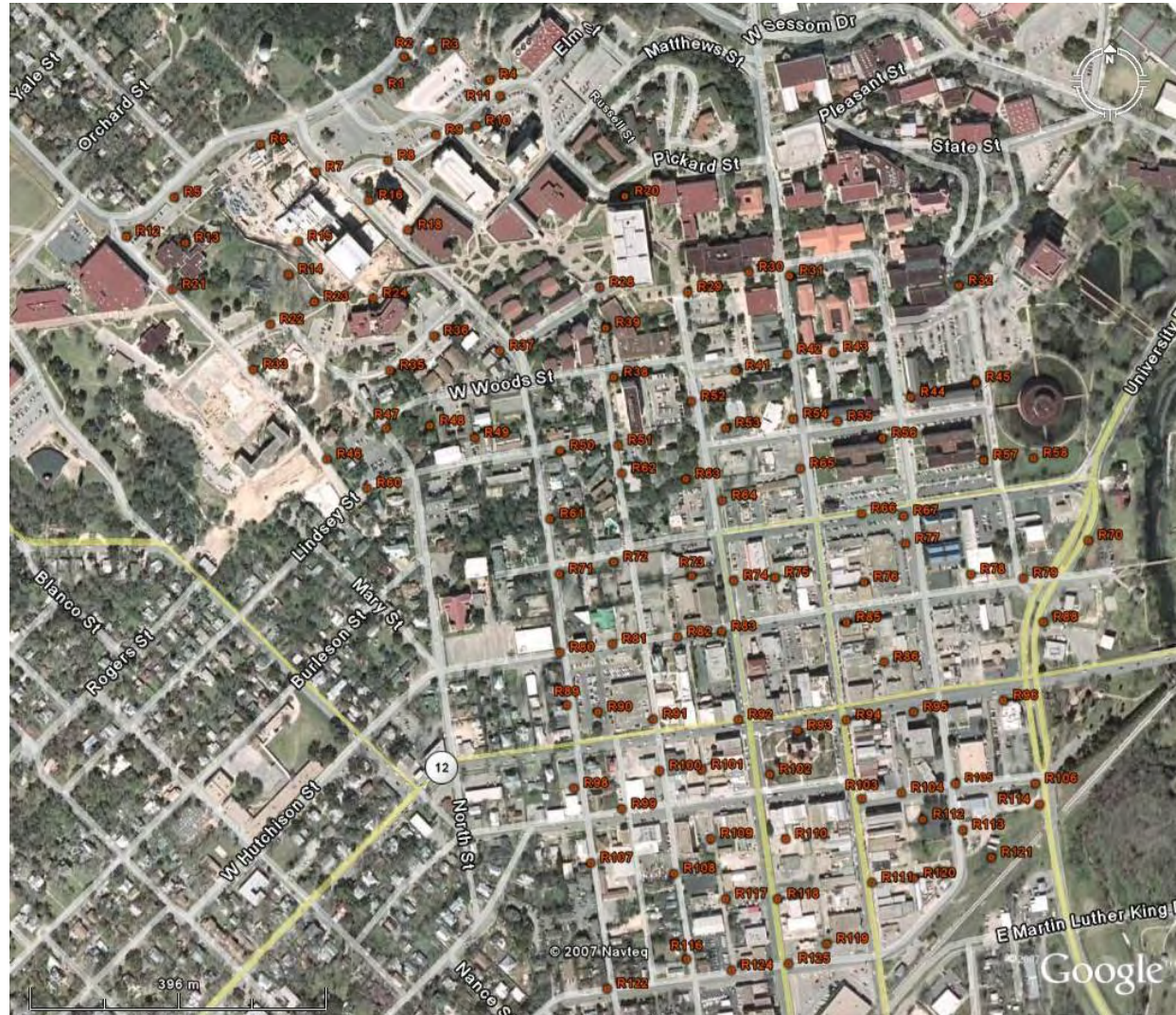
Ground Cov: absence = 0 or presence = 1 of ground cover or understory vegetation

Tree Canopy: distance (m) to the nearest tree's canopy edge

Street: distance (m) to the nearest street



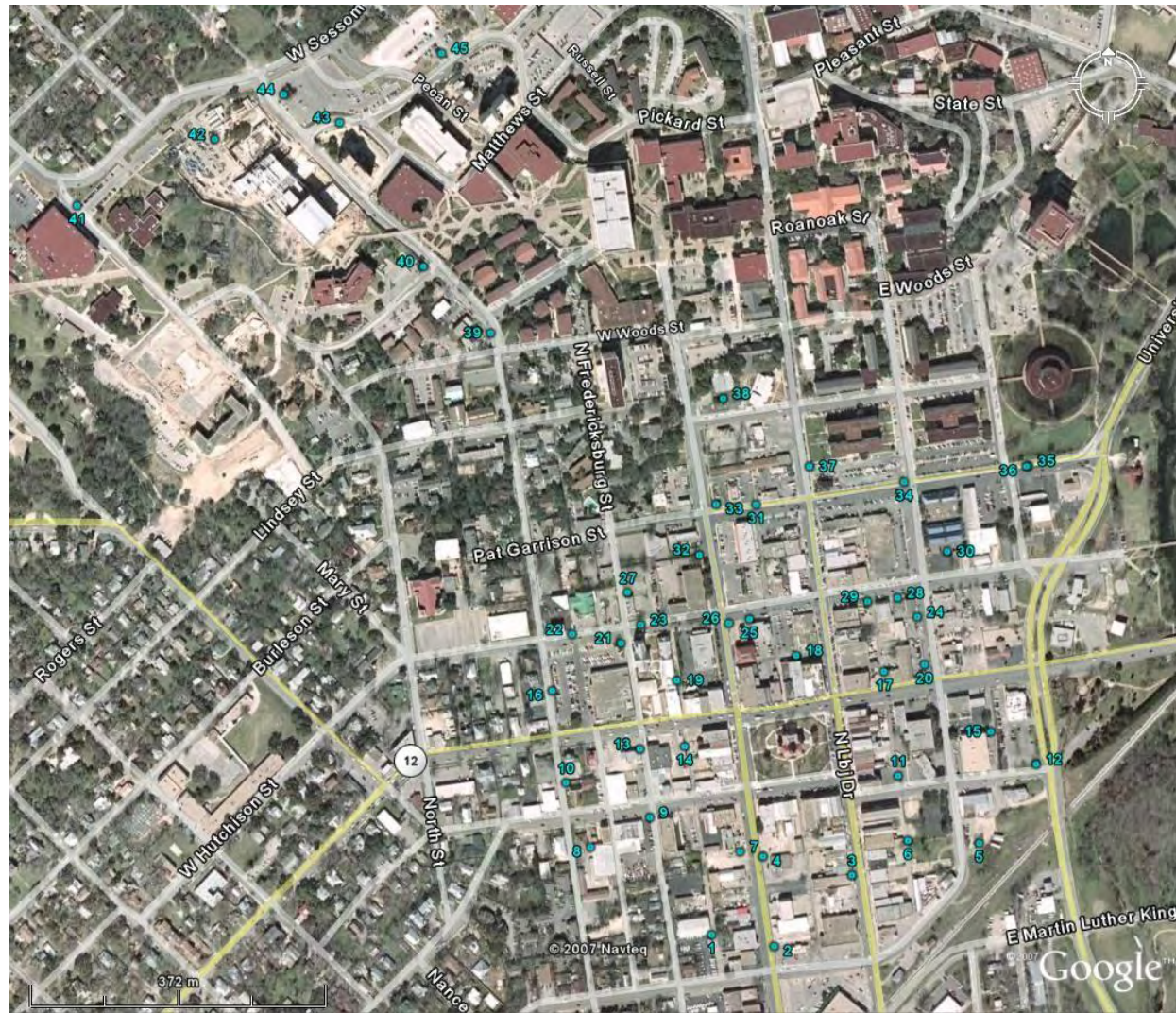
Appendix 4. Map of unused sites (Google Earth™ mapping service 2007).



Orange circle = unused site



Appendix 5. Map of 2005 nest sites (Google Earth™ mapping service 2007).



Blue circle = 2005 nest site



Appendix 6a. Part 1 of data recorded for 2005 nest sites.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
1	8.48	165	S/SE	—	—	utility pole (transformer)	9.44	—	0.30	26.0	3.5
2	6.40	335	N/NW	—	—	utility pole (light & transformer)	8.96	—	0.30	1.0	17.0
3	7.56	70	E/NE	—	—	utility pole (light & transformer)	11.52	—	0.32	0.6	3.5
4	5.12	45	NE	—	—	utility pole (light & transformer)	9.60	—	0.29	2.4	10.9
5	9.35	120	E/SE	6.00	2.50	tree (?)	16.83	8.50	0.64	13.6	47.0
6	10.54	255	W/SW	—	—	utility pole (light & transformer)	11.73	—	0.32	0.0	5.4
7	4.56	270	W	—	—	sign	6.84	—	0.19	11.4	11.2
8	7.52	300	W/NW	—	—	utility pole	8.32	—	0.27	27.0	0.7
9	9.57	On Top	Center	—	—	utility pole (light)	9.57	—	0.29	1.0	9.2
10	6.24	175	S	—	—	utility pole (light)	6.88	—	0.25	0.8	3.3
11	10.58	35	NE	—	—	utility pole (transformer)	11.27	—	0.30	3.8	17.0
12	8.84	5	N	—	—	utility pole (light)	10.88	—	0.30	0.0	29.0
13	9.36	255	W/SW	—	—	utility pole	10.26	—	0.32	13.4	5.2
14	6.40	235	SW	—	—	utility pole (light)	6.60	—	0.29	1.2	15.4
15	5.78	40	NE	—	—	utility pole	6.80	—	0.25	5.4	7.2
16	6.24	260	W	—	—	utility pole (transformer)	10.24	—	0.30	21.0	16.0
17	6.29	10	N	—	—	utility pole	7.14	—	0.27	17.0	0.6

Appendix 6a. Continued.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
18	9.90	260	W	–	–	utility pole (transformer)	11.00	–	0.32	1.4	9.8
19	11.20	295	W/NW	–	–	utility pole (transformer)	13.00	–	0.37	14.2	1.5
20	9.80	45	NE	–	–	utility pole (transformer)	11.55	–	0.27	0.0	18.0
21	4.76	120	E/SE	5.00	1.50	tree ( <i>Ulmus americana</i> )	12.16	6.50	0.51	25.0	17.8
22	9.72	On Top	Center	–	–	utility pole (light & transformer)	9.72	–	0.29	0.8	9.0
23	10.40	165	S/SE	–	–	utility pole (light & transformer)	10.88	–	0.35	0.5	13.5
24	5.89	30	N/NE	–	–	utility pole (transformer)	11.21	–	0.30	0.9	7.0
25	11.44	355	N	–	–	utility pole (light & transformer)	11.88	–	0.29	1.0	3.6
26	8.00	230	SW	–	–	utility pole (light)	9.50	–	0.30	1.8	13.4
27	9.69	In Center	Center	–	–	light tower	12.73	–	0.46	0.8	5.4
28	10.08	345	N	–	–	utility pole	10.88	–	0.30	19.0	9.2
29	11.73	160	S/SE	–	–	utility pole	12.24	–	0.33	5.7	11.0
30	8.88	On Top	Center	–	–	Light tower (w/TV antennae)	9.84	–	0.18	0.5	6.4
31	7.60	255	W/SW	–	–	utility pole (transformer)	11.60	–	0.30	4.0	8.3
32	7.20	165	S/SE	–	–	utility pole (light & transformer)	10.32	–	0.27	2.4	16.0
33	5.80	200	S/SW	2.00	0.50	tree ( <i>Ulmus crassifolia</i> )	6.96	2.50	0.21	6.2	20.0
34	9.76	5	N	–	–	utility pole	11.52	–	0.30	2.9	24.0

Appendix 6a. Continued.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
35	8.96	70	E/NE	–	–	utility pole (transformer)	11.52	–	0.30	20.0	36.0
36	10.47	250	W/SW	–	–	utility pole (transformer)	11.52	–	0.30	19.0	36.0
37	6.12	160	S/SE	–	–	utility pole (transformer)	9.35	–	0.30	33.0	19.0
38	6.12	75	E/NE	–	–	utility pole (light & transformer)	10.44	–	0.30	1.5	13.7
39	10.56	55	NE	–	–	utility pole (transformer)	11.04	–	0.35	0.0	8.4
40	8.40	100	E	2.50	1.50	tree ( <i>Quercus fusiformis</i> )	14.56	4.00	0.67	13.6	23.0
41	5.58	0	N	–	–	utility pole	10.62	–	0.29	3.7	28.0
42	6.20	150	S/SE	2.20	2.30	tree ( <i>Quercus fusiformis</i> )	11.59	4.50	0.45	16.0	24.0
43	4.32	340	N/NW	3.00	0.30	tree ( <i>Quercus fusiformis</i> )	4.93	3.30	0.29	11.1	34.0
44	4.84	230	SW	7.00	1.50	tree ( <i>Quercus fusiformis</i> )	11.36	8.50	0.51	3.6	45.0
45	2.72	295	W/NW	0.20	1.00	tree ( <i>Ulmus crassifolia</i> )	3.84	1.20	0.06	3.6	63.0

Appendix 6b. Part 2 of data recorded for 2005 nest sites.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
1	Golden Chick	80.48	no	tree ( <i>Celtis reticulata</i> )	0.6	8.1	tree ( <i>Celtis reticulata</i> )	0.6	8.1	1.0	alley
2	CenturyTel alley	80.48	grass	tree ( <i>Carya illinoensis</i> )	52.0	60.0	Utility Pole	–	28.0	0.8	Guadalupe
3	Rhino Graphics alley	82.72	no	tree ( <i>Celtis reticulata</i> )	18.5	22.5	Utility Pole	–	27.0	0.6	LBJ
4	Comet Cleaners Parking Sign	29.41	no	tree ( <i>Quercus fusiformis</i> )	30.0	33.0	Utility Pole	–	18.0	1.0	Guadalupe
5	Rhino Graphics alley	90.31	grass	tree (?)	17.0	19.4	Utility Pole	–	15.5	16.5	Edward Gary
6	Valentino's alley	82.41	small tree, grass	tree ( <i>Morus</i> sp.)	0.0	1.1	tree ( <i>Morus</i> sp.)	2.3	3.2	0.0	alley
7	Comet Cleaners (across from)	29.41	grass	tree ( <i>Quercus fusiformis</i> )	25.0	30.0	Utility Pole	–	10.8	5.2	Guadalupe
8	San Antonio at Fredericksburg (SW corner)	83.33	no	tree ( <i>Ehretia anacua</i> )	25.0	32.0	Utility Pole	–	22.0	23.0	Comanche
9	Sierra's Carpet Service	83.33	no	tree (?)	3.9	5.0	tree (?)	5.3	9.2	0.8	Fredericksburg

Appendix 6b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
10	Sierra's Carpet Service	86.34	grass	tree ( <i>Carya illinoensis</i> )	11.0	20.0	Utility Pole	–	12.5	4.4	Comanche
11	Rhino Graphics alley	82.41	no	tree ( <i>Celtis reticulata</i> )	21.0	26.0	Light Pole	–	3.7	0.0	alley
12	Bank of America (SE lot)	70.21	small tree, grass	tree ( <i>Vitex agnus-castus</i> )	1.0	2.0	tree (?)	11.2	15.4	4.6	San Antonio
13	Ozona Bank (East side)	56.75	no	tree ( <i>Celtis reticulata</i> )	66.3	71.3	Utility Pole	–	25.0	1.3	Fredericksburg (alley)
14	Ozona Bank (West side)	56.75	shrubs	tree (?)	12.8	16.3	Utility Pole	–	10.5	0.8	alley
15	Mr. Gatti's (SE lot)	70.21	bushes	tree ( <i>Quercus fusiformis</i> )	8.3	10.8	Utility Pole	–	4.5	0.0	alley
16	Daily Directions	75.52	grass	tree ( <i>Ulmus crassifolia</i> )	2.0	4.1	tree ( <i>Ulmus crassifolia</i> )	2.0	4.1	1.0	Comanche
17	Goodyear	51.64	weeds, grass	tree ( <i>Celtis reticulata</i> )	17.0	13.0	Utility Pole	–	3.8	21.0	Hopkins
18	Fire Station	75.31	no	tree ( <i>Sabal mexicana</i> )	83.5	85.0	Utility Pole	–	17.0	33.0	LBJ

Appendix 6b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
19	Ozona Bank (East side)	83.10	no	Tree ( <i>Sabal mexicana</i> )	4.3	6.5	Utility Pole	–	14.7	0.0	alley
20	Pedal Power alley	51.64	grass	tree ( <i>Lagerstroemia indica</i> )	16.0	16.0	Utility Pole	–	32.0	0.0	Edward Gary
21	Methodist Church (across from Hutchinson)	33.83	grass	tree ( <i>Lagerstroemia indica</i> )	15.5	12.7	Utility Pole	–	9.5	7.4	Fredericksburg
22	HEB (NE lot tree)	62.55	grass	tree ( <i>Quercus fusiformis</i> )	18.0	19.0	Utility Pole	–	17.0	1.0	Hutchinson
23	HEB (NE lot tree)	33.83	grass	tree ( <i>Carya illinoensis</i> )	0.0	5.6	tree ( <i>Carya illinoensis</i> )	0.0	5.6	0.8	Hutchinson
24	Farmer's Insurance	34.58	no	tree ( <i>Lagerstroemia indica</i> )	7.1	7.1	Utility Pole	–	28.0	1.0	Edward Gary
25	Hutchinson at Guadalupe (SE corner)	26.48	no	tree ( <i>Quercus fusiformis</i> )	32.0	37.0	Utility Pole	–	31.0	2.0	Hutchinson
26	Fire Station	26.48	no	tree ( <i>Quercus fusiformis</i> )	26.0	31.0	Utility Pole	–	24.0	1.5	Hutchinson
27	Methodist Church (across from Hutchinson)	43.54	grass	tree ( <i>Carya illinoensis</i> )	18.0	20.0	Utility Pole	–	20.0	2.6	Fredericksburg

Appendix 6b. Continued.

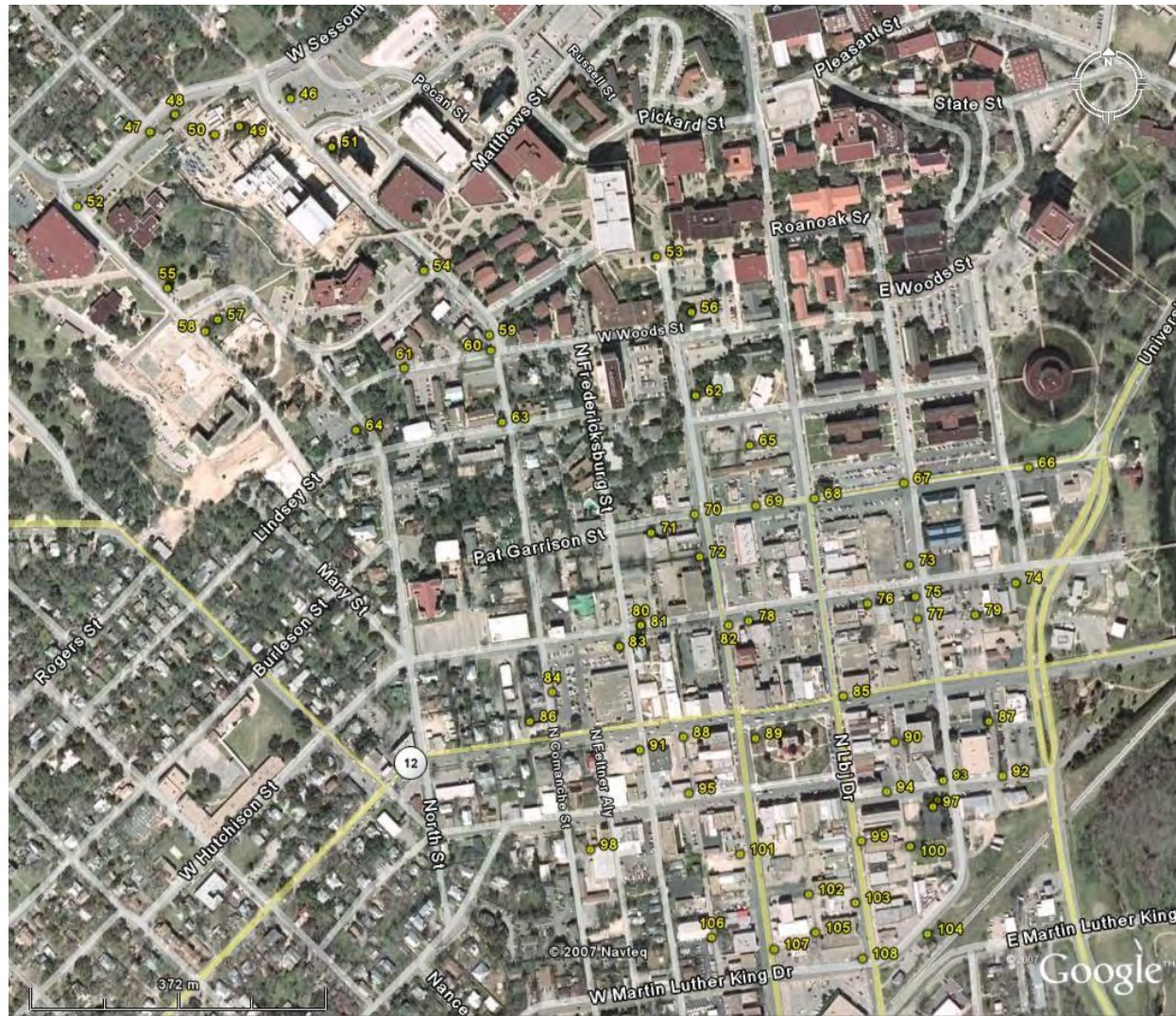
Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
28	Jack Brown Cleaners	34.58	no	tree ( <i>Morus</i> sp.)	9.3	15.3	tree (?)	9.3	15.3	0.5	Hutchinson
29	Farmer's Insurance	37.87	grass	tree ( <i>Celtis reticulata</i> )	36.0	38.0	Utility Pole	–	5.0	2.2	Hutchinson
30	Farmer's Insurance	85.14	no	tree ( <i>Carya illinoensis</i> )	5.5	15.8	tree ( <i>Carya illinoensis</i> )	5.5	15.8	19.0	alley
31	Taco Bell lot (SW corner)	50.44	shrubs, grass	tree ( <i>Ulmus crassifolia</i> )	19.0	21.0	Utility Pole	–	17.0	2.0	University
32	Taco Bell lot (SW corner)	66.91	grass	tree ( <i>Carya illinoensis</i> )	3.8	12.5	tree (?)	3.8	12.5	1.4	Guadalupe
33	Chipotle drive-thru	50.44	grass	tree ( <i>Ulmus crassifolia</i> )	12.5	14.0	Utility Pole	–	9.5	5.5	Guadalupe
34	Papillon Villa shopping center lot	102.56	no	tree ( <i>Pistacia chinensis</i> )	1.6	4.8	tree (?)	1.6	4.8	1.2	University
35	Papillon Villa shopping center lot	146.70	grass	tree ( <i>Quercus buckleyi</i> )	4.7	10.3	tree ( <i>Quercus buckleyi</i> )	4.7	10.3	0.7	University
36	Papillon Villa shopping center lot	146.70	grass	tree ( <i>Quercus buckleyi</i> )	4.7	10.3	tree ( <i>Quercus buckleyi</i> )	4.7	10.3	0.7	University

Appendix 6b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
37	Chipotle drive-thru	82.51	no	tree (?)	19.0	26.0	tree (?)	19.0	26.0	0.5	LBJ
38	Taco Bell lot (SW corner)	132.92	grass	tree (?)	7.0	11.3	tree (?)	7.0	11.3	17.0	Concho
39	Biology Building lot	118.91	no	tree ( <i>Carya illinoensis</i> )	19.0	24.0	tree ( <i>Carya illinoensis</i> )	19.0	24.0	1.5	Comanche
40	Campus Colony Apartments	118.91	no	tree ( <i>Lagerstroemia indica</i> )	9.2	9.7	Utility Pole	–	7.9	7.0	Comanche
41	Art Building lot (tree)	192.69	grass	tree ( <i>Juniperus ashei</i> )	5.1	7.7	Utility Pole	–	7.0	10.1	Academy
42	Comanche at Sessom (SE corner)	103.84	no	tree ( <i>Platanus occidentalis</i> )	11.1	17.0	tree ( <i>Platanus occidentalis</i> )	11.1	17.0	60.0	Sessom
43	Comanche at Sessom (SE corner)	77.49	grass	tree ( <i>Guaiacum angustifolium</i> )	21.0	29.0	Utility Pole	–	30.0	1.0	Student Center Dr
44	Student Center Dr. at Gaillardia	77.49	no	tree ( <i>Quercus fusiformis</i> )	52.0	57.0	Utility Pole	–	38.0	12.5	Comanche
45	Student Center Dr. at Gaillardia	154.82	grass	tree ( <i>Quercus fusiformis</i> )	15.0	21.0	Light Pole	–	3.5	25.0	Student Center Dr



Appendix 7. Map of 2006 nest sites (Google Earth™ mapping service 2007).



Yellow circle = 2006 nest site

Appendix 8a. Part 1 of data recorded for 2006 nest sites.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
46	4.95	180	S	5.00	1.50	tree ( <i>Quercus fusiformis</i> )	11.36	6.50	0.49	10.10	46.00
47	14.07	130	SE	0.00	0.80	utility pole	14.91	0.80	0.29	1.60	30.00
48	5.40	290	W/NW	2.40	0.40	tree ( <i>Quercus fusiformis</i> )	5.94	2.80	0.16	24.00	30.00
49	5.04	350	N	7.00	2.40	tree ( <i>Quercus fusiformis</i> )	11.20	9.40	0.59	16.00	16.00
50	10.62	10	N	1.65	7.00	tree ( <i>Quercus fusiformis</i> )	11.59	8.65	0.35	16.00	27.00
51	9.10	240	W/SW	1.90	3.90	tree ( <i>Quercus fusiformis</i> )	10.14	5.80	0.56	12.30	15.40
52	5.58	315	NW	0.00	0.90	utility pole	10.62	0.90	0.29	3.80	27.00
53	5.07	105	E/SE	4.33	4.64	tree ( <i>Carya illinoensis</i> )	13.92	8.97	0.86	19.00	27.00
54	7.65	100	E	2.00	1.20	tree ( <i>Quercus fusiformis</i> )	14.56	3.20	0.67	13.40	24.00
55	10.35	210	S/SW	4.40	2.40	tree ( <i>Magnolia grandiflora</i> )	14.25	6.80	0.61	6.70	57.00
56	8.80	150	S/SE	2.80	5.74	tree ( <i>Quercus fusiformis</i> )	10.40	8.54	0.74	8.90	18.00
57	10.24	305	NW	7.35	0.90	tree ( <i>Quercus fusiformis</i> )	15.12	8.25	0.76	26.00	51.00
58	12.32	230	SW	2.30	7.40	tree ( <i>Quercus fusiformis</i> )	14.88	9.70	0.65	21.00	40.00
59	10.56	230	SW	0.76	0.35	utility pole (transformer)	11.04	1.11	0.35	1.40	7.25
60	9.02	10	N	2.48	6.57	tree ( <i>Quercus fusiformis</i> )	11.28	9.05	0.85	16.00	23.00
61	9.30	345	N/NW	1.91	3.68	tree ( <i>Quercus fusiformis</i> )	12.64	5.59	1.02	5.95	9.74
62	8.70	320	NW	4.60	2.50	tree ( <i>Quercus fusiformis</i> )	11.60	7.10	1.05	27.00	27.00

Appendix 8a. Continued.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
63	12.24	30	N/NE	4.20	3.13	tree ( <i>Quercus fusiformis</i> )	15.66	7.33	0.89	22.00	12.06
64	9.12	255	W/SW	3.75	2.80	tree ( <i>Ulmus crassifolia</i> )	12.35	6.55	0.46	19.00	29.00
65	6.80	130	SE	5.40	1.30	tree ( <i>Celtis reticulata</i> )	8.46	6.70	0.33	7.70	3.15
66	8.96	70	E/NE	0.00	1.20	utility pole (transformer)	11.52	1.20	0.30	19.00	50.00
67	9.76	10	N	0.00	1.20	utility pole	11.52	1.20	0.30	2.80	23.00
68	4.76	160	S/SE	0.00	1.50	traffic light	5.44	1.50	0.13	1.30	11.30
69	7.60	255	W/SW	0.00	1.20	utility pole (transformer)	11.60	1.20	0.30	5.20	8.50
70	6.16	55	NE	0.00	1.40	utility pole	10.92	1.40	0.28	4.90	25.00
71	11.76	190	S	1.40	4.00	tree ( <i>Ulmus crassifolia</i> )	12.06	5.40	0.48	17.00	0.00
72	7.20	170	S	0.00	1.30	utility pole (light & transformer)	10.32	1.30	0.29	2.50	13.50
73	7.70	165	S/SE	0.00	0.90	utility pole	9.46	0.90	0.29	0.50	17.00
74	8.17	355	N	0.25	4.05	tree ( <i>Catalpa</i> sp.)	10.07	4.30	0.67	27.80	12.95
75	4.20	0	N	0.00	0.70	utility pole	12.39	0.70	0.29	0.70	3.50
76	11.73	155	S/SE	0.30	0.65	utility pole	12.24	0.95	0.33	6.10	10.90
77	5.89	25	N/NE	0.00	1.25	utility pole (light & transformer)	11.21	1.25	0.30	1.00	7.10
78	11.44	355	N	0.60	–	utility pole (light & transformer)	11.88	–	0.30	0.80	4.35
79	8.32	335	N/NW	0.00	1.70	utility pole	9.92	1.70	0.27	1.10	1.20

Appendix 8a. Continued.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
80	10.40	345	N/NW	1.60	0.30	utility pole (light & transformer)	10.88	1.90	0.35	2.85	9.80
81	10.40	190	S	0.35	0.45	utility pole (light & transformer)	10.88	0.80	0.35	0.50	11.95
82	8.00	200	S/SW	0.00	–	utility pole (light)	9.50	–	0.30	2.00	13.40
83	7.20	150	S/SE	5.65	1.20	tree ( <i>Ulmus americana</i> )	12.16	6.85	0.53	23.00	19.00
84	8.80	320	NW	0.00	2.15	utility pole	10.24	2.15	0.30	22.00	13.75
85	8.19	270	W	0.00	–	utility pole (light)	8.58	–	0.25	2.40	1.20
86	9.92	140	SE	3.20	3.10	tree ( <i>Ulmus crassifolia</i> )	15.52	6.30	0.80	3.50	0.93
87	6.11	155	S/SE	3.90	3.50	tree ( <i>Quercus fusiformis</i> )	9.28	7.40	0.86	12.60	14.15
88	8.46	75	E/NE	0.00	1.35	utility pole (transformer)	11.16	1.35	0.41	10.30	14.85
89	10.54	320	NW	0.90	1.50	tree ( <i>Carya illinoensis</i> )	16.15	2.40	0.62	11.10	25.00
90	8.50	200	S/SW	6.00	0.70	tree ( <i>Celtis reticulata</i> )	13.09	6.70	0.44	5.70	8.30
91	9.36	60	E/NE	0.93	0.30	utility pole	10.26	1.23	0.38	25.00	4.70
92	4.86	130	SE	0.00	1.00	utility pole (double, east side)	10.44	1.00	0.31	4.95	15.65
93	6.75	85	E	4.00	2.80	tree ( <i>Quercus fusiformis</i> )	13.50	6.80	0.84	8.20	8.20
94	10.62	345	N/NW	0.40	1.00	utility pole	11.34	1.40	0.29	17.00	7.50
95	4.32	40	NE	1.50	2.40	tree ( <i>Quercus fusiformis</i> )	8.10	3.90	0.30	2.40	2.40
96	9.03	40	NE	1.30	1.90	tree ( <i>Quercus fusiformis</i> )	11.00	3.20	0.59	31.00	25.00

Appendix 8a. Continued.

Site ID	Nest Height (m)	Nest Orientation (directional degrees)	Nest Direction	Nest Distance to Trunk (m)	Nest Distance to Canopy Edge (m)	Nest Structure	Structure Height (m)	Trunk to Canopy Edge Distance (m)	dbh (m)	Nearest Light Distance (m)	Nearest Building Distance (m)
97	5.28	200	S/SW	5.20	2.20	tree ( <i>Quercus fusiformis</i> )	10.71	7.40	0.59	22.00	32.00
98	7.52	300	W/NW	0.00	–	utility pole	8.32	–	0.25	4.20	0.70
99	5.27	290	W/NW	0.00	–	utility pole (light)	8.33	–	0.25	2.90	3.70
100	7.04	190	S	2.00	1.00	tree ( <i>Morus</i> sp.)	8.32	3.00	0.25	8.10	16.00
101	4.56	265	W	0.00	1.40	sign	6.84	1.40	0.20	11.80	8.90
102	7.52	260	W	0.00	1.60	utility pole	10.72	1.60	0.31	1.10	8.30
103	12.16	80	E	1.20	0.30	utility pole	12.35	1.50	0.32	0.90	13.80
104	5.92	30	N/NE	0.60	–	utility pole (wires adjacent)	8.96	–	0.40	27.00	10.40
105	10.88	155	S/SE	0.00	1.60	utility pole	12.58	1.60	0.31	11.80	6.90
106	8.48	195	S/SW	0.00	1.45	utility pole (transformer)	9.44	1.45	0.50	3.50	3.50
107	6.40	345	N/NW	0.00	1.20	utility pole (light & transformer)	8.96	1.20	0.30	1.10	16.00
108	10.45	75	E/NE	0.00	1.70	utility pole	11.78	1.70	0.48	1.95	19.00

Appendix 8b. Part 2 of data recorded for 2006 nest sites.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
46	Art Building courtyard	73.1	no	tree ( <i>Quercus fusiformis</i> )	6.60	6.60	tree ( <i>Quercus fusiformis</i> )	6.60	6.60	18.20	Comanche
47	Art Building lot gate	38.14	yes, grass & small trees	tree ( <i>Parkinsonia aculeata</i> )	1.10	3.80	tree ( <i>Carya illinoensis</i> )	17.00	22.00	1.60	Sessom
48	Sessom @ Alamo	38.14	yes, grass	tree ( <i>Quercus fusiformis</i> )	8.00	9.25	utility pole	13.50	14.20	11.90	Sessom
49	Art Building lot (original)	32.66	yes, grass	tree ( <i>Quercus fusiformis</i> )	3.70	6.60	tree ( <i>Quercus fusiformis</i> )	3.70	6.60	41.70	Comanche
50	Art Building courtyard	32.66	yes, grass	tree ( <i>Platanus occidentalis</i> )	9.70	13.10	tree ( <i>Quercus fusiformis</i> )	11.20	17.50	49.00	Sessom
51	Sessom @ Comanche (SE corner)	79.9	yes, grass & ground cover	tree ( <i>Quercus fusiformis</i> )	5.30	8.90	tree ( <i>Quercus fusiformis</i> )	5.30	8.90	13.10	Comanche

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
52	Sessom @ Alamo	130.88	yes, grass & trees	tree ( <i>Juniperus ashei</i> )	4.70	7.60	utility pole	7.00	6.95	9.50	Academy
53	Campus Christian Community	83.03	yes, ground cover	tree ( <i>Cercis canadensis</i> )	10.62	4.21	tree ( <i>Quercus fusiformis</i> )	15.00	17.00	50.00	Guadalupe
54	Campus Colony Apartments (U-pole)	114.25	no	tree ( <i>Cercis canadensis</i> )	6.70	8.70	utility pole	–	7.50	8.75	Comanche
55	President's House Commuter lot #2	71.84	yes, grass	tree ( <i>Pyrus calleryana</i> )	9.30	11.90	utility pole (light)	–	11.60	9.10	Academy
56	Alkek Library (Guadalupe)	83.03	yes, grass, shrubs, & ground cover	tree ( <i>Quercus fusiformis</i> )	3.45	7.80	tree ( <i>Quercus fusiformis</i> )	3.45	7.80	16.00	Guadalupe
57	President's House Commuter lot #2	21.63	yes, grass & shrubs	tree ( <i>Ulmus crassifolia</i> )	10.40	11.90	tree ( <i>Ulmus crassifolia</i> )	10.40	11.90	12.10	James

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
58	President's House Commuter lot #1	21.63	yes, grass & shrubs	tree ( <i>Quercus fusiformis</i> )	4.90	12.50	tree ( <i>Quercus fusiformis</i> )	4.90	12.50	11.05	Academy
59	Campus Colony Apartments (tree)	19.68	no	tree ( <i>Ulmus crassifolia</i> )	2.10	22.00	tree ( <i>Carya illinoensis</i> )	17.00	24.00	3.15	Comanche
60	Campus Colony Apartments (U-pole)	19.68	no	tree ( <i>Quercus fusiformis</i> )	3.23	4.49	tree ( <i>Quercus fusiformis</i> )	3.23	4.49	4.50	Woods
61	Lindsay @ North Parking Lot	99.18	yes, little grass	tree ( <i>Quercus fusiformis</i> )	7.40	10.98	utility pole	–	6.58	4.10	Woods
62	Colloquium (small on LBJ)	92.71	no	tree ( <i>Quercus fusiformis</i> )	0.00	4.00	tree ( <i>Quercus fusiformis</i> )	0.00	4.00	1.15	Guadalupe
63	Campus Colony Apartments (tree)	91.45	yes, some grass	tree ( <i>Quercus fusiformis</i> )	20.00	29.00	utility pole (transformer)	–	3.16	0.00	Comanche



Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
64	Woods Street (middle)	99.18	no	tree ( <i>Ligustrum lucidum</i> )	5.91	6.66	tree ( <i>Quercus fusiformis</i> )	8.00	10.73	7.37	North
65	Chipotle drive-thru	75.46	yes, little grass	tree ( <i>Celtis reticulata</i> )	7.20	7.80	utility pole (light)	–	6.05	29.00	Concho
66	Haircuts Etc.	145.55	grass (pond near)	tree ( <i>Quercus buckleyi</i> )	4.80	10.30	tree ( <i>Quercus buckleyi</i> )	4.80	10.30	0.70	University
67	Fed Ex/Kinko's	103.04	no	tree ( <i>Pistacia chinensis</i> )	1.50	4.60	utility pole	–	18.00	0.90	University
68	Chipotle drive-thru	73.99	no	tree ( <i>Pistacia chinensis</i> )	28.00	33.00	utility pole	1.30	0.45	0.50	LBJ
69	University @ LBJ (NE corner)	73.99	yes, little grass & shrubs	tree ( <i>Ulmus crassifolia</i> )	18.50	21.00	utility pole (light)	–	16.00	2.50	University

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
70	Exxon (Guadalupe)	53.76	yes, little grass	tree ( <i>Carya illinoensis</i> )	22.00	25.00	utility pole (light)	–	23.00	1.60	Guadalupe
71	7 / 11	59.67	yes, ground cover	tree ( <i>Cercis canadensis</i> )	6.50	7.70	tree ( <i>Sapium sebiferum</i> )	10.60	16.00	4.80	Pat Garrison
72	7 / 11	53.76	yes, little grass	tree ( <i>Carya illinoensis</i> )	3.90	12.40	utility pole	–	6.05	1.30	Guadalupe
73	Hutchinson @ Edward Gary (SW corner)	39.96	yes, tiny bit grass	tree ( <i>Quercus fusiformis</i> )	21.00	26.00	tree ( <i>Quercus fusiformis</i> )	21.00	26.00	5.60	Edward Gary
74	Lo's Liquor alley (Edward Gary)	64.93	yes, grass	tree ( <i>Ulmus crassifolia</i> )	10.70	16.00	tree ( <i>Ulmus crassifolia</i> )	10.70	16.00	3.10	Hutchinson
75	Jack Brown Cleaners	27.86	no	tree ( <i>Populus</i> sp.)	16.04	17.67	utility pole	–	24.00	4.80	Hutchinson

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
76	Hutchinson @ Edward Gary (SW corner)	61.24	yes, tiny bit grass	tree ( <i>Celtis reticulata</i> )	27.00	38.00	utility pole (light)	–	5.05	6.90	Hutchinson
77	Hutchinson @ Edward Gary (SW corner)	27.86	no	tree ( <i>Lagerstroemia indica</i> )	7.05	7.09	tree ( <i>Morus</i> sp.)	16.24	18.66	5.15	Edward Gary
78	Hutchinson @ Guadelupe (SE corner)	25.91	no	tree ( <i>Quercus fusiformis</i> )	31.00	34.00	utility pole	–	30.00	1.40	Hutchinson
79	Haircuts Etc.	64.93	no	tree ( <i>Celtis reticulata</i> )	1.50	5.80	tree ( <i>Celtis reticulata</i> )	1.50	5.80	0.00	alley
80	HEB tree (NE lot)	37.89	yes, grass	tree ( <i>Carya illinoensis</i> )	2.90	0.70	tree ( <i>Carya illinoensis</i> )	2.90	0.70	3.00	Hutchinson
81	HEB tree (NE lot)	37.89	yes, grass	tree ( <i>Carya illinoensis</i> )	5.50	3.30	tree ( <i>Carya illinoensis</i> )	5.50	3.30	0.75	Hutchinson

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
82	Fire Station	25.91	no	tree ( <i>Sabal mexicana</i> )	19.50	21.00	utility pole (light)	–	24.00	1.40	Hutchinson
83	Methodist Church #1 &2 (across from Hutchinson)	37.89	yes, grass	tree ( <i>Lagerstroemia indica</i> )	10.70	13.55	utility pole	–	12.60	9.15	Fredericksburg
84	Century 21 office	46.38	yes, some grass	tree ( <i>Ulmus crassifolia</i> )	1.90	4.00	utility pole	–	9.00	0.95	Comanche
85	Wells Fargo Bank (West alley)	85.98	no	tree ( <i>Quercus muhlenbergii</i> )	24.00	27.00	utility pole (light)	–	23.00	3.10	Hopkins
86	HEB (Comanche)	46.38	yes, few flowers	tree ( <i>Carya illinoensis</i> )	10.20	12.70	tree ( <i>Carya illinoensis</i> )	10.20	12.70	22.00	Hopkins
87	Mr. Gattii's (SW lot)	70.46	yes, ground cover	tall shrub (?)	6.20	6.60	utility pole (light & transformer)	–	13.80	0.60	alley

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
88	Ozona Bank (West alley)	57.32	yes, shrubs	tree ( <i>Quercus fusiformis</i> )	59.00	60.00	utility pole (light)	–	5.00	0.65	alley
89	Ozona Bank (East alley)	91.33	yes, grass & shrubs	tree ( <i>Ulmus crassifolia</i> )	12.00	14.20	tree ( <i>Ulmus crassifolia</i> )	12.00	14.20	14.50	Guadalupe
90	Tax Assessor Building	63.19	no	tree ( <i>Celtis reticulata</i> )	4.90	7.40	utility pole (light & transformer)	–	5.70	0.00	alley
91	Ozona Bank (East alley)	57.32	no	tree ( <i>Celtis reticulata</i> )	64.00	69.00	utility pole (light & transformer)	–	25.00	0.00	Fredericksburg (alley)
92	Bank of America drive-thru	70.46	yes, grass, weeds, & small trees	tree ( <i>Ligustrum lucidum</i> )	0.70	3.35	utility pole (light & transformer)	–	4.95	1.80	alley
93	Wells Fargo Bank back lot #1	26.03	yes, grass	Tall shrub ( <i>Ilex vomitoria</i> )	16.85	19.00	utility pole	–	0.50	1.60	Edward Gary

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
94	Wells Fargo Bank back lot #2	61.03	no	tree ( <i>Quercus fusiformis</i> )	46.00	51.00	utility pole (light)	–	17.00	6.60	San Antonio
95	Ozona Bank (East alley)	71.4	yes, grass, shrubs, & ground cover	tree (?)	27.20	32.00	utility pole (double)	–	5.20	3.35	alley
96	Wells Fargo Bank back lot #2	9.19	no	tree ( <i>Quercus fusiformis</i> )	3.45	7.50	tree ( <i>Quercus fusiformis</i> )	3.45	7.50	2.30	San Antonio
97	Wells Fargo Bank back lot #1	9.19	no	tree ( <i>Quercus fusiformis</i> )	2.20	8.00	tree ( <i>Quercus fusiformis</i> )	2.20	8.00	7.80	San Antonio
98	Ozona Bank (West alley)	139.54	no	tree (?)	32.00	25.00	tree (?)	32.00	25.00	23.80	Comanche
99	Rhino Graphics alley	61.88	no	tree ( <i>Lagerstroemia indica</i> )	17.00	18.00	utility pole (light & transformer)	–	18.00	5.80	LBJ

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
100	Wells Fargo Bank back lot #2	57.62	yes, grass, weeds, shrubs, & small trees	tree ( <i>Celtis reticulata</i> )	2.50	3.50	tree ( <i>Celtis reticulata</i> )	2.50	3.50	6.80	alley
101	Ozona Bank drive-thru	100.08	yes, tiny bit grass & weeds	tree ( <i>Quercus fusiformis</i> )	25.00	30.00	utility pole	–	20.00	9.40	Guadalupe
102	Dayton Tires alley	48.77	yes, tiny bit of grass & weeds	tree ( <i>Celtis reticulata</i> )	12.70	19.00	tree ( <i>Celtis reticulata</i> )	12.70	19.00	1.35	alley
103	Costumed Occasions alley	60.26	no	tree (?)	21.00	28.00	utility pole (light & transformer)	–	29.00	2.00	LBJ
104	MLK @ LBJ (NW corner)	88.06	yes, grass & shrubs	tree ( <i>Ehretia anacua</i> )	6.05	8.30	utility pole (light)	–	32.00	2.15	MLK

Appendix 8b. Continued.

Site ID	NND Nest Name	NND (m)	Ground Cover or Understory Vegetation	Nearest Tree	Nearest Tree Canopy Distance (m)	Nearest Tree Trunk Distance (m)	Nearest Other Possible Nesting Structure	Distance to Nearest Possible Nest Structure Canopy (m)	Distance to Nearest Possible Nest Structure Trunk (m)	Nearest Street Distance (m)	Nearest Street Name
105	Costumed Occasions alley	48.77	yes, small amount of grass & weeds	tree ( <i>Ulmus americana</i> )	4.50	19.00	tree ( <i>Ulmus americana</i> )	4.50	19.00	1.00	alley
106	Golden Chick	80.15	no	tree ( <i>Celtis reticulata</i> )	3.10	8.15	tree ( <i>Celtis reticulata</i> )	3.10	8.15	1.20	alley
107	Dayton Tires alley	56.12	yes, tiny bit grass & weeds	tree ( <i>Carya illinoensis</i> )	58.00	61.00	utility pole	–	28.00	0.90	Guadalupe
108	Dayton Tires alley	67.78	yes, some grass	tree ( <i>Pyrus calleryana</i> )	49.00	54.00	utility pole (capacitors)	–	16.00	2.50	MLK



Appendix 9. Nest site ID, UTM coordinates (WGS 84 map datums), nest site name, nest placement, and number of fledglings.

Site ID	UTM Easting	UTM Northing	Nest Site Name	Nest Placement	Fledglings
1	602189.52	3306022.94	CenturyTel alley	bottom wooden cross arm & wire loops	1
2	602268.27	3306008.90	Golden Chick	bottom transformer attachment	3
3	602365.91	3306099.10	Costumed Occasions	bottom transformer attachment	3
4	602252.87	3306121.78	Comet Cleaners (across from)	wires against pole	2
5	602526.38	3306140.82	Farmers' Market lot	tree branches facing upward to SW side	3
6	602436.26	3306143.28	Rhino Graphics alley	against cut-out to N side	3
7	602224.41	3306127.98	Comet Cleaners Parking Sign	right diagonal sign support	0
8	602035.54	3306131.70	Sierra's Carpet Service	wires against bracket & post	3
9	602110.01	3306169.70	San Antonio @ Fredericksburg (SW corner)	very top of pole	2
10	602003.50	3306212.21	Price Senior Center (Comanche side)	wires against bracket & post	2
11	602423.15	3306225.26	Valentino's alley	inner-most DA bolt to E	1
12	602596.90	3306241.22	Mr. Gatti's (SE lot)	against cut-out to E	0
13	602096.71	3306255.62	Ozona Bank (West side)	inner-most DA bolt to W	0
14	602152.67	3306259.48	Ozona Bank (East side)	light attachment arm against pole	3
15	602539.58	3306281.92	Bank of America (SE lot)	bottom wire attachment bracket against pole	3
16	601985.40	3306328.44	HEB (Comanche side)	upper transformer attachment	4
17	602403.87	3306356.50	Pedal Power alley	wires & bottom connector at post	0
18	602293.00	3306375.56	Tap Room lot	bottom wooden cross arm, against main pole	3
19	602142.39	3306342.48	Methodist Church (East side alley)	curved metal platform that supports insulators	1

Appendix 9. Continued.

Site ID	UTM Easting	UTM Northing	Nest Site Name	Nest Placement	Fledglings
20	602455.01	3306365.74	Goodyear	against cut-out to E end	0
21	602071.55	3306389.34	HEB (NE lot)	SE lower part of tree, towards canopy edge	0
22	602009.64	3306399.85	Daily Directions	very top of post	3
23	602096.24	3306412.97	Methodist Church (across from Hutchinson)	inner-most DA bolt to S	2
24	602445.36	3306425.92	Jack Brown Cleaners	wires against pole	3
25	602233.75	3306420.87	Fire Station	outer-most DA bolt to N	2
26	602207.38	3306415.45	Hutchinson @ Guadalupe (SE corner)	wires against pole	3
27	602078.96	3306452.70	Frost Bank Drive-thru lot (Fredericksburg)	tri-pod legs support of light tower	2
28	602419.81	3306449.48	Farmer's Insurance	inner-most DA bolt to N	0
29	602382.51	3306444.49	Rawson's Upholstery (across from)	inner-most DA bolt to S	1
30	602482.55	3306508.28	Papillon Villa shopping center lot	very top of light tower	1
31	602240.15	3306565.40	Chipotle drive-thru	on top of lower wire attachment bracket	2
32	602168.85	3306501.09	Exxon	bottom transformer attachment	3
33	602189.67	3306565.37	Taco Bell lot (SW corner)	SW part of tree near top	3
34	602427.28	3306595.53	Edward Gary @ University (NW corner)	metal diagonal support of bottom cross arm	3
35	602583.87	3306617.08	Broadway Bank Drive-thru_A (across from)	between pole & capacitor box, E side	0
36	602581.49	3306617.06	Broadway Bank Drive-thru_B (across from)	bottom wooden cross arm, W side	3
37	602307.17	3306613.74	Italian Garden (across from)	upper transformer attachment	1
38	602197.52	3306698.60	McCarty Student Center	between two attachment brackets & wires against pole	3

Appendix 9. Continued.

Site ID	UTM Easting	UTM Northing	Nest Site Name	Nest Placement	Fledglings
39	601902.48	3306778.05	Campus Colony Apartments	inner-most DA bolt	3
40	601817.15	3306862.00	Biology Building lot	SE part of tree, smaller, lower branch	3
41	601379.40	3306933.77	Academy @ Sessom (SE corner)	wire attachment bracket against pole	2
42	601552.06	3307019.23	Art Building lot (tree)	SE part of tree, dense leaves & ball moss	2
43	601709.70	3307041.98	Student Center Dr. @ Gaillardia	N side small tree, close to canopy edge	2
44	601639.70	3307076.70	Comanche @ Sessom (SE corner)	W side large tree	5
45	601838.53	3307130.31	University Health Clinic lot	N side small tree, small upward directed branches	0
46	601647.44	3307071.47	Sessom @ Comanche (SE corner)	S/SW side of tree	4
47	601470.70	3307027.97	Sessom @ Alamo	lower cross arm on S side	0
48	601501.75	3307050.18	Art Building lot gate	small live oak between gates, N side tree	0
49	601583.22	3307036.42	Art Building courtyard	N directed branch, almost hanging over concrete fence	3
50	601552.43	3307025.45	Art Building lot tree (original)	E facing part of tree, near top	1
			Art Building lot tree (nest reused)		1
51	601699.60	3307011.42	College Inn Dorm (Comanche)	top of tree, almost center	3
52	601379.30	3306933.52	Sessom @ Academy (SE corner)	wire attachment bracket against pole	2
53	602111.15	3306877.34	Alkek Library (Guadalupe)	NE part of tree near top	4
54	601818.15	3306857.14	Biology Building lot	S facing branch of tree, almost to edge	3
55	601494.22	3306832.09	President's House Magnolia tree	W part of tree, closer in to trunk	0*
56	602156.10	3306808.14	Campus Christian Community	SE part of tree	4

\* Nest destroyed by rain storm.

Appendix 9. Continued.

Site ID	UTM Easting	UTM Northing	Nest Site Name	Nest Placement	Fledglings
57	601558.07	3306793.18	President's House Commuter lot #1	N/NE part of tree	4
58	601542.81	3306778.49	President's House Commuter lot #2	W/NW part of tree	2
59	601901.03	3306777.19	Campus Colony Apartments (U-pole)	on outer-edge of DA bolt to W	2
60	601903.60	3306758.19	Campus Colony Apartments (tree)	top, slightly NE, directly under wires	2
61	601794.73	3306734.65	Woods Street (middle)	N side of tree near top	3
62	602162.39	3306703.18	McCarty Student Center (tree)	tree in NW part near top	2
63	601918.47	3306667.85	Lindsay @ Comanche (NE corner)	N/NW center top of tree	3
64	601734.38	3306656.14	Lindsay @ North Parking Lot (South of stop sign)	SW part of tree S of stop sign, upward facing branch	1
65	602231.20	3306640.94	Colloquium (small on LBJ)	SE facing part of tree near top	2
66	602584.33	3306616.77	Broadway Bank Drive-thru (across from)	between pole & capacitor box, E side	3
67	602426.66	3306595.50	University @ Edward Gary (NW corner)	metal diagonal support of bottom cross arm	4
68	602314.22	3306575.30	University @ LBJ (NE corner)	arm attached to pole facing South	4
69	602239.88	3306565.63	Chipotle drive-thru	on top of lower wire attachment bracket	5
70	602163.37	3306554.39	7 / 11	wires against pole	3
71	602107.76	3306530.84	Frost Bank new drive-thru (Pat Garrison)	SW part of tree, right above drive-thru awning	0
72	602168.97	3306501.43	Exxon (Guadalupe)	bottom transformer attachment	4
73	602434.14	3306491.87	Fed Ex/Kinko's	between pole & capacitor box	3
74	602568.65	3306472.26	Haircuts Etc.	nest on E side tree, upwards facing crook of branches	5
75	602442.38	3306453.56	Hutchinson @ Edward Gary (SW corner)	lower wires against pole	1

Appendix 9. Continued.

Site ID	UTM Easting	UTM Northing	Nest Site Name	Nest Placement	Fledglings
76	602381.31	306444.04	Rawson's Upholstery (across from)	inner-most DA bolt to S	2
77	602445.50	3306425.16	Jack Brown Cleaners	wires against pole	5
78	602232.24	3306420.73	Fire Station	W outside edge of outer-most DA bolt to N	2
79	602518.37	3306431.24	Lo's Liquor alley (Edward Gary)	bottom cross arm on N side	3
80	602096.29	3306414.39	Methodist Church #2 (across from Hutchinson)	N DA bolt next to tree	2
81	602096.69	3306412.72	Methodist Church #1 (across from Hutchinson)	inner-most DA bolt to S	1
82	602206.86	3306415.57	Hutchinson @ Guadalupe (SE corner)	wires against pole	3
83	602068.81	3306386.80	HEB tree (NE lot)	S/SE edge of canopy	3
84	601984.95	3306329.35	HEB (Comanche)	lower wires against pole	2
85	602352.24	3306327.43	Hopkins @ LBJ (NE corner)	light arm bracket against pole	3
86	601957.39	3306291.66	Century 21 office	SE part of tree	2
87	602536.10	3306297.38	Bank of America drive-thru	S facing in upper part of tree near top	1
88	602150.92	3306273.75	Ozona Bank (East alley)	top bracket of E facing transformer	2
89	602242.08	3306273.18	Courthouse (NW corner)	N/NE part of tree	4
90	602417.08	3306270.84	Wells Fargo Bank (West alley)	SW part of tree, just above utility wires running below	0
91	602096.21	3306256.76	Ozona Bank (West alley)	N outside edge of inner-most DA bolt	0*
92	602554.57	3306228.94	Mr. Gatti's (SW lot)	wires against E pole of double utility poles set	0
93	602480.22	3306222.22	Wells Fargo Bank drive-thru	E side of tree	0
94	602408.90	3306207.73	Tax Assessor Building	inner-most DA bolt to N	1

\* Nest destroyed by rain storm.

Appendix 9. Continued.

Site ID	UTM Easting	UTM Northing	Nest Site Name	Nest Placement	Fledglings
95	602158.66	3306203.85	Ozona Bank drive-thru	N side of tree	0
96	602472.72	3306197.31	Wells Fargo Bank back lot #1	NE part of tree near top	2
97	602467.28	3306189.65	Wells Fargo Bank back lot #2	SW part of tree, near lower branch	0
98	602035.14	3306131.76	Sierra's Carpet Service	wires against bracket & post	2
99	602377.58	3306145.81	Rhino Graphics front (LBJ)	lower wires against pole	3
100	602438.92	3306139.65	Rhino Graphics alley	nest in dead tree, crook of upwards facing branches	0
101	602224.16	3306127.64	Comet Cleaners Parking Sign	right diagonal sign support	3
102	602311.21	3306078.03	Costumed Occasions alley	bottom transformer attachment	1
103	602370.37	3306068.06	Diaz Martial Arts (LBJ, N of MLK)	beneath eastern-most DA bolt	4
104	602461.93	3306029.48	Ted Breihan Electric (across from)	wire loop adjacent to utility pole	3
105	602320.33	3306030.08	Dayton Tires alley	S facing top metal cross arm	3
106	602189.53	3306022.57	CenturyTel alley	bottom wooden cross arm & wire loops	4
107	602268.62	3306008.77	Golden Chick (original)	bottom transformer attachment	3
			Golden Chick (nest reused)		0
108	602380.02	3305998.17	MLK @ LBJ (NW corner)	E edge of crossbar	0*

\* Nest destroyed by rain storm.

Appendix 10. Unused site ID, UTM coordinates (WGS 84 map datums), and site description.

Site ID	UTM Easting	UTM Northing	Unused Site Description
R1	601713.10	3307143.11	SE corner Sessom & Tomas Rivera
R2	601747.46	3307186.31	NE corner off of Health Center bldg on Sessom
R3	601784.87	3307196.15	E side of Health Center
R4	601863.12	3307156.84	u-pole E of big live oak @ E of Health Center lot
R5	601440.88	3306996.05	u-pole off Sessom @ turn-in to middle parking lot
R6	601555.54	3307067.68	u-pole 2nd to W of Comanche @ Sessom
R7	601631.20	3307031.33	Center of Comanche between Sessom & Student Center Dr
R8	601727.43	3307047.58	NW corner of Gaillardia @ Student Center Dr
R9	601791.25	3307082.53	u-pole on corner NW of Student Center Dr @ Tomas Rivera
R10	601845.37	3307094.95	u-pole near SE corner of Tomas Rivera & Student Center Dr
R11	601876.82	3307135.15	curve of Student Center Dr to SW of Power plant
R12	601377.04	3306942.56	u-pole @ NE corner of Academy @ Sessom
R13	601455.99	3306935.10	live oak in courtyard of Family & Consumer science bldg
R14	601595.30	3306894.78	pecan tree behind President's house
R15	601607.56	3306938.63	sycamore tree @ stairs on W side of Mitte bldg
R16	601701.86	3306994.37	live oak nearest Comanche @ NW corner of College Inn
R18	601755.08	3306954.96	live oak between LBJ garage & Student Center bldg
R20	602045.64	3307002.63	oak in middle of Alkek N side on Pickard
R21	601439.47	3306872.84	u-pole near W entrance to Family & Consumer Science bldg
R22	601571.32	3306828.00	Live Oak tree corner sidewalk of President's house
R23	601630.08	3306858.58	Pecan tree edge of President's house yard, east side
R24	601709.04	3306863.65	Live Oak tree front of Biology Building in planter

## Appendix 10. Continued.

Site ID	UTM Easting	UTM Northing	Unused Site Description
R28	602013.61	3306880.72	live oak in front of Library book return garage
R29	602131.77	3306875.73	live oak E of Alkek crest tree
R30	602213.26	3306903.07	live oak next to SE entrance to Evans building
R31	602267.91	3306898.48	SE corner of LBJ @ Bobcat Trail
R32	602495.05	3306888.07	tree @ NW corner of Moon & Woods
R33	601548.70	3306766.79	across from San Marcos Hall Dorm sign on Academy
R35	601732.71	3306767.53	middle of Vista behind greenhouse
R36	601791.27	3306814.19	u-pole north side apartments opposite bio building on Vista
R37	601879.63	3306795.32	next to Campus Colony Apartments bldg
R38	602033.06	3306761.20	NW corner of Tower Dorm on Woods
R39	602021.61	3306827.11	big tree live oak next to Food Service on Talbot
R41	602196.60	3306771.82	live oak on Woods across from police lot exit
R42	602266.33	3306793.84	NW corner of LBJ @ Woods
R43	602328.50	3306797.57	E end of Laurel Dorm on Woods E of LBJ
R44	602432.08	3306738.43	tree @ NE corner of Concho @ Edward Gary
R45	602519.17	3306758.98	live oak tree on Moon NE corner of 2nd dorm
R46	601648.73	3306648.47	u-pole on Academy to SW of KA house
R47	601727.88	3306690.59	SE corner of North @ Woods
R48	601786.92	3306694.43	netleaf hackberry tree between apartments & house middle of Woods & Lindsay
9R4	601847.27	3306678.94	cedar elm tree by apartments courtyard off of Lindsay
R50	601961.82	3306662.74	u-pole center Lindsay across dorm garage
R51	602039.76	3306670.58	SE corner of Lindsay & Fredericksburg



## Appendix 10. Continued.

Site ID	UTM Easting	UTM Northing	Unused Site Description
R52	602137.52	3306730.07	u-pole on S side of E Tower Garage exit drive on Guadalupe
R53	602184.16	3306694.55	anacua tree to W of McCarty Center u-pole nest
R54	602274.52	3306708.10	u-pole directly opposite front door on E side Catholic Center on LBJ
R55	602334.33	3306705.29	live oak tree 4th from LBJ on N side of Concho next to dorm
R56	602394.18	3306683.26	next to end SW of dorm on corner of Concho & Edward Gary
R57	602530.53	3306655.11	live oak tree on Moon @ SE corner of 1st dorm
R58	602597.37	3306659.08	tree to left of huge tree on S walkway to theater
R60	601703.22	3306610.10	u-pole to W of Lindsay @ North parking lot driveway
R61	601949.18	3306571.41	u-pole middle of Pat Garrison & Lindsay on Comanche
R62	602045.02	3306633.14	middle of Fredericksburg between Lindsay & Pat Garrison
R63	602130.84	3306626.51	large live oak N of Tanco on Guadalupe in Undergrad Admissions yard
R64	602179.96	3306598.25	u-pole on NW corner of Taco Bell lot
R65	602284.36	3306641.70	u-pole @ alley on S side of small Colloquium
R66	602367.23	3306582.47	u-pole on University directly across from alley behind Sherman Williams
R67	602423.91	3306579.90	large u-pole on SW corner of Edward Gary & University
R70	602671.90	3306549.67	u-pole CM Allen between Hutchinson & University
R71	601962.11	3306497.96	u-pole SE corner of Pat Garrison @ Comanche
R72	602035.20	3306514.80	middle of Pat Garrison between Comanche & Fredericksburg
R73	602140.09	3306497.55	exit alley for Frost bank drive-thru
R74	602196.39	3306491.72	middle of Guadalupe between Pat Garrison & Hutchinson
R75	602252.47	3306496.13	u-pole middle of Jack-n-Box alley on E side
R76	602371.74	3306491.52	W leg of double u-pole Kinko's alley closest to Hutchinson

## Appendix 10. Continued.

Site ID	UTM Easting	UTM Northing	Unused Site Description
R77	602426.57	3306543.14	u-pole in front of Sherman Williams
R78	602514.80	3306502.69	u-pole in alley directly behind Minuteman Press
R79	602585.41	3306498.46	NE corner of Hutchinson @ Moon
R80	601964.08	3306393.34	u-pole NW corner Comanche @ Hutchinson
R81	602034.21	3306405.91	middle Hutchinson between Comanche & Fredericksburg
R82	602121.62	3306415.83	middle of Hutchinson between Fredericksburg & Guadalupe
R83	602180.96	3306423.29	u-pole NW corner of Guadalupe @ Hutchinson
R85	602348.44	3306437.29	just East on Hutchinson from LBJ
R86	602399.54	3306384.79	u-pole in NW corner of Pedal Power back lot
R88	602612.65	3306440.30	u-pole CM Allen on SW corner of Chamber of Commerce lot
R89	601973.48	3306323.39	u-pole W side Comanche across HEB
R90	602015.45	3306314.97	light tower HEB front lot
R91	602090.22	3306305.84	u-pole behind HEB, Fredericksburg
R92	602204.62	3306305.71	u-pole NW corner of Hopkins @ Guadalupe
R93	602284.33	3306292.39	tree directly N of courthouse center
R94	602349.55	3306306.94	light tower SE corner of Hopkins @ LBJ
R95	602439.66	3306318.69	tree W side of Wells Fargo front ATM
R96	602559.87	3306334.79	Mr. Gatti's front sign
R98	601984.52	3306212.75	u-pole on Comanche SE corner Longhorn Dental lot
R99	602049.28	3306185.34	u-pole SE corner of Price Senior Center
R100	602099.20	3306237.17	u-pole W side Ozona Bank Fredericksburg
R101	602155.61	3306238.73	u-pole E side Ozona Bank alley

## Appendix 10. Continued.

Site ID	UTM Easting	UTM Northing	Unused Site Description
R102	602247.31	3306233.65	SW corner courthouse yard
R103	602371.08	3306202.18	NE corner of LBJ @ San Antonio
R104	602424.36	3306210.55	u-pole Valentino alley off San Antonio NE corner
R105	602496.91	3306223.74	u-pole NE corner of San Antonio @ Edward Gary
R106	602604.32	3306224.41	u-pole SW corner of San Antonio & CM Allen
R107	602008.38	3306112.91	u-pole on Comanche across from Sierra Carpet drive-way
R108	602119.91	3306099.85	u-pole on Fredericksburg between Little Guys Movers & house
R109	602169.28	3306147.06	u-pole on alley by CenturyTel office
R110	602269.78	3306147.35	behind south square buildings
R111	602386.05	3306090.31	front of u-pole cutting corner salon
R112	602453.69	3306175.22	u-pole in Wells Fargo back lot
R113	602507.15	3306161.59	u-pole next to driveway old hardware store & farmers market
R114	602609.73	3306196.80	u-pole 1 South of SW corner CM Allen @ San Antonio
R116	602138.16	3305986.21	u-pole driveway of church on MLK @ Fredericksburg
R117	602189.83	3306066.58	u-pole in CenturyTel alley
R118	602259.68	3306067.22	u-pole on Guadalupe
R119	602326.02	3306008.41	u-pole across alley from Golden Chick drive-thru
R120	602442.55	3306096.71	u-pole in alley NW back corner of Ted Brehein
R121	602546.08	3306125.37	farmers market middle of awning
R122	602031.80	3305945.53	u-pole on NW corner of MLK @ Comanche
R124	602198.59	3305971.34	u-pole NW corner of MLK & CenturyTel alley
R125	602275.33	3305981.36	u-pole NE corner of MLK & Guadalupe

Appendix 11a. Anecdotes – Interesting Observations of Western Kingbirds in 2005.

- 13 April 2005: First Western Kingbird sighting of the season in the vicinity of nest site 40.
- 15 May 2005: At nest site 23 there was a Western Kingbird nest located on DA bolt of a utility pole and on the adjacent DA bolt there was a White-winged Dove (*Zenaida asiatica*) nest. The distance apart was approximately 0.5 m or a little less. Both nests were occupied at the same time.
- 5 June 2005: At nest site 1, a male Western Kingbird left the nest pole and joined a group of other birds, including Grackles (*Quiscalus* sp.) and Mockingbirds (*Mimus polyglottos*), mobbing a Red-shouldered Hawk (*Buteo lineatus*), while the female Western Kingbird remained on the nest.
- 5 June 2005: A Western Kingbird from nest site 7 flew across street to nest site 4, removed nesting material, and flew back to deposit material in its own nest. It returned to nest site 4 and stole more nesting material; however, this time it was chased by the owners of site 4. Site 4 owners returned to nest pole to guard the nest.

- 5 June 2005: Western Kingbird chicks at nest site 32 started begging for food even as White-winged Dove flew over nest.
- 11 June 2005: Western Kingbird nest at nest site 23 had three chicks present, while the adjacent White-winged Dove nest had two chicks present.
- 12 June 2005: At nest site 1, two adult Western Kingbirds left their chick in the nest and joined a Grackle to mob a Red-shouldered Hawk.
- 12 June 2005: At nest site 2, there are three Western Kingbird juveniles in the nest. They saw a bug flying over their heads. I could see their heads turning to follow the bug. Two of them tried to snap their beaks at the bug but did not catch it.
- 13 June 2005: The Western Kingbird juveniles from nest site 23 have left their nest; however, I found one dead in flower bed next to driveway near site. From comparing its state of development to other Western Kingbird fledglings, I thought that it looked too young to be ready to fledge. The adjacent White-winged Dove nest still had two juveniles present.

- 6 July 2005: At the base of the utility pole of nest site 20, I found a badly decomposed body of a bird. The wings were mostly still intact and the feather coloring looked like that of an adult Western Kingbird. Afterwards, I never saw any other western Kingbirds at this nest, so I believed it was the owner.
- 8 July 2005: It appears that a House Sparrow (*Passer domesticus*) has been attempting to build its nest next to the Western Kingbird nest at site 41, as there is nesting material present. The adult Western Kingbirds kept chasing off the House Sparrow.
- 30 July 2005: At nest site 8, a House Finch (*Carpodacus mexicanus*) has modified the Western Kingbird nest for its own use.
- 3 August 2005: A House Sparrow has completed building a nest next to the now abandoned Western Kingbird nest at site 41.
- 15 August 2005: Last Western Kingbird sighting of the season in the vicinity of nest site 12.

Appendix 11b. Anecdotes – Interesting Observations of Western Kingbirds in 2006.

11 April 2006: First Western Kingbird sighting of the season just north of the Texas State campus on N. LBJ Street.

18 May 2006: There were four Western Kingbirds perched on the utility lines between nest sites 59 and 60. There was a male Grackle sitting on top of the utility pole at nest site 59. One of the Western Kingbirds flew off and returned with what looked like nest building material. It repeatedly tried to chase off the Grackle without success. The Western Kingbird perched on the wire near the utility pole and started vocalizing, “pik...pik...pik.” After about five minutes, the other three Western Kingbirds that had been perched nearby flew over to assist in mobbing the Grackle and he finally left. The first Western Kingbird went back to building its nest on the utility pole and the other three dispersed.

23 May 2006: Nest site 104 had a nest in which I previously confirmed a Scissor-tailed Flycatcher (*Tyrannus forficatus*) sitting. The nest had been taken over by Western Kingbirds.

- 28 May 2006: Near nest site 66, a Western Kingbird was hawking over the pond that is just north. It was swooping back and forth over the pond and once came very close to the surface, appearing to skim the surface and get slightly wet. While in the same vicinity, I witnessed Western Kingbirds, Grackles, and some other birds mobbing a Red-shouldered Hawk.
- 5 June 2006: While at nest site 54, I witnessed a great commotion with a group of Western Kingbirds. Before I knew it, they had chased a Red-shouldered Hawk into the nest tree. The hawk perched in the tree for only a few seconds before the Western Kingbirds were successful at chasing it away.
- 6 June 2006: At nest site 87, a Turkey Vulture (*Cathartes aura*) flew low over the nest tree. One of the Western Kingbirds at this site went chasing after it.
- 13 June 2006: While observing the Western Kingbird family at nest site 82, I noticed the adults were making low swooping flights into the adjacent parking lot. I then noticed a fledgling on shrubbery next to the building of the parking lot. I kept my distance, but to my amazement, the fledgling hopped across the parking lot directly towards me. I was concerned that if it continued to hop in the same direction it would move into the



street. I returned about an hour later to find that the fledgling had indeed hopped into the middle of Guadalupe Street and was run over by cars.

- 14 June 2006: Late in the evening as the sun was almost down and the parking lights at the University Health Center were turned on, I witnessed a few Western Kingbirds flying and swooping around the parking lot. Although the behavior was characteristic of foraging behavior, I was unable to confirm if they were actually catching any insects. This was in the vicinity of 2005 nest site 45.
- 25 June 2006: I first suspected that the nest at site 107 was being reused. It looked as though it had been refurbished.
- 26 June 2006: The two chicks at nest site 62 started vocalizing as a White-winged Dove flew over their nest.
- 28 June 2006: I found the remains of the only fledgling from nest site 64. It had been run over by a car in the adjacent parking lot.
- 28 June 2006: I first suspected that the nest at site 50 was being reused.

- 1 July 2006: The three fledglings from nest site 70 were perched in some nearby trees. There was a fourth, much younger fledgling with them. I believe that this younger fledgling flew over from neighboring nest site 72, as there is one chick missing from there and it is about the correct age.
- 2 July 2006: The extra, younger fledgling is still with the Western Kingbird family from site 70.
- 2 July 2006: Near nest site 66, a Western Kingbird was again hawking over the pond that is just north. This time it definitely got wet as it swooped over the pond and returned dripping with water to perch on the utility lines.
- 2 July 2006: While at nest site 88, one of the Western Kingbirds noticed other Western Kingbirds dive-bombing a Grackle in a tree behind HEB grocery store on Fredericksburg. It flew to join in with the group of five.
- 3 July 2006: The extra, younger fledgling is still with the Western Kingbird family from site 70. It seems as though they have adopted it. It is responding to the parents from site 70.

- 5 July 2006: Parents at nest site 77 are both feeding the chicks. One parent flew in with a very large insect and feed it to one chick. The second parent flew in and fed the second chick a small insect and then promptly removed the oversized insect from the first chick's beak. It proceeded to fly up and perch on the utility wires above the nest. After several seconds it returned and re-fed the insect to the first chick.
- 8 July 2006: Suspected nest reuse at site 50 was confirmed as a female Western Kingbird was sitting in the nest.
- 8 July 2006: Suspected nest reuse at site 107 was confirmed as a female Western Kingbird was sitting in the nest.
- 13 July 2006: At reused nest site 107, an adult Western Kingbird was perched guarding the nest. It chased off a pair of House Finches. Upon returning, it stood on the edge of the nest bending down into it as if it was checking on hatchlings.
- 15 July 2006: At reused nest site 107, an adult Western Kingbird was standing on the edge of the nest bending down into it as if it was feeding or checking on hatchlings.
- 23 July 2006: I confirmed hatched chicks in the reused nest at site 50.

- 23 July 2006: Previously I had counted three chicks at nest site 84. This day there was only one chick. At the base of the utility pole, I found the intact skeletal remains of what I assume was one of the three chicks.
- 3 August 2006: Another Red-shouldered Hawk mobbing incident in vicinity of nest site 60.
- 18 August 2006: Last Western Kingbird sighting of the season in the vicinity of nest site 44.

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Katherine Marie Grobe was born in Las Cruces, New Mexico on 24 March 1972, to parents Robert P. and Marilyn J. Grobe. Katherine graduated in June 1990 from Skyline High School in Dallas, Texas. She continued her education at the college level, graduating in August 1995 with a Bachelor of Science degree in Biology from the University of Texas at Arlington. Katherine was admitted to the Graduate School of Education at the University of Texas at Arlington and earned a secondary science teaching certification in January 1997. For the next seven years, Katherine worked in a number of industries including education, cosmetic and pharmaceutical testing, hospital and healthcare administration, and telecommunications. In August 2004, Katherine was admitted to the Wildlife Ecology Graduate Program at Texas State University-San Marcos and began working toward a Master of Science degree.

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