PRODUCTIVITY OF AN URBAN WHITE-WINGED DOVE POPULATION AT THE BOUNDARY OF THE COASTAL PRAIRIES ECOREGION

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Eastern White-winged Doves (*Zenaida asiatica asiatica*) have been steadily expanding their breeding range in Texas northward since the 1950s. The cause of this range expansion could be attributed to habitat loss and land use changes within the original breeding range as a result of increased urbanization and agricultural production in the Lower Rio Grande Valley (LRGV). Newly colonized areas by White-winged Doves are generally urban with non-migratory populations. Study sites were located in residential neighborhoods in Katy, Texas in once farmed, but now abandoned rice fields.

My objectives were to survey for active nests of White-winged Doves at 10 randomly selected 1-ha sites and collect micro-habitat measurements at nest sites and trees during the 2009 nesting seasons. A tree survey determined the availability of potential nesting sites. Twenty-six active nests were found in 2009. The majority of nests (19 out of 26, 73%) occurred in three species of trees: live oak (11, 58%); loblolly pine (5, 26%); and blue jack oak (3, 16%) with the other 27% in seven different tree species. I rejected the null hypothesis of random selectivity of nesting trees by White-winged Doves ($P = 0.02$). Mean empirical nest success was 74.5%. Three variables (tree height, nest height, and mean canopy width) explained 76% of total variance influencing nest success.

CHAPTER 1

INTRODUCTION

Eastern White-winged Doves (*Zenaida asiatica asiatica*) are migratory game birds that breed throughout most of Texas (Small et al. 2005, 2006, 2007). Historically, White-winged Doves nested in South Texas along the Lower Rio Grande Valley (LRGV) primarily in colonial flocks inhabiting riparian areas along the Rio Grande delta at the state's southernmost tip (Schwertner et al. 2002, Small et al. 2006). They over-wintered south of the U. S. in southern Mexico and Central America (Cottam and Trefethen 1968, Swanson and Rappole 1992). Changes in distribution and habitat use by White-winged Doves have been occurring in Texas since the 1950s [Texas Parks and Wildlife Department (TPWD) 2007]. The loss of traditional breeding habitat to agricultural and urban development caused a habitat shift by White-winged Doves and a gradual expansion over the past several decades from historical riparian environments northward into alternative urban habitats with large populations now occurring in the larger urban centers of Texas (Purdy and Tomlinson 1982, 1991, West et al. 1993, George et al. 2004, Small et al. 2007, TPWD 2007, Dolton et al. 2008). The range expansion has also been eastward with White-winged Doves now inhabiting areas of southeastern Texas in the Houston area (TPWD 2007). Although breeding populations were originally restricted to rural environments in the LRGV, breeding populations are now common in urban areas (Schaefer et al. 2004, Breeden et al. 2007, Small et al. 2007).

In addition to changes in breeding range, changes have occurred in nesting behavior. White-winged Doves outside the LRGV have become urban obligate breeders with some individuals becoming year-round residents (Small et al. 2005, 2006, 2007) and successful breeding throughout the year (Hayslette and Hayslette 1999). Presently, more White-winged Doves inhabit and breed in areas of Texas outside the traditional LRGV than within (Schwertner et al. 2002, Collins et al. 2010). Currently, outside the LRGV, White-winged Dove nesting occurs only in and around urban areas (Small 2007). This may be in response to the year-round availability of anthropogenic food sources and other resources.

White-winged Doves are multiple-brooders and both males and females participate in incubation and fledgling care (Schacht et al. 1995). Urban nesting White-winged Doves seem to prefer older, more established residential neighborhoods with large trees. This may result from better protection of nests from predators and consistent food and water sources from bird feeders and watering of lawns. Yet, even as White-winged Doves become more dependent on urban areas for nesting sites, they still continue to aggregate in large fall feeding flight flocks (Small et al. 2005). These flights from urban areas to brush or agricultural tracts occur because of abundant food available in unharvested fields (Rabe 2008).

The primary focus of research on the expansion of White-winged Dove distribution in Texas has been in a north-south gradient primarily in central Texas (Schaefer et al. 2004, Small et al. 2005, 2006, 2007). Consequently, limited effort has been applied to studying a concurrent eastward range expansion. The presence of an urban population of White-winged

Doves nesting near Houston in the city of Katy in the Coastal Prairies ecoregion provided the opportunity for a needed study of productivity by White-winged Doves in a different ecoregion of Texas with different environmental and climatic dynamics. The objectives of my study were to document productivity of White-winged Doves breeding in an environment with a different array of potential nesting trees, assess nest success in an urban environment, and determine habitat selection between study sites.

CHAPTER 2

MATERIALS AND METHODS

Study Area

Surveys were conducted for White-winged Dove nests in Katy, Texas (29.79 ° N, 95.82 ° W) within Harris, Waller and Fort Bend counties in 2009. Katy encompasses 2,771.3 ha with a human population of about 13,833 (City-data 2007) and is primarily a suburban residential community west of Houston. Until the late 1960s, rice farming was the predominant industry in Katy. White-winged Doves possibly extended their distribution further east from central Texas because of an abundant, reliable food resource in rice fields.

The majority of my study sites are residential neighborhoods, but some are transitioning from residential to business zoning. Housing density varies from larger affluent, homes > 186 m^2 (Site 10) with fewer homes/ha to a mobile-home park (Site 3) with closely positioned trailers. Sites 1 and 2 are residential communities in a more rural area. The homes are middle to upper-class with large yards. Both sites are older neighborhoods with large oak and pine trees. Site 2 has a home with a large bird-seed pan feeder, where large numbers of White-winged Doves roost and feed. Site 3, a mobile-home park, has homes close to one other and a preponderance of Chinaberry trees (*Melia azedarach*). Site 4 is a residential neighborhood transitioning to a business district. Homes vary from trailers to small, historic-style houses. Sites 5 and 6 are older residential neighborhoods with lower to middle-class homes. Some yards are extremely over-grown and invasive species dominate the vegetation. One home in Site 6 has a bird feeder. Site 7 is a large church and adjoining parking lot. Trees line the road around the church. Site 8 is a newer neighborhood with closely-spaced, middle-class brick homes. Property sizes are smaller than Sites 1 and 2. Trees in this neighborhood are younger and smaller in size. Site 9 is located along a tree-lined street next to Katy Mills Mall; however, some trees sustained damage by Hurricane Ike in 2008. Site 10 is an affluent neighborhood with large homes and small yards. Trees are older and larger at this site.

Nest Search

I used the 2001 National Land Cover Database (U. S. Geological Survey 2003) to delineate areas classified as urban residential land for study sites in Katy. Ten points within residential areas (Fig. 1) were randomly selected using geographic information systems (GIS) ArcGIS version 9.2 (Environmental Systems Research Institute, Inc., Redlands, CA). Each point became the center of a 1-ha study site. I obtained landowner permission to access properties within the 1-ha study site. At each study site, I identified and counted all trees and shrubs (any woody plant $\geq$ 2 m in height) with the potential to function as nest sites for White-winged Doves at each study site (Cottam and Trefethen 1968).

I conducted searches for active White-winged Dove nests during June through August on the first and second day of each week (Rodewald 2004). Nests were designated as active if an adult was present on two consecutive visits and at least one egg or nestling was present (Small et al. 2010). I only collected and analyzed data on tree and nest-site attributes and nest success for active nests. Nest-site and tree parameter data collected included tree height, nest height (distance from a nest to the ground), nest distance from main tree truck, nest distance from nearest neighboring branch, nest aspect ratio (height of nest divided by distance from tree trunk), trunk diameter at breast height (indicator of size and age of tree), and mean canopy width (average width of two diameter measurements of the canopy width at the four cardinal directions).

Thereafter, I checked nests on the fourth day of each week using a wireless camera on an extendable pole with an LCD monitor (TreeTop Peeper 4®, Sandpiper Technologies, Inc., Manteca, CA), or for lower nests, a mirror on a pole confirmed active status. Active nests were monitored until all young fledged or the nest failed. When checking nest status, I minimized disturbance by avoiding flushing incubating adults (Hayslette et al. 2000). Incubation period was assumed to be 14 days as was hatching to fledging time (Boydstun and DeYoung 1987, Hayslette et al. 2000).

Productivity Analysis

I determined total young fledged for the nest monitoring period from nest surveys. I designated nests as successful or unsuccessful after fledging of nestlings. Mean number of young fledged/ha and mean nest success were calculated for each study site. I used these data to calculate empirical fledging success (Small et al. 2010). Each nest was categorized as successful (at least one young fledged) or unsuccessful (no young fledged). The number of young fledged from each nest (0, 1, or 2) was documented. For unsuccessful nests, I attempted to determine the cause of failure through observation of the nest site and adjacent area. Nests had an unknown fate if the nest monitoring period ended prior to a determinable nest outcome. Nest failures were categorized as abandoned, predation, destroyed, or unknown.

Statistical Analysis

I used Morisita's Index of Similarity to test for similarity of tree species occurring in the 10 study sites. Values for Morisita's Index of Similarity range from 0-1 with values near 1 indicating higher similarity (Krebs 1999). I calculated tree diversity and evenness for each study site using Brillouin's Diversity Index and Simpson' Measure of Evenness (Krebs 1999).

I used the Forage Ratio (Savage 1931, Williams and Marshall 1938) (also called the Selection Index) (Manly et al. 1993) to test for resource selection of nesting sites by White-winged Doves. I applied a Design I-type study with known proportions of available resources (trees) and known number of potential resources used (trees with nests) (Krebs 1999) to calculate a selection index (*w*) and 95% confidence limits with Bonferroni correction (α corrected to 0.0015). Selection indices may range from 0 to ∞ with indices > 1.0 indicating preference and values < 1.0 indicating avoidance. I tested my null hypothesis of random selectivity using a chi-squared log likelihood statistic.

Since nest location was an important variable, I measured the intensity of association between nest height and other tree variables using the Pearson product-moment correlation coefficient.

I used The Scrambler software program (Brothersoft.com), to conduct a principal component analysis (PCA) to determine whether a correlation existed between vegetative variables associated with trees used for nesting and nest success. A multiple linear regression (MLR) was used to determine which of these vegetative variables influenced nest success.

All activities were conducted in accordance with Texas State University–San Marcos IACUC approval #06-05CC59736D and state permit #SPR-0890-234.

CHAPTER 3

RESULTS

I counted and identified 634 trees and shrubs of 32 known species and one unknown species inhabiting the 10 study sites (Table 1). Mean number of trees and shrubs per study site was 63.4 (SE = 2.81, 95% CL = 57.0-69.8, Range = 46-73). Tree and shrub species inhabiting the 10 study sites had a moderate to high similarity except for Study Site 3 with a preponderance of Chinaberry trees (Table 2). Two sites, 9 and 10, had the most active nests in 2009; however, these sites had the least tree diversity but the highest evenness (Table 3). Live oak was the most available tree, although not the most abundant tree at all sites (Table 1).

In 2009, 26 active nests were found at eight sites. Tree species with active nests were similar at study sites (Table 1). Nests were located in 10 tree species with 42.3% (11) of nests in live oak and 19.2% (5) in loblolly pine trees. The remaining 10 (38.5%) nests occurred in 8 species: one in white ash (*Fraxinus americana*), cedar elm, crepe myrtle (*Lagerstroemia indica*), yaupon holly (*Ilex vomitoria*), water oak (*Quercus nigra*), short-leaf pine (*Pinus echinata*) and eastern baccharis (*Baccharis halimifolia*), and three in blue jack oak.

Thirty-three hatchlings successfully fledged from 52 eggs. Nests with known fates produced a mean of 1.75 (SE = 0.10) young/nest (Table 4). Empirical nest success was

74.5% (SE = 9.52, 95% CL = 52.0-97.0). Of 26 nests, one (4%) had unknown fate, four (15%) failed due to predation, two (8%) failed because of weather-related destruction, and 19 (73%) fledged young. Overall, 1.9 fledglings/ha were produced at my study sites. Extrapolating data from my study sites to Katy as a whole, an estimated 5,265 White-winged Doves fledged in residential areas of Katy, Texas in 2009.

Fourteen nests (73.7%) successfully fledged two hatchlings for a 100% nest success. Nests fledging two young were found at: Site 1 (two nests, one nest in a live oak and another in a crepe myrtle); Site 2 (one nest in short-leaf pine); Site 3 (one nest in an American ash); Site 5 (two nests in live oaks); Site 6 (one nest in a yaupon holly); and Site 8 (one nest in a live oak and another in a loblolly pine). Five nests (23.3%) successfully fledged one hatchling for a 50% nest success. Nests were found at: Site 6 (one hatchling fell out of nest in a water oak); Site 9 (one egg never hatched); and Site 10 (two hatchlings fell out of nests in loblolly pines and, due to human intervention one hatchling fell out of a nest in live oak). Seven nests produced no hatchlings for 0% nest success. Nests were found at: Site 1 (two nests in young live oaks destroyed by weather); Site 8 (one nest failed due to predation in blue jack oak); Site 9 (one nest failed from predation in eastern baccharis); and Site 10 (two nests failed due to predation in a loblolly pine and a live oak as well as one nest failure in a loblolly that was unknown).

White-winged Doves in Katy, Texas selected only 10 of 32 known species of trees for nesting sites. I rejected the null hypothesis of random selectivity of nesting trees by White-winged Doves (x^2 = 49.7, df = 32, P = 0.02). White-winged Doves selected live oak, loblolly pine, yaupon holly, American ash, short-leaf pine, blue jack oak, cedar elm, and eastern baccharis trees as preferred nesting sites (Table 5).

Table 6 presents measurements for seven variables associated with trees having active nests. The mean tree height was 7.56 m (SE = 0.62, 95% CL = 6.31-8.81 m, range = 2.74-16.8 m); mean nest height was 3.79 m (SE = 0.22, 95% CL = 3.34-4.24 m, range = 1.83-6.79 m); mean distance from nest to tree trunk was 2.62 m (SE = 0.29, 95% CL = 2.02-3.22 m, range = 0.13-7.32 m); mean distance from nest to nearest neighboring branch was 0.12 m (SE = 0.01, 95% CL = 0.09-0.15 m, range = 0.03-0.33 m); mean aspect ratio was 0.07 (SE = 0.02, 95% CL = 0.03-0.10, range = 0.01-0.60); mean canopy width was 4.17 m (SE = 0.34, 95% CL = 3.48-4.86 m, range = 1.83-10.1 m); and mean trunk diameter breast height was 0.36 m (SE = 0.44, 95% CL = 0.27-0.45 m, range = 0.08-1.22 m).

Nest height had the strongest and highly significant correlations with trunk diameter of tree at breast height ($r = 0.77$, $P < 0.001$), mean canopy width ($r = 0.71$, $P < 0.001$) and distance to tree trunk ($r = 0.67$, $P < 0.001$) and a weaker but significant correlation to tree height ($r = 0.50$, $P = 0.002$). Nest height had negative and non-significant correlations with distance to nearest neighboring branch ($r = -0.007$, $P = 0.97$) and nest aspect ratio ($r = -0.26$, $P = 0.12$).

Three variables (tree height, nest height, and mean canopy width) explained 76% of total variance influencing nest success (Fig. 2). Tree height explained (13%), nest height (58%), and mean canopy width (5%) of total variance influencing nest success (Fig. 2). Nest height had the strongest correlation to nest success ($r = 0.144$). The slopes of these three variables had the greatest effect on nest success based on successfully fledged chicks

CHAPTER 4

DISCUSSION

No studies have addressed nesting success and productivity of White-winged Doves in urban environments of the eastern Coastal Prairies ecoregion of Texas. My study provides new, important information on White-winged Doves at an extension of the breeding distributional boundary within the Coastal Prairies ecoregion. This is important information because White-winged Doves could potentially displace other dove species native to communities where expansion is occurring. Therefore, it is vital that populations near the breeding periphery be studied and monitored to develop appropriate management practices and harvest regulations.

White-winged Doves have adapted to environments that differ substantially from the semi-arid environs of their historic range and have altered a regular migratory pattern. Despite this, over half of the 26 nests I observed in Katy successfully fledged at least one dove. Fourteen nests (53.8%) and five nests (19.2%) successfully fledged one hatchling. These were unique findings based on only one nest (0.7%) fledged one young, whereas, 66 nests (47.5%) fledged two young out of 139 active nests in Mason, Texas (Small et al. 2010).

Although a variety of trees were available as potential nesting sites in Katy, Texas, White-winged Doves selected oaks, American ash, cedar elm, and short-leaf and loblolly pine trees as nest sites. Nine nests occurred in loblolly and short-leaf pine trees. Neither of these pine species were the most abundant trees at my study sites (Table 1). White-winged Doves have not previously been documented as using pine trees for nesting sites. During 2009, there were seven nests found constructed of pine needles instead of small twigs. Also, I documented the first nesting by White-winged Doves in water oak and blue-jack oak trees. Apparently selection for nesting sites by White-winged Doves is a broadly adaptable trait. White-winged Doves selected nesting sites in preferred tree species in southern Texas (Hayslette et al. 2000). Breeden et al. (2007) found dense canopy trees, such as live oak, were the best indicator of suitable nesting habitat in urban areas and predictors of White-winged Dove presence. In Mourning Doves (*Zenaida macroura*) in Kansas nest success correlated positively with vegetative height (Hughes et al. 2000). However in contrast to my results, Wiley (1991) concluded Zenaida Doves (*Zenaida aurita*) used nest trees in relation to their abundance in southwestern Puerto Rico.

Empirical nest success (74.5%) for White-winged Doves in Katy was higher than the values reported for the species in Mason, Texas (55.4%, Small et al. 2009) and Puerto Rico (29%, Rivera-Milan 1996). Empirical nest success for White-winged Doves in Katy was higher than the values reported for other columbids such as Mourning Doves in Kansas (56.4%, Hughes et al. 2000), California (22-45%, Miller et al. 2001) and Puerto Rico (21%, Rivera-Milan 1996), Ground Doves (*Columbina passerina*) in Puerto Rico (17%, Rivera-Milan 1996), Zenaida Doves in Puerto Rico (49%, Rivera-Milan 1996), and Rock Doves in Rhode Island (42%, Preble and Heppner 1981). Nest success by

White-winged Doves in my study was predicated on nest height, tree height, and mean canopy width.

White-winged Doves are susceptible to predation from raccoons (*Procyon lotor*), grackles (*Quiscalus mexicanus*), and opossums (*Didelphis virginiana*) (Swanson and Rappole 1992). Nests too close to the ground were found to be prone to predation from raccoons, house cats (*Felis catus*), and opossums (Boydstun and Deyoung 1987, Hughes et al. 2000). Nests not concealed well with foliage are prone to predation from corvids (*Corvidae*) and Great-tailed Grackles (*Quiscalus mexicanus*) (Hayslette et al. 1996). Predation was the main cause of nest failure for columbids in Puerto Rico where foliage cover was crucial for survival (Riviera-Milan 1996). Four of 26 (15%) active White-winged Dove nests at Katy failed because of predation. Predation and weather were the main causes of nest failure during 2009 surveys. Nests that are further out on limbs are more likely to be destroyed during strong storms (Hoover and Brittingham 1998).

Based on my data, White-winged Doves in Katy building nests at approximately one-half tree height and limb mid-length had the greatest probability of successfully fledgling young. Nest success for White-winged Doves in the Puerto Rico was 29% out of 20 active nests observed in the year following Hurricane Hugo (Rivera-Milan 1996). This was much lower than the 74.5% nest success the year following Hurricane Ike. Rivera-Milan (1996) found the more foliated trees provided nest cover, which accounted for a higher survival rates compared to sparsely foliated trees (Swanson and Rappole 1992). This held true in my observations. Nest densities were greatest in live oak trees, which have more foliage than other common trees at my study sites, such as crepe myrtle.

Future research is recommended to determine if management of dove productivity affects song bird nesting success. White-winged Doves could not only be displacing the smaller Mourning Dove but song birds as well. Both song birds and White-winged Doves interact at bird feeders around Katy.

Table 1. Morisita's Index of Similarity coefficients for similarity of tree species with active nests in 10 study sites in Katy, Texas in 2009. Similarity values ≥ 0.80 indicate a high degree of similarity, ≥ 50 indicate a moderate similarity, ≥ 30 indicate a slight similarity, and < 30 little similarity.

Sample Sites	1	2	3	4	5	6	7	8	9	10
1		0.68	0.38	0.88	0.97	0.68	0.86	0.88	0.72	0.93
2			0.61	0.60	0.67	0.55	0.79	0.93	0.41	0.85
3				0.26	0.48	0.39	0.54	0.34	0.30	0.42
4					0.93	0.74	0.91	0.87	0.63	0.77
5						0.70	0.97	0.83	0.79	0.83
6							0.80	0.62	0.47	0.56
7								0.91	0.68	0.79
8									0.63	0.94
9										0.64

Table 2. Total number of trees by species counted at 10 study sites in Katy, Texas in 2009.

Tree Species	1	2	3	4	5	6	7	8	9	10	
Live oak	25	9	6	30	27	13	13	19	19	15	176
Crepe myrtle	15	9	14	5	16	8	7	6	15	11	106
Loblolly pine	3	16	7	4	2		2	14		11	59
Possumhaw	2									2	4
Southern red oak	10	3	1			2		5		5	26
American holly	1									6	7
Black walnut		3	1		2		3	2			11
American sweetgum		1									1
Water oak	5	6	1	7	9	7	5	6			46
Chinese tallow		6	31		4	4	4				49
American ash	2	1	3		1	1					8
Southern magnolia		2		4	2	1	5	2			16
Red maple	1	2									3
Redbud		2		2				1			5
Shortleaf pine		3									3
Weeping willow			1								1
Eastern red cedar			2	2	1	3	1				9
Pecan			1	2	1						4
Silktree				1		7					8
Goldenrain tree				5		12					17
Flowering dogwood				3							3
Chinaberry				6							6
Oleander				1							1
Common hackberry						5	2	1			8
Yaupon holly						1					1
Texas elbow-bush						4					4
Bluejack oak							3	4	7		14
Cedar elm								2	20		22
Red mulberry								2			2
Green hawthorn	1										1
Texas mountain laurel	1										1
Eastern baccharis									1		1
Unknown tropical tree	1	1	2	1		4	1	1			11
Total	67	64	70	73	65	72	46	65	62	50	634

Table 3. Brillouin's Diversity Index (*H*) and Simpson' Measure of Evenness (*D*) for tree species with active nests in the 10 study sites in Katy, Texas in 2009.

Sample Sites	1	2	3	4	5	6	7	8	9	10
Diversity	2.34	2.89	2.24	2.64	2.13	3.05	2.64	2.68	1.83	2.12
Evenness	0.375	0.55	0.323	0.349	0.385	0.657	0.617	0.472	0.742	0.783

Table 4. Number of active White-winged Dove nests and nest success by study site in Katy, Texas in 2009.

Study Site	# of Active Nests Found	Percentage of Success (# of fledglings/# of eggs)	
1	4	4/8	50%
2	1	2/2	100%
3	1	2/2	100%
4	0		0%
5	2	4/4	100%
6	2	3/4	75%
7	0		0%
8	3	4/6	66%
9	7	11/14	79%
10	6	3/12	25%
Total	26		74.5%

Table 5. Measurements for tree parameters for each of 26 active White-winged Dove nests in 10 species of trees at 10 study sites in Katy, Texas in 2009. The variables are tree height (TH), nest height (NH), mean canopy width (MCW), nest aspect ratio (NAR), nest distance to nearest neighboring branch (NDNB), nest distance to tree trunk (NDT), and diameter at breast height (DBH).

Species	TH	NH	MCW	NAR	NDNB	NDT	DBH
Live oak	7.01	3.44	3.44	0.01	0.05	4.27	0.58
Live oak	6.71	5.49	5.49	0.02	0.31	4.57	0.51
Live oak	9.14	5.49	5.49	0.02	0.13	6.10	0.71
Crepe myrtle	3.05	2.59	2.59	0.02	0.03	1.22	0.08
Short-leaf pine	8.84	2.74	2.74	0.10	0.31	3.05	0.46
American ash	3.65	3.05	3.05	0.08	0.08	0.91	0.20
Live oak	6.10	4.63	4.63	0.02	0.05	3.05	0.38
Live oak	11.6	6.71	6.71	0.01	0.10	7.32	1.22
Yaupon holly	3.17	2.23	2.23	0.04	0.10	2.44	0.08
Water oak	6.22	3.11	3.11	0.04	0.08	1.83	0.27
Live oak	9.14	3.66	3.66	0.07	0.17	2.44	0.40
Bluejack oak	6.10	3.05	3.05	0.03	0.10	3.66	0.33
Loblolly pine	9.86	6.10	6.10	0.11	0.33	3.05	0.61
Live oak	4.12	2.13	2.13	0.11	0.10	0.91	0.13
Bluejack oak	4.57	2.74	2.74	0.05	0.15	0.91	0.10
Cedar elm	4.57	2.44	2.44	0.08	0.31	1.22	0.18
Eastern baccharis	2.74	1.83	1.83	0.02	0.05	0.91	0.10
Bluejack oak	4.57	3.05	3.05	0.02	0.08	1.28	0.15
Live oak	5.49	3.08	3.08	0.13	0.10	0.76	0.15
Live oak	4.57	2.90	2.90	0.60	0.08	0.13	0.15
Loblolly pine	16.8	2.74	2.74	0.02	0.10	4.57	0.51
Live oak	6.10	4.57	4.57	0.02	0.05	2.44	0.31
Loblolly pine	10.4	5.18	5.18	0.02	0.05	2.13	0.31
Live oak	7.63	2.74	6.71	0.02	0.02	3.05	0.25
Loblolly pine	16.8	3.66	8.53	0.03	0.03	3.05	0.51
Loblolly pine	16.8	5.49	8.53	0.01	0.01	3.66	0.51

Table 6. Selection indices (w) for tree species used as nesting sites by White-winged Doves and the proportion available of each species at eight study sites in Katy, Texas in 2009. Selection indices with a value ≥ 1 indicate selection or preference for a tree species and a value < 1 indicates avoidance. The standard error for selection indices (w) are indicated by parentheses.

	Availability	w	95% CL
Live oak	27.7	1.61 (0.30)*	0.66-2.56
Crepe myrtle	16.7	0.17 (0.16)	0-0.69
Loblolly pine	0.09	2.39 (0.75)*	0.02-4.76
Yaupon holly	0.01	4.42 (4.35)*	0-18.2
Water oak	0.07	0.38 (0.38)	0-1.59
American ash	0.01	2.21 (2.18)*	0-9.12
Short-leaf pine	0.01	5.89 (5.81)*	0-24.3
Bluejack oak	0.02	5.44 (2.56)*	0-13.6
Cedar elm	0.04	1.61 (1.10)*	0-5.11
Eastern baccharis	0.01	3.53 (3.48)*	0-14.6

*Indicates selectivity.

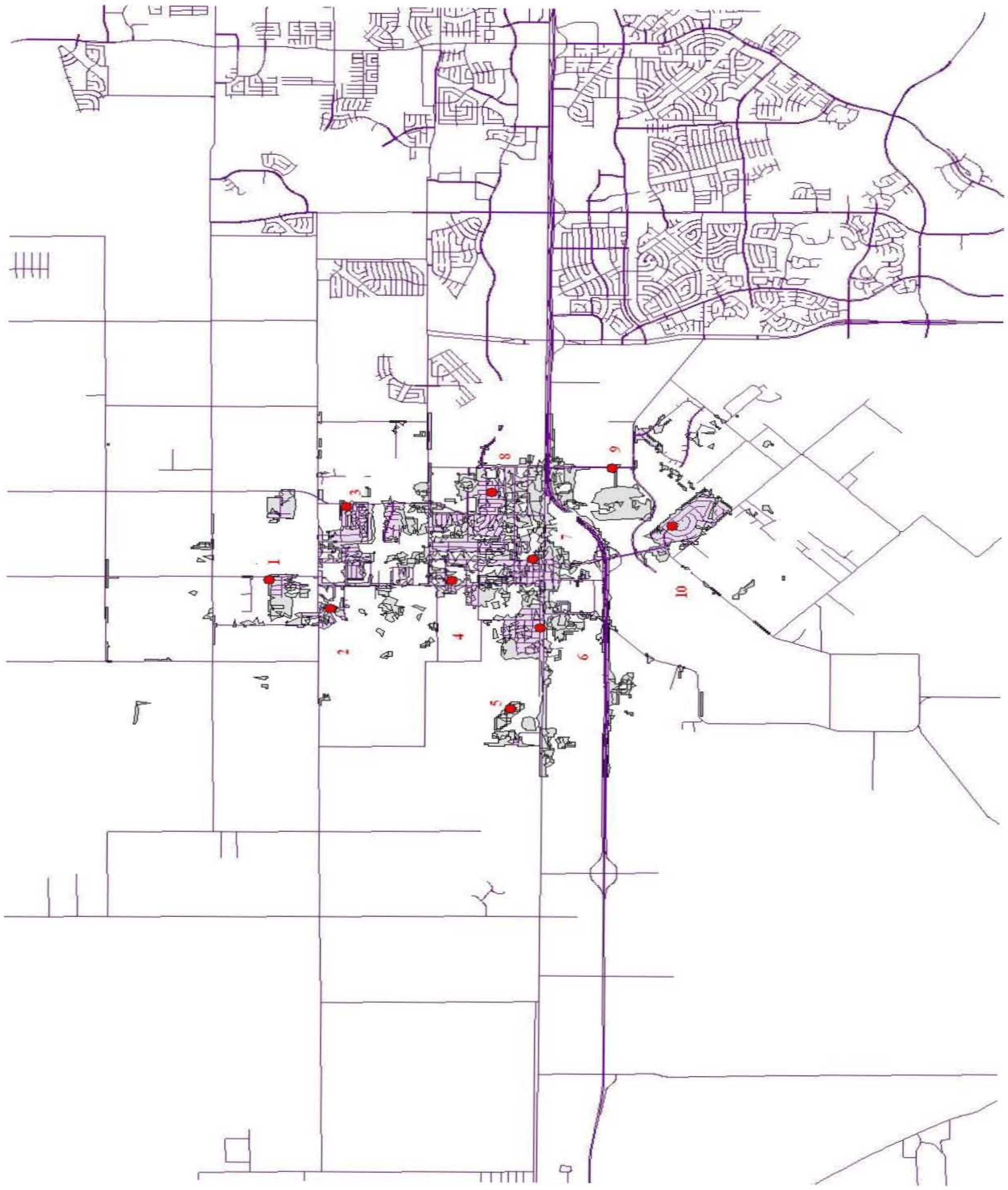

Figure 1. Map of study area with 10 randomly selected study sites in Katy, Texas – Harris, Waller and Fort Bend Counties.

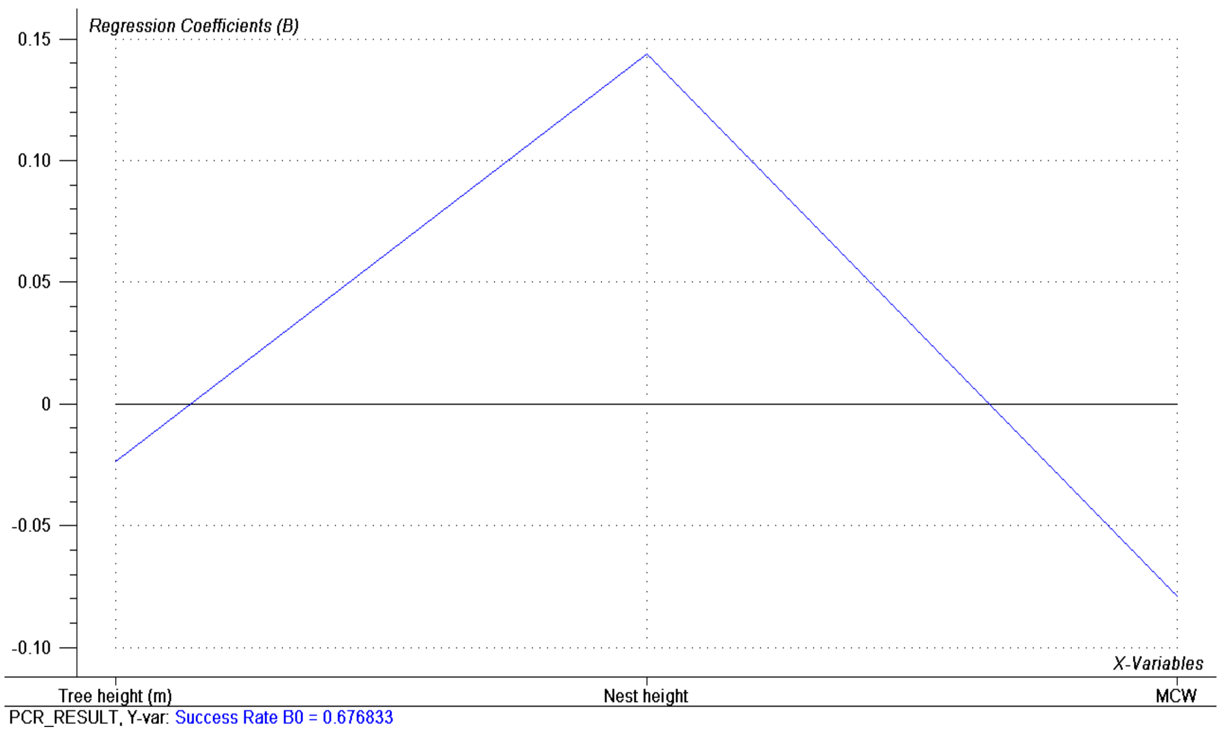

Figure 2. Line graph of regression coefficients showing the extent predictor variables correlated with nest success.

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VITA

Melissa Rothrock was born in Springdale, Arkansas in 1980. Moving back and forth from Texas to Arkansas growing up, Melissa's family finally settled in Houston, Texas in 1994 where she started high school. After earning a B.S. in Biology with a minor in Art from Texas State University- San Marcos in 2004, Melissa moved to Northern California to hike in the Redwood National & State Park and conduct Northern Spotted owl surveys in Shasta-Trinity National Forest. After a year, she moved back to Texas to work for Texas A&M University surveying for Black-capped vireo and Golden-cheeked warbler in Southwest Texas. In 2006, she entered the Wildlife Ecology program at Texas State University-San Marcos. While in the M.S. program, Melissa worked as an intern at Texas Commission on Environmental Quality (TCEQ) in Austin, Texas. Currently, Melissa is employed by Texas Engineering Experiment Station (TEES) as a Research Associate in Austin, Texas.

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