EFFECTS OF GRASSLAND RESTORATION ON AVIAN ASSEMBLAGE CHARACTERISTICS AND DICKCISSEL NESTING SUCCESS IN TEXAS

A Thesis

by

CHRISTOPHER M. LITUMA

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2009

Major Subject: Wildlife and Fisheries Sciences

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Approved by:

Chair of Committee, Michael L. Morrison
Committee Members, William E. Rogers
Bret A. Collier
Head of Department, Thomas E. Lacher, Jr.

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ABSTRACT

Effects of Grassland Restoration on Avian Assemblage Characteristics and Dickcissel Nesting Success in Texas. (May 2009)

Christopher M. Lituma, B.S., Millersville University of Pennsylvania

Chair of Advisory Committee: Dr. Michael L. Morrison

The prairies of North America have undergone substantial changes since European settlement in the 1800's, with some estimates suggesting that 96% of the tallgrass prairie has been converted. Multiple factors contributed to reduction in prairie, including: grazing, row-crop farming, depressed fire regimes, and exotic grass species introduction. In Texas, 35% of the historic grassland ecosystems have been either altered or converted. Introduced in the 1940's, exotic grass species such as Bermuda grass (*Cynodon* sp) have displaced native grass species throughout Texas. Introduced grass species can alter the existing plant communities degrading habitat for birds and other animals. Grassland birds are declining faster than any other bird group within North America; due in part to a reduction in suitable breeding habitat. I addressed this issue by comparing nesting success of grassland birds between exotic grass sites and restored native grass sites in the blackland prairie region of east-central Texas during 2007–2008 breeding seasons. I conducted point counts and nest searching from March – July. Point count data indicate no difference in species richness between sites. Dickcissel (*Spiza americana*) nests represented 89% of the nests found (n = 104). Dickcissel abundance was 44% higher in restored sites and 76% of nests were located in restored sites. Daily survival (DSR) for dickcissels in restored sites was 0.895 (SE = 0.013) and for exotic

sites was 0.930 (SE = 0.017). I used an independent samples *t*–test to compare mean nest height, which was 56% higher in restored sites than exotic sites (n = 83, $\bar{x}$ = 38.0 cm ± 1.90; $\bar{x}$ = 15.2 cm ± 2.19, df = 81, t = -6.31, P = 0.001), and mean nest substrate height which was 58% higher in restored sites than in exotic sites (n = 83, $\bar{x}$= 118.8 cm ± 6.50; $\bar{x}$= 46.5 cm ± 4.77, df = 81, t = -6.08, P = 0.001). Although dickcissel abundance was greater in restored sites than exotic sites, their observed nesting success and DSR was lower in restored sites. This is indicative of an ecological trap, which occurs when an organism is attracted to a habitat that negatively impacts the organism. Some research suggests that restored fields in other states are acting as traps for dickcissels, and according to my results restored sites I sampled may also be acting as ecological traps for dickcissels in Texas.

ACKNOWLEDGMENTS

I thank my committee chair Dr. Michael L. Morrison for all of his guidance and advice throughout my graduate career. I also thank my thesis committee members Dr. William E. Rogers, and Dr. Bret A. Collier for their help with analyses and advice during planning of the project. I would also like to thank Jay Whiteside (Technical Guidance Biologist), of Texas Parks and Wildlife Department (TPWD), and Brian Hays (Extension Program Specialist) with the Institute of Renewable Natural Resources (IRNR) for their help with logistics, and locating and obtaining access to study sites. I want to thank my lab mates for professional guidance. This project was supported with funding from Texas Parks and Wildlife Department. I thank the landowners for allowing me access to their properties, and my technicians; J. Nadal, K. Webb, L. Tomlinson, and J. Rondon. I thank my supportive family, and dear wife.

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INTRODUCTION

The prairies of North America have undergone substantial changes since European settlement in the 1800's, with 96% of the tallgrass prairie converted (Samson and Knopf 1994). One of the impacts of lost tallgrass prairie is a reduction in grassland bird populations due to a loss of breeding habitat. Grassland bird numbers are declining more than any other avian group in North America (Herkert 1995, Peterjohn and Sauer 1999, Vickery and Herkert 2001, Brennan and Kuvlesky 2005). There are a number of compounding factors that contribute to a loss of breeding habitat, including: grazing, row-crop farming, depressed fire regimes, and exotic grass species introduction (Bock et al. 1984, Askins 1999, Patten et al. 2006, Powell 2006). Exotic invasive species can negatively impact the environment and the native organisms within those environments by altering the landscape in such a way that the habitat suitability decreases and it becomes uninhabitable for many species, including avian species (Bock and Bock 1992, Krebs 2001, Lloyd and Martin 2005). Lloyd and Martin (2005) found that chestnut-collared longspurs (*Calcarius ornatus*) in eastern Montana showed lower reproductive success in an exotic grass monoculture. However, some exotic grasses can provide attractive habitat for certain species, such as the Botteri's sparrow (*Aimophila botterii*) in southeastern Arizona (Jones and Bock 2005).

This thesis follows the style of The Journal of Wildlife Management.

A number of different agencies and programs, such as the Landowner Incentive Program (LIP) and Conservation Reserve Program (CRP), are implementing restoration of exotic grasslands and row crops to native grasslands (Patterson and Best 1996, Best et al. 1997, Koford 1999, O'Connor et al. 1999, Herkert 2007). When compared to row crop fields, CRP fields had greater avian abundance, and 3 times more nesting species (Best et al. 1997). Species-specific studies have shown that CRP fields contributed to increases in Henslow's sparrow (*Ammodramus henslowii*) population trends and grasshopper sparrow (*Ammodramus savannarum*) recruitment and fecundity (Gill et al. 2006, Herkert 2007). Also, in shortgrass prairies CRP fields provide similar though not equivalent arthropod abundances to native prairies (McIntyre and Thompson 2003).

The blackland prairie in east central Texas was a tallgrass prairie ecosystem dominated by typical tallgrass species such as little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*) Indian grass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*) (Smeins and Diamond 1983, Harmel et al. 2003). The prairie stretched from the Dallas area to San Antonio and covered approximately 5 million hectares. Pre-European settlement accounts described a wide open prairie with scattered woody vegetation. Human settlement, agricultural expansion and the introduction of exotic grasses contributed to a 90% loss in native prairie. Some native avian species included the dickcissel (*Spiza americana*), grasshopper sparrow (*Ammodramus savannarum*), eastern meadowlark (*Sturnella magna*) and northern bobwhite (*Colinus virginianus*). These species were once common throughout the blackland prairie region but have shown significant population declines over the past three decades (Herkert 1995, Peterjohn and Sauer 1999, Vickery and Herkert 2001).

In Texas, 21 million ha of the original 60 million ha of native grasslands have been altered, and 90% of the estimated 7.2 million ha of tallgrass prairie has been converted (Samson et al. 2004, Hays et al. 2005). Many exotic grass species, such as Lehman lovegrass (*Eragrostis lehmanniana*) and Bermuda grass (*Cynodon* spp), were introduced to provide better grazing for cattle (Bock and Bock 1992, McClaran and Anable 1992, Flanders et al. 2006). There is approximately 4 million ha of Bermuda grass planted in Texas (Hays et al. 2005). Private ranchers grow Bermuda grass in monotypic stands to maximize yield for cattle grazing and hay production (Bade and McFarland 1998, Hays et al. 2005, Flanders et al. 2006). These exotic and invasive grasses are spreading and have displaced native bunchgrasses of Texas. Exotic grassland habitats alter the habitat structure of the plant community so that it becomes less suitable for avian species (Flanders et al. 2006).

Efforts have begun to restore exotic-grass dominated landscapes to original native grass species (e.g., bunchgrasses in Texas) by eliminating exotic grasses present and re-seeding native grass species (Hays et al. 2005, Ogden and Rejmanke 2005, Flanders et al. 2006). Restoration and management efforts of grasslands in Texas are usually small in scale (<40 ha) and in cooperation with private landowners (Wilkins et al. 2003, Hays et al. 2005).

Prairie patch size can have a species specific affect on density and avian nest success depending on a number of factors associated with the patch including: increased perimeter–area ratio, the predator community, and the surrounding landscape matrix (Helzer and Jelinski 1999, Johnson and Igl 2001, Herkert et al. 2003, Winter et al. 2006). Despite similar densities, nesting songbirds in small tallgrass prairie fragments showed lower nest success than large fragments (Helzer and Jelinski 1999, Winter and Faaborg 1999, Fletcher et al. 2006).

To understand factors which limit grassland bird populations, I evaluated assemblage characteristics and breeding parameters of grassland birds in the blackland prairie region in east–central Texas. My goal was to determine how conservation and restoration efforts impacted grassland birds so future restorations can be more impactful. Ultimately, my research will provide guidance for future management involving the restoration of exotic grasslands to native grasslands, and provide information to programs such as LIP and CRP. I evaluated differences in species richness, species abundance, nesting success and daily nest survival (DSR) between exotic grass sites and restored native grass sites. I also explored correlations between nesting success and DSR, and the surrounding vegetation types. I related differences between the grasslands that are available to the birds and the sections in which they actually nest. Based upon previous studies, I predicted greater species abundance of 30–40% occurring on native grassland sites (Flanders et al. 2006). I also expected that the average nesting success would be 10–20% higher in native grassland sites than exotic sites (Lloyd and Martin 2005).

METHODS

Study Area

I conducted my study over 2-seasons during the spring of 2007 and 2008 across 6 counties in the blackland prairie region of Texas, which is composed of gently rolling hills ranging from 100–300 m above sea level. This region is dominated by bunchgrasses such as little bluestem, Indian grass, and switchgrass, with scattered woody vegetation (*Quercus* spp, *Celtis* spp, *Prosopis* spp). The soil types are sandy and clay loams depending on the elevation and the average annual rainfall is 900 mm (Smeins and Diamond 1983, Harmel et al. 2003).

Study Design

Sites were located on privately owned lands that had been restored. The number of completed restorations limited site selection. I focused sampling effort on sites 15–30 ha in size and maintained an equal sample size of restored (n = 8) and exotic (n = 8) sites. However, I opportunistically sampled some smaller (3–12 ha) restored (n = 5) and exotic (n = 2) sites (Table 1). Each site was either a distinct field of restored grasses, or a distinct field of exotic grasses. Native grassland sites had been restored 3–5 years prior to conducting sampling because grasses regenerate quickly (McClaran and Anable 1992, Powell 2006). I combined years when analyzing differences between sites because of small sample sizes, and because the sites were chosen randomly from available sites, in order to account for inter–annual variability. I present some summary information about the smaller sites, even though I did not conduct any formal analyses because of small sample sizes (Table 2). I used all the restored sites available with similar soil type and land use histories to minimize variability.

I treated the sampling techniques and analysis of my study as an impact assessment (Parker and Wiens 2005). Because the restoration events have already occurred and no quantitative pre-treatment data were available, I relied on the TPWD data and the histories of each site to aid in the analysis of the restored study sites.

Point counts.— I used Global Positioning System units (GPS) and Geographic Information Systems (GIS) to map study sites, place point counts, and keep track of nests. I conducted point counts during two spring monitoring seasons (March–July 2007 and 2008) using a fixed radius point count technique (Hutto et al. 1986). I systematically placed points across study sites using to ensure the study area was properly represented in the analysis (Garton et al. 2005). Each point was 150–200 m from the previous point to avoid repeat detections of the same individual that could bias the data (Hutto et al. 1986, Fletcher and Koford 2002). I conducted point counts between sunrise and 4 hrs after sunrise, when breeding birds are most active. I rotated between sites and rotated points. I stood in a fixed location for 10 minutes recording each individual bird seen or heard during that time within 50 m (Hutto et al. 1986, Fletcher and Koford 2002). One way to increase the detection probability for birds is to sample a point multiple times (MacKenzie 2005), and for grassland birds this number can be between 3 and 8 times per point (Diefenbach et al. 2003). Thus, I sampled each point 5 times. Birds encountered upon arrival of a point were included in that point count; however, I omitted birds seen en route from point to point.

Nest searching.—I began nest searching in mid March and ended in early July (Lloyd and Martin 2005, Shochat et al. 2005, Patten et al. 2006). I searched for nests at each site once a week. I used nesting behavioral cues such as singing, material carries, multiple direct flights, and territorial behavior in combination with a systematic sweep of each study site in order to locate nests (Berthelsen and Smith 1995, Rodewald 2004, Lloyd and Martin 2005). To relocate nests for successive checks I marked nests with a stake flag 10 m from the location, and used a compass to determine the direction, which along with the distance we wrote on the flag with a marker. I also used broom handles to search for nests by extending the broom handle and tapping the grasses to flush the birds (Winter et al. 2005). Once nests were discovered and determined to be active I visited them at least once a week (Walk et al. 2004, Lloyd and Martin 2005, Shochat et al. 2005, Winter et al. 2005). The data collected for each nest included: species of grass in which the nest was found, height of the nest, percent concealment from each cardinal direction (explained below), if the nest was parasitized, clutch size, and a GPS point of each nest. Brood parasitism by brown-headed cowbirds (*Molothrus ater*) is a common occurrence for a number of grassland nesting species, though frequencies can vary regionally and have not been reported for grassland birds in Texas (Herkert et al. 2003, Brennan and Kuvlesky 2005, Jensen and Cully 2005a, Patten et al. 2006). If the nest failed, I noted signs of predation such as: if the nest had been torn apart, tipped to the ground, egg shell fragments in the nest, holes in the nest, or rodent droppings around the nest (Best and Stauffer 1980, Wray et al. 1982, Patterson and Best 1996).

Vegetation sampling.— At each point count location I used the point intercept method to evaluate the surrounding vegetative structure (Flanders et al. 2006). Starting from the center of each point count I ran a 25 m tape in each cardinal direction. I then recorded shrub, grass, forb, thatch, and bare ground cover every 10 m. I also measured the percent cover of the vegetation every 10 m using a 2 m tall profile board (Fletcher and Koford 2002). I used the point intercept method at each nest to measure vegetative characteristics immediately surrounding the nest. I ran a tape measure 10 m in each cardinal direction, and recorded shrub, grass, forb, thatch, and bare ground cover every 5 m. I also used profile board techniques to measure the percent concealment at the nest and the vertical structure immediately surrounding the nest (Flanders et al. 2006).

ANALYSIS

Point Count Analysis

I only conducted analyses using data collected on larger, primary sites. I calculated avian species richness as the number of species per site. Because I had a limited number of sites (n = 16) I used a two-tailed Mann–Whitney test to compare species richness between site types (α = 0.05)(Zar 1996:146–155). I also used the Shannon-Wiener Index to calculate evenness for each site (Zar 1996:41–43). For abundance analyses, detection probability estimates, and nest related analyses I focused on dickcissels (*Spiza american*) which represented 90% of the nests located during my study. I used program PRESENCE to estimate detection probabilities of singing male dickcissels from the point count data for detection at a single point (PRESENCE 2002). I calculated relative abundance as an index of number of singing males/point/visit. I compared relative abundance of dickcissels between native and exotic grassland sites using a two–tailed Mann–Whitney test (α = 0.05). For dickcissel abundance calculations I only included visits to points that occurred after 22 April of each year, because this is when the largest number of birds are expected to arrive on their breeding grounds (Basili and Temple 1999).

Nest Searching Analysis

I calculated daily survival rate (DSR) of dickcissel nests using the nest survival model in program MARK (Rotella et al. 2004, Shaffer 2004, Grant et al. 2005). The two parameters I incorporated into the model were: restored and exotic, and to estimate DSR I assumed constant daily survival (White and Burnham 1999, Dinsmore et al. 2002, Shaffer 2004). I compared observed nest success between sites by comparing the percentage of successful nests between exotic and restored site locations. I compared differences in clutch size between site types using an independent samples t-test (α = 0.05)(Zar 199, 122–129). I also compared dickcissel nest characteristics between sites such as nest height, substrate height, and percent concealment using independent samples *t*-tests (α = 0.05)(Zar 199, 122–129).

Vegetation Analysis

I compared plant species richness between site types using a Mann-Whitney test. I compared vegetation height at the site scale and vegetation height surrounding the nest between site types using an independent samples *t*-test (Zar 1996).

RESULTS

Point Count

There was no difference in species richness between site types, although there was a higher variability in restored sites than exotic sites (Figure 1). Evenness was the same between restored sites and exotic sites (Table 1). A complete species list by site and by year is listed in Appendix A and Appendix B. Detectability of dickcissels was 33% higher at points in restored sites (0.738) than at points in exotic sites (0.489). I Dickcissel abundance was 44% higher in restored sites than in exotic sites ($\bar{x}$ = 0.323 ± 0.082; $\bar{x}$ = 0.181 ± 0.067, df = 14, Z = -1.26) although this difference was not statistically different (Mann–Whitney, *P* = 0.207) (Figure 2, Table 1). Brown-headed cowbird numbers were low; on 5 of the 8 primary exotic sites where I detected dickcissels there were 9 individual brown-headed cowbirds detected and on half of the primary restored sites where I detected dickcissels there were 14 individual brown-headed cowbirds detected. I detected dickcissels on 3 of the 5 restored smaller sites, and none on the exotic smaller sites (Table 2).

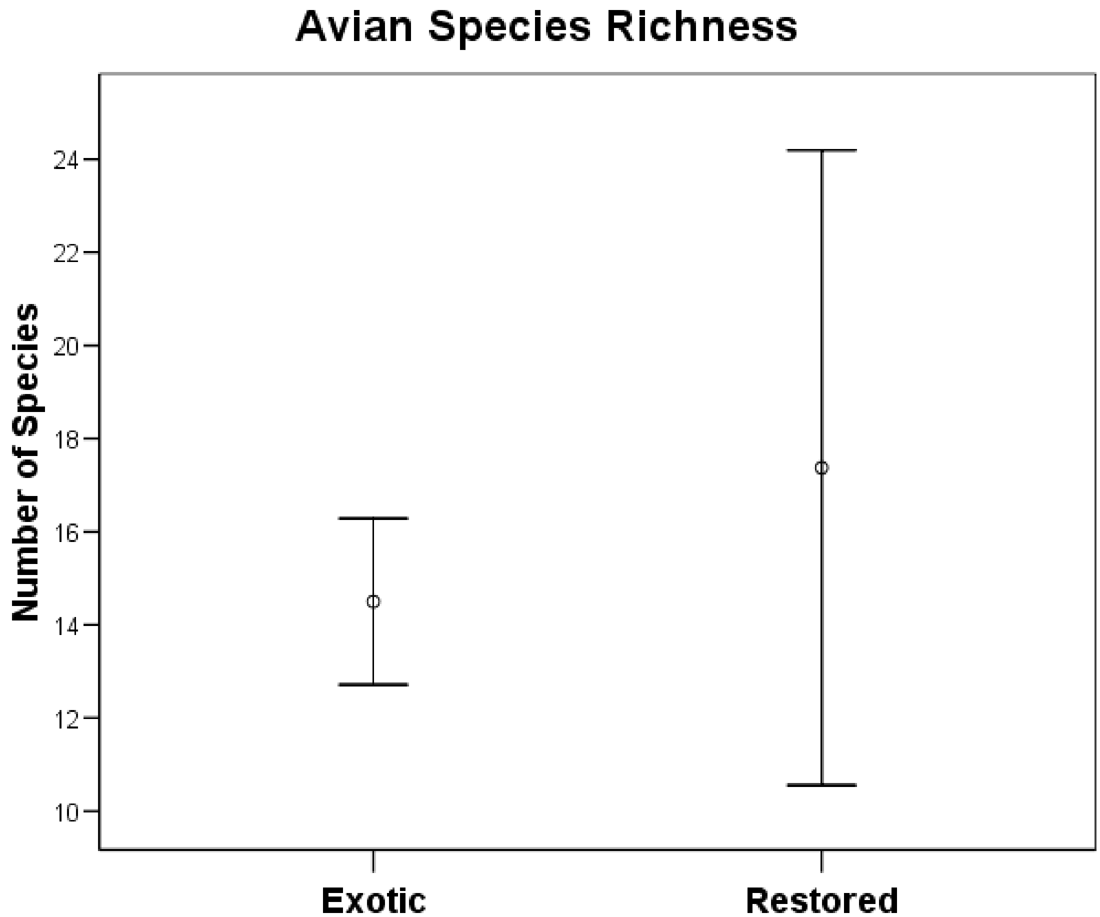

Figure 1. Avian species richness (x̄ ± SE) for exotic and restored sites in east-central Texas, USA, 2007–2008.

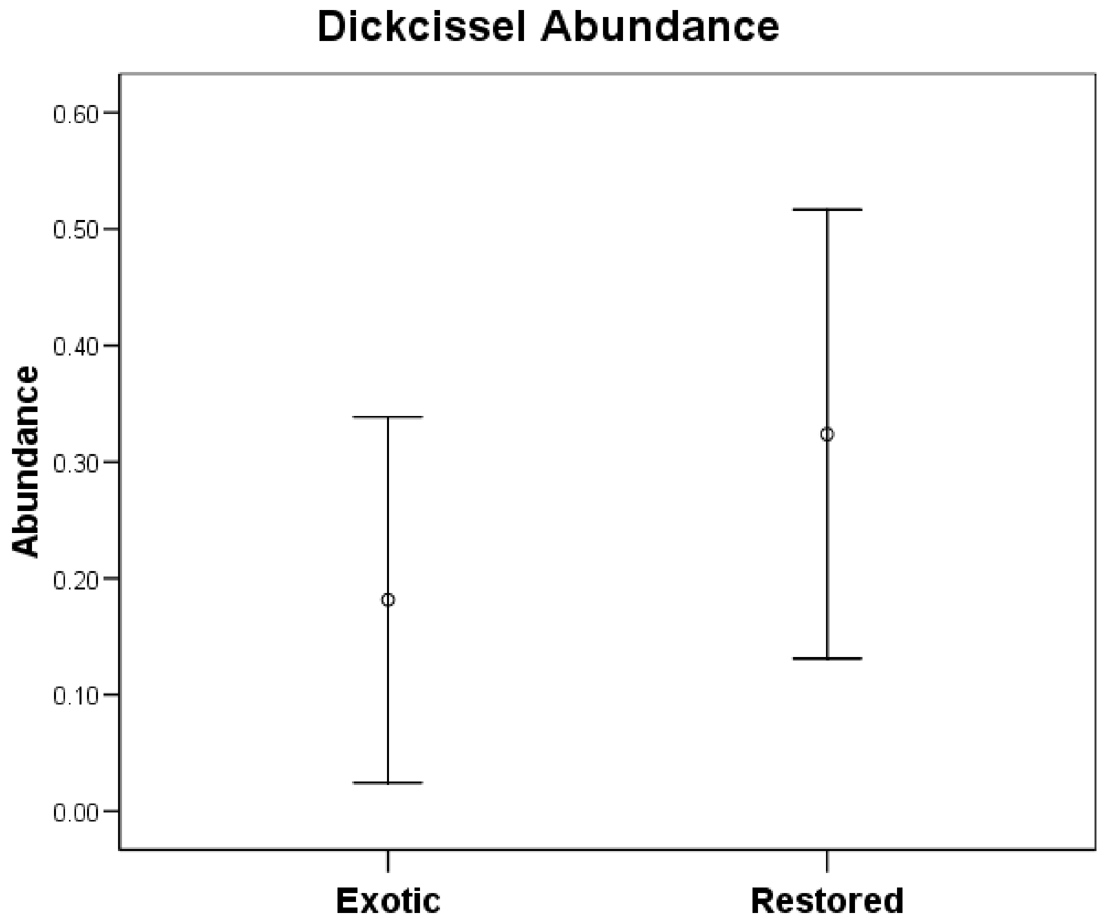

Figure 2. Abundance of breeding dickcissels (males/count/visit; $\bar{x} \pm SE$) in restored and exotic grass sites in east-central Texas, USA, 2007–2008.

Table 1. Site characteristics including an index of abundance (singing males/point/visit), and Shannon–Wiener index of evenness arranged by size (ha) for 16 primary study sites in the blackland prairie region in east-central Texas, USA, 2007–2008.

EXOTIC				RESTORED			
County	**Size (ha)**	**DICK Abund.**	**Evenness**	**County**	**Size (ha)**	**DICK Abund.**	**Evenness**
Washington	34	0	0.81	Washington	29	0.43	0.69
Navarro	34	0.13	0.82	Colorado	29	0.3	0.8
Navarro	32	0.11	0.63	Anderson	26.6	0.11	0.77
Navarro	29.7	0.04	0.84	Navarro	22.5	0.18	0.75
Navarro	24.5	0.26	0.74	Navarro	21.9	0.6	0.32
Navarro	18.4	0.33	0.72	Navarro	17.6	0.31	0.76
Navarro	17.8	0.032	0.76	Lee	17.3	0	0.86
Navarro	17.2	0.55	0.741	Navarro	15.4	0.66	0.6

Table 2. Site characteristics including an index of abundance (singing males/point/visit), and Shannon–Wiener index of evenness arranged by size (ha) for 7 opportunistically sampled study sites in the blackland prairie region in east-central Texas, USA, 2007–2008.

EXOTIC				RESTORED			
County	**Size (ha)**	**DICK Abund.**	**Evenness**	**County**	**Size (ha)**	**DICK Abund.**	**Evenness**
Lee	7.2	0	0.92	Navarro	12	1.4	0.74
Ellis	7	0	0.72	Navarro	11.4	0.45	0.6
				Lee	8.8	0	0.83
				Anderson	5	0	0.96
				Navarro	3.7	0.4	0.65

Nest Searching

I found 104 nests of 3 species. The majority of nests (93%) were dickcissel nests, although some of the nests (11) were either abandoned or their fate could not be determined, and I did not include these in my analysis. Of the dickcissel nests found (n = 86), 3% were parasitized and all were located in restored sites. The majority of nests (76%) were located in restored sites. Observed dickcissel nest success for restored sites was 17% and for exotic sites was 25%. Daily survival rate for dickcissel nests was 4% (*n* = 86) lower in restored sites than in exotic sites (Table 3). Independent samples *t* – test showed that mean nest height was 56% higher in restored sites than exotic sites (*n* = 83, $\bar{x}$ = 38.0 cm ± 1.90; $\bar{x}$ = 15.2 cm ± 2.19, df = 81, F = 7.52, *P* = 0.001), and mean nest substrate height was 58% higher in restored sites than in exotic sites (*n* = 83, $\bar{x}$= 118.8 cm ± 6.50; $\bar{x}$= 46.5 cm ± 4.77, df = 81, F = 23.8, *P* = 0.001) (Figures 3 & 4). Dickcissel clutch size did not differ between site types, though it was 10% greater in exotic than restored sites (*n* = 83, $\bar{x}$ = 4.7 ± 0.134, $\bar{x}$ = 4.2 ± 0.138, df = 83, F = 3.9, *P* = 0.052) (Figure 5). Dickcissel nest concealment did not differ between exotic and restored sites.

Table 3. Modified Daily Survival Rate (DSR) from Mayfield estimates for dickcissel nests with 95% confidence intervals in restored and exotic grass sites in the blackland prairie region, east-central Texas, USA, 2007– 2008.

	DSR	Lower	Upper	Period Survival
Exotic	0.931	0.889	0.957	0.215
Restored	0.895	0.864	0.919	0.092

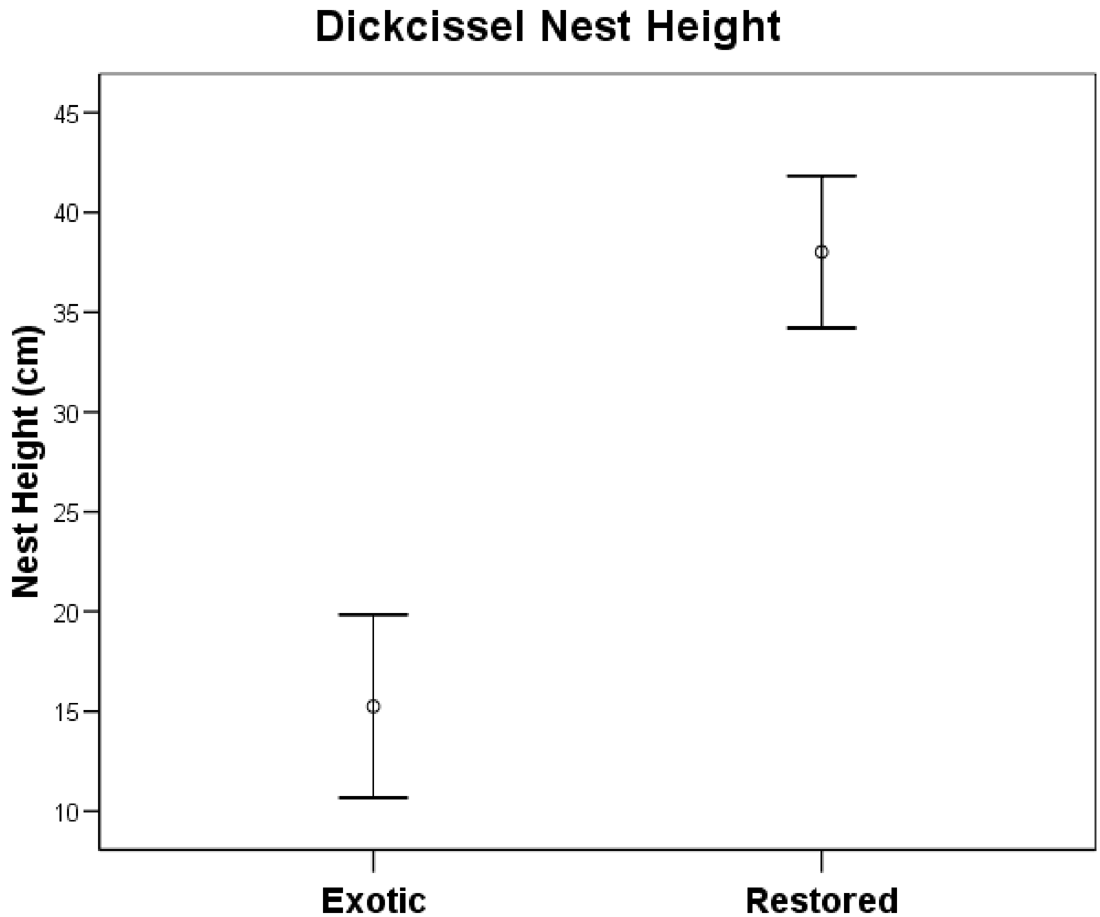

Figure 3. Dickcissel nest height in primary restored and exotic grass sites **(**$\bar{x} \pm$ SE; *n* = 83, df = 81, F = 7.52, *P* = 0.001) in east central Texas, USA, 2007–2008.

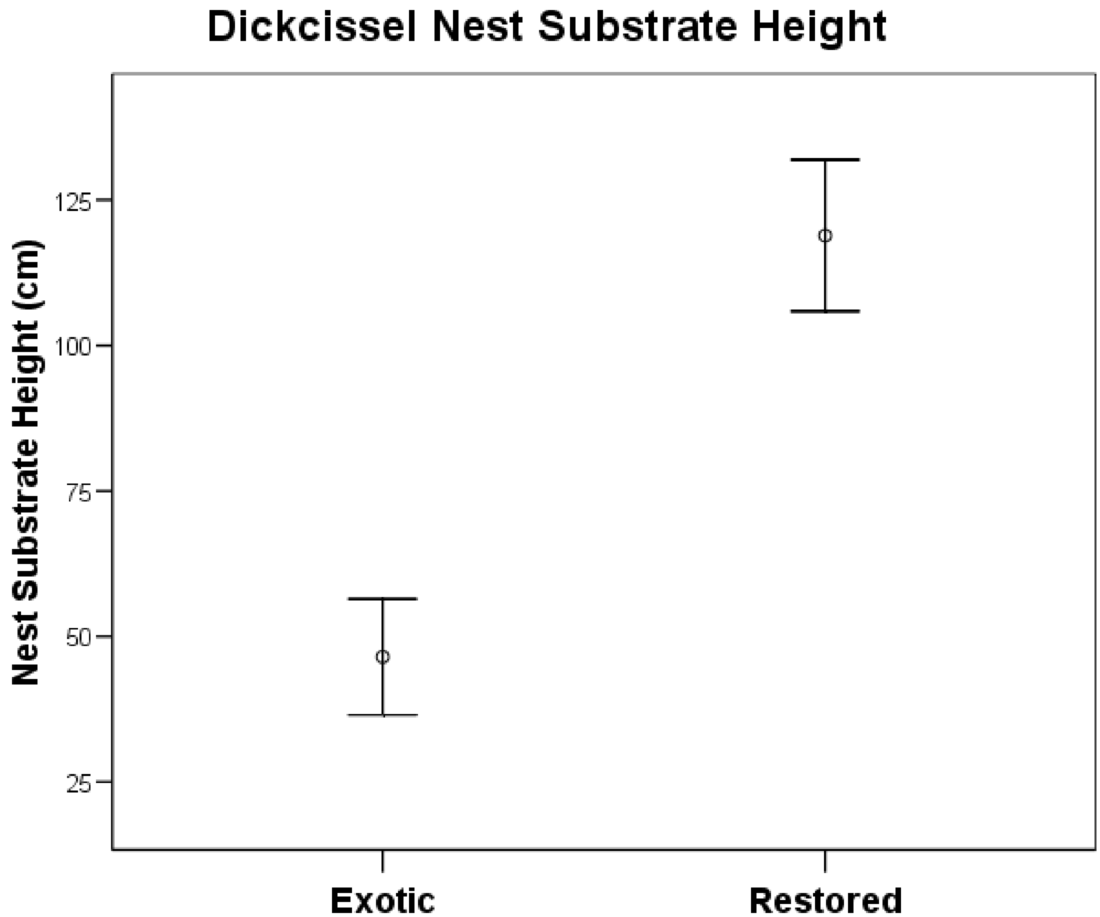

Figure 4. Dickcissel nest substrate height in restored and exotic grass sites **(**$\bar{x}$ ± SE; *n* = 83, df = 81, F = 23.8, *P* = 0.001) in east-central Texas, USA, 2007–2008.

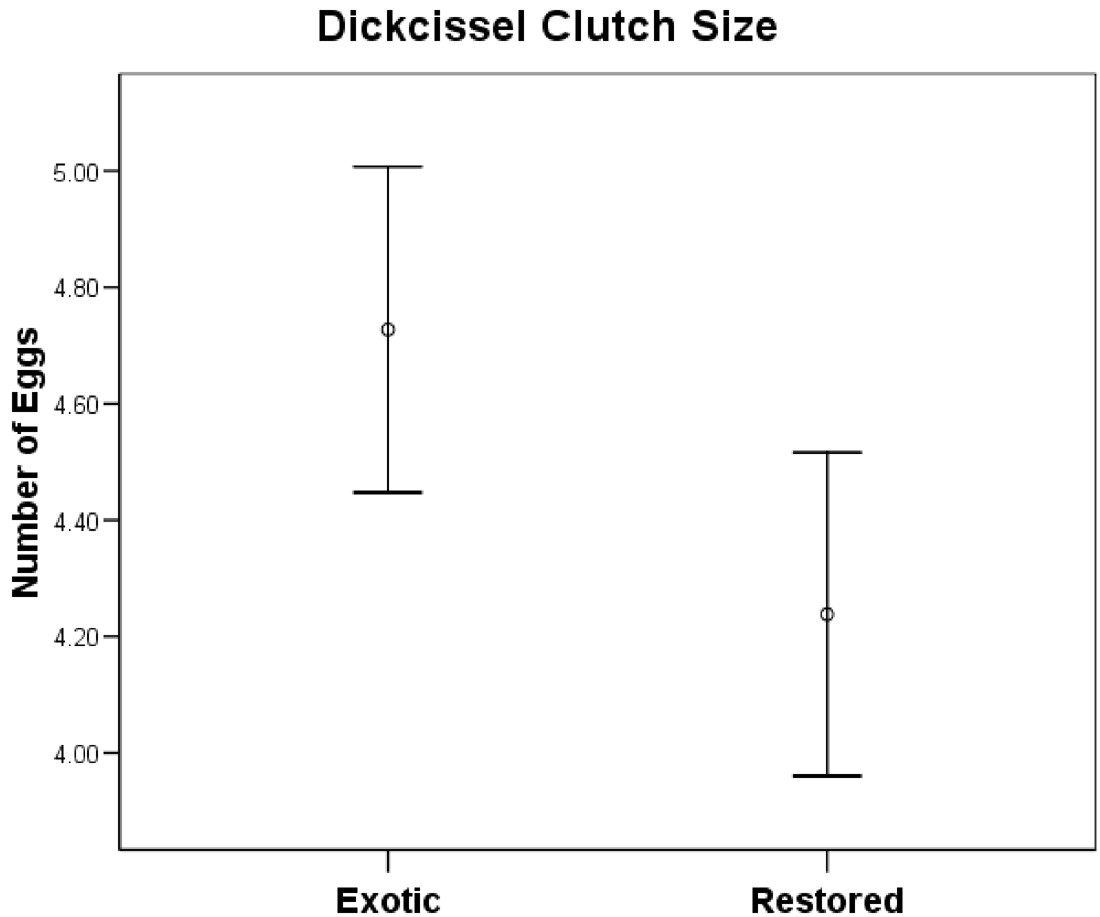

Figure 5. Dickcissel clutch size in restored and exotic grass sites **(**x̄ ± SE; *n* = 83, df = 83, F = 3.9, *P* = 0.052) in east-central Texas, USA, 2007–2008.

Vegetation

Vegetation species richness was 27% higher in restored sites than in exotic sites (*n* = 16, x̄ = 41.63 ± 2.3; x̄ = 30.3 ± 1.9, df = 14, Z = -2.79) (Figure 6). Vegetation height at restored sites was 37% higher than at exotic sites (*n* = 121, x̄ = 58.4 cm ± 1.5; x̄ = 37.1 cm ± 1.8, df = 119, F = 2.65, *P* = 0.001) (Figure 7), and vegetation surrounding nests at restored sites was 38% higher than at exotic sites (*n* = 88, x̄ = 61.0 cm ± 1.3; x̄ = 38.0 cm ± 2.2, df = 86, F = 0.89, *P* = 0.001) (Figure 7). There was no difference in nest height for failed and successful dickcissel nests between sites (Figure 8) and there was no difference in the surrounding nest substrate height for failed and successful dickcissel nests (Figure 9).

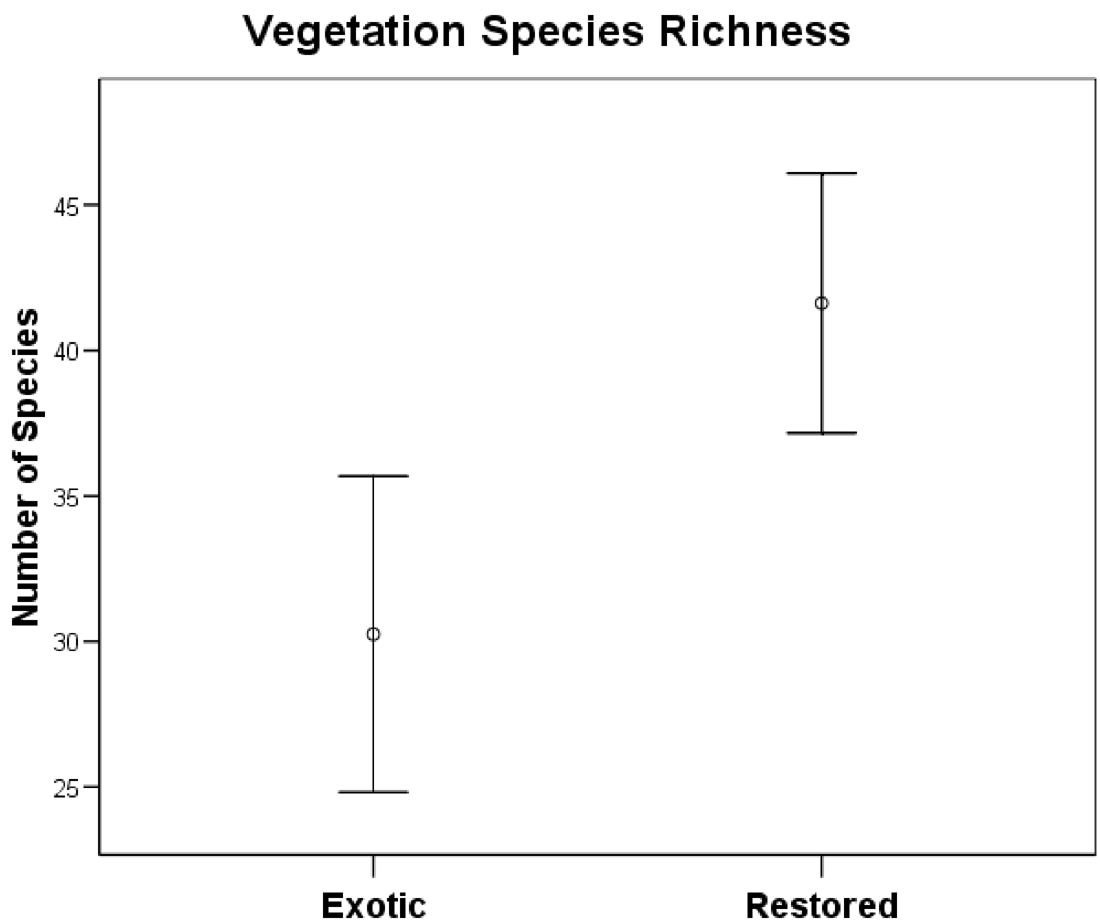

Figure 6. Vegetation species richness in restored and exotic grass sites ($\bar{x} \pm$ SE) in east-central Texas, USA, 2007–2008.

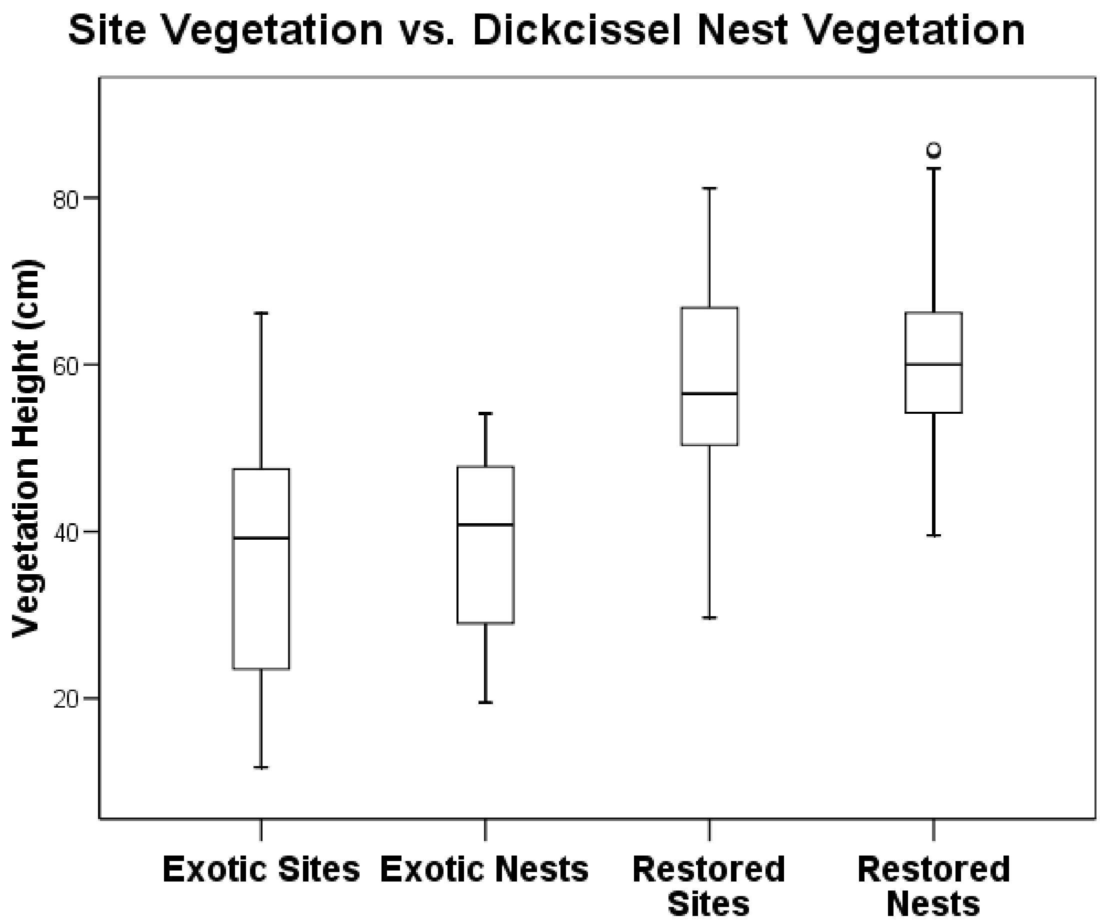

Figure 7. Box plot of median vegetation height at point counts and mean vegetation height immediately surrounding dickcissel nests in exotic and restored sites in east-central Texas, USA, 2007–2008.

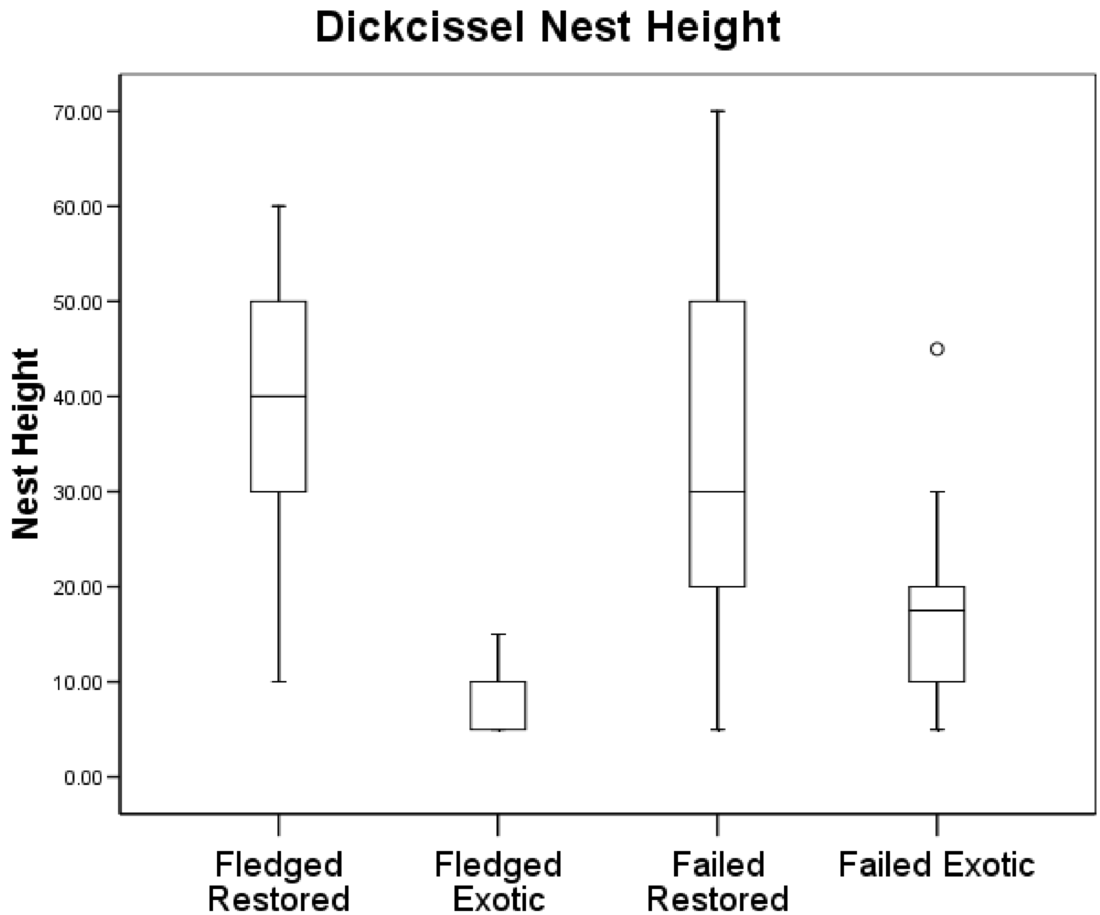

Figure 8. Box plot of dickcissel nest height for fledged and failed nests in exotic and restored sites in east-central Texas, USA, 2007–2008.

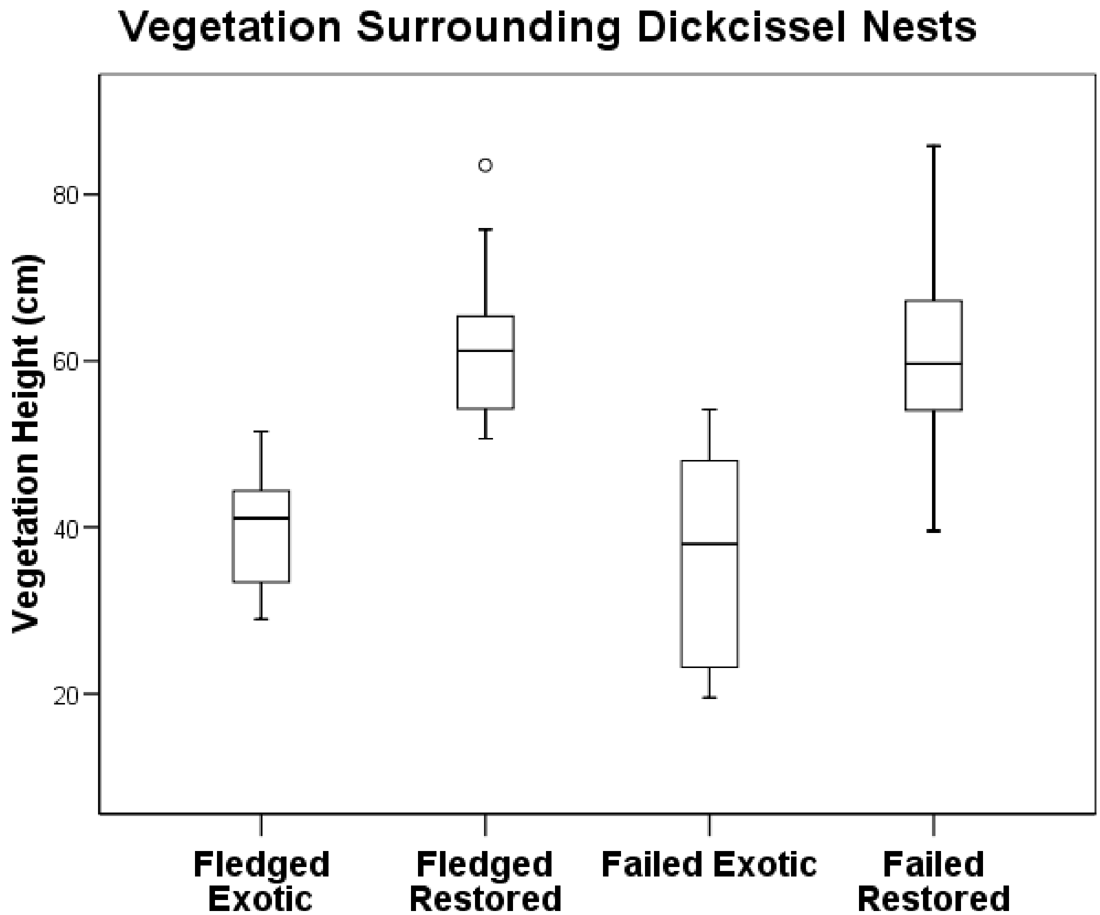

Figure 9. Box plot of vegetation height immediately surrounding dickcissel fledged and failed nests in exotic and restored sites in east-central Texas, USA, 2007–2008.

DISCUSSION

I found that species richness and evenness did not differ between site types. Dickcissels were consistently the most abundant grassland species on all of the sites. The significant impact of prairie restorations on the avian assemblage was an increase in species richness variability on restored sites, and an increase in dickcissel abundance, suggesting that dickcissels were more attracted to restored sites than exotic sites (Best et al. 1997, Winter and Faaborg 1999, Veech 2006).

Although dickcissel abundance was greater in restored sites than exotic sites, their observed nesting success and DSR was lower in restored sites. In other parts of the country CRP restorations have improved the nesting success of a number of birds including dickcissels (Best et al. 1997, Hughes et al. 1999, McCoy et al. 1999). The DSR for dickcissel nests was lower for both site types when compared to DSRs reported in other states (Kansas DSR = 0.955, Iowa DSR = 0.957, Missouri DSR = 0.94), which could be a product of the early breeding period in Texas (Zimmerman 1982, Patterson and Best 1996, Basili et al. 1997, Winter and Faaborg 1999). My research re-affirms the hypothesis that abundance is not a good indicator of habitat quality for dickcissels (Zimmerman 1982, Van Horne 1983, Winter and Faaborg 1999, Fletcher et al. 2006).

Dickcissel parasitism rates have been known to vary across their range from as low as 5% to as high as 100% (Zimmerman 1983, Winter et al. 2000, Jensen and Finck 2004, Jensen and Cully 2005b). The low parasitism rate in this study (3%) is likely a product of the low observed numbers of brown–headed cowbirds in the area.

Dickcissels were not selecting specific areas within sites, but were nesting in available vegetation within each site (Figure 7). Nest height, nest substrate height, vegetation height at the sites, and vegetation heights surrounding the nests were significantly different between site types, but this did not appear to play a part in DSR or nesting success (Figures 8 & 9). Clutch size was higher in exotic sites when compared to restored sites and nearly statistically significant (P = 0.052, Figure 5), however, the difference did not appear to be biologically significant especially since dickcissels on restored sites still produced more young overall.

An ecological trap occurs when an organism is attracted to a specific type of habitat and because of human alterations that habitat is less suitable than other available habitats (Schlaepfer et al. 2002). Many grassland passerine species including the dickcissel, can be attracted to areas that can act as traps (McCoy et al. 1999, Winter and Faaborg 1999, Fletcher et al. 2006). Some research suggests that CRP fields are acting as traps for dickcissels (Best et al. 1997, McCoy et al. 1999). Despite a high failure rate (82%) and a lower DSR and observed success in restored sites than exotic sites, the number of nests that fledged and number of individual birds fledged in restored sites (n=11; n=47) compared to exotic sites (n=7; n=32) suggests that dickcissels at restored sites produced more young overall. The restored areas are contributing more to dickcissel population recovery than exotic areas, and are not acting as ecological traps.

Site size may also be playing a role in the overall reduced dickcissel observed nest success and DSR. The sites I sampled were small in size (<40 ha), and dickcissels nesting on small sites can be subject to increased edge effects, brood parasitism, and predatory pressures (Winter et al. 2000, Johnson and Igl 2001, Herkert et al. 2003, Jensen and Finck 2004, Winter et al. 2006). Larger restored areas do not currently exist in the blackland prkairie of Texas, however, a management implication of my research would be to restore areas that are close together to create larger continuous tracts of restored prairie.

Continued research in the blackland prairie region of Texas should focus on the predator community. Though I did not identify predators for this study because of logistical constraints, I noted signs of predation and the majority of predatory signs suggest that snakes are the main predator in this area. Snakes are a common predator of many passerines including dickcissels (Pietz and Granfors 2000, Renfrew and Ribic 2003, Stake et al. 2005). These restored areas are attracting large numbers of dickcissels, which are potentially attracting predators. Dickcissels were among the most abundant bird species detected on all sites, and this is likely another reason for high depredation. My research provides information suggesting more dickcissel nests fledged in restored areas than in exotic areas, despite a lower DSR and observed success. According to my research prairie restorations in Texas are positively impacting the dickcissel. Further research is needed to definitively state what the cause for high predation rates in this area is, and to more accurately assess the predator community (Vickery and Herkert 2001, Renfrew and Ribic 2003, Weatherhead and Blouin–Demers 2004, Fletcher et al. 2006).

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APPENDIX A

Avian Abundance on Exotic Sites (2007)					
PRICEA (34 ha)	Total Birds	PointCountPoints	Visits Detected	Abundance	Grassland Obligate
American Crow	1	6	1	0.167	
Barn Swallow	1	6	1	0.167	
Brown-headed Cowbird	10	6	4	0.417	
Carolina Chickadee	14	6	4	0.583	
Carolina Wren	2	6	2	0.167	
Cliff Swallow	5	6	2	0.417	
Dickcissel	32	6	3	1.778	Y
Eastern Bluebird	1	6	1	0.167	
Eastern Meadowlark	1	6	1	0.167	Y
Field Sparrow	1	6	1	0.167	Y
Great-crested Flycatcher	1	6	1	0.167	
Grasshopper Sparrow	1	6	1	0.167	Y
Harris's Sparrow	1	6	1	0.167	
Indigo Bunting	1	6	1	0.167	
Lark Sparrow	4	6	2	0.333	
Mourning Dove	1	6	1	0.167	
Northern Cardinal	33	6	6	0.917	
Northern Mockingbird	1	6	1	0.167	
Painted Bunting	1	6	1	0.167	
Red-bellied Woodpecker	4	6	4	0.167	
Ruby-crowned Kinglet	1	6	1	0.167	
Red-eyed Vireo	2	6	1	0.333	
Savannah Sparrow	4	6	2	0.333	Y
Song Sparrow	4	6	2	0.333	
Scissor-tailed Flycatcher	2	6	2	0.167	
Tufted Titmouse	5	6	3	0.278	
White-crowned Sparrow	2	6	1	0.333	
White-eyed Vireo	4	6	3	0.222	
NAVMILLS (32 ha)					
American Crow	3	7	2	0.214	
American Robin	1	7	1	0.143	
Blue-gray Gnatcatcher	1	7	1	0.143	
Brown-headed Cowbird	1	7	1	0.143	
Carolina Chickadee	6	7	4	0.214	
Cedar Waxwing	14	7	1	2.000	
Dickcissel	5	7	1	0.714	Y
Eastern Kingbird	2	7	1	0.286	
Eastern Meadowlark	1	7	1	0.143	Y
Grasshopper Sparrow	4	7	2	0.286	Y
Lark Sparrow	28	7	3	1.333	
Northern Cardinal	17	7	6	0.405	
Red-winged Blackbird	1	7	1	0.143	
Savannah Sparrow	3	7	1	0.429	Y
Song Sparrow	40	7	4	1.429	
Scissor-tailed Flycatcher	1	7	1	0.143	
Tufted Titmouse	1	7	1	0.143	
White-eyed Vireo	8	7	3	0.381	

BARHAM (18.4 ha)					
Barn Swallow	5	7	1	0.714	
Dickcissel	39	7	2	2.786	Y
Eastern Kingbird	3	7	1	0.429	
Eastern Meadowlark	73	7	7	1.490	Y
Grasshopper Sparrow	31	7	5	0.886	Y
Killdeer	1	7	1	0.143	
Lark Sparrow	16	7	3	0.762	
Loggerhead Shrike	4	7	2	0.286	Y
Northern Bobwhite	1	7	1	0.143	
Northern Cardinal	1	7	1	0.143	
Northern Mockingbird	4	7	2	0.286	
Pied-billed Grebe	2	7	1	0.286	
Red-winged Blackbird	5	7	1	0.714	
Savannah Sparrow	8	7	2	0.571	Y
Song Sparrow	4	7	1	0.571	
Scissor-tailed Flycatcher	6	7	4	0.214	
Upland Sandpiper	9	7	2	0.643	Y
PRICEB (17.2 ha)					
Barn Swallow	4	6	1	0.667	
Brown-headed Cowbird	1	6	1	0.167	
Dickcissel	23	6	2	1.917	Y
Downy Woodpecker	1	6	1	0.167	
Eastern Meadowlark	87	6	7	2.071	Y
Field Sparrow	1	6	1	0.167	Y
Grasshopper Sparrow	12	6	4	0.500	Y
Great-tailed Grackle	1	6	1	0.167	
Lark Sparrow	5	6	3	0.278	
Loggerhead Shrike	1	6	1	0.167	Y
Mourning Dove	1	6	1	0.167	
Northern Cardinal	3	6	2	0.250	
Northern Harrier	1	6	1	0.167	
Northern Mockingbird	5	6	3	0.278	
Red-winged Blackbird	11	6	6	0.306	
Savannah Sparrow	4	6	2	0.333	Y
Song Sparrow	29	6	4	1.208	
Scissor-tailed Flycatcher	13	6	6	0.361	
WOLFE (7.2 ha)					
Barn Swallow	1	3	1	0.333	
Brown-headed Cowbird	3	3	3	0.333	
Carolina Chickadee	7	3	5	0.467	
Carolina Wren	4	3	3	0.444	
Chipping Sparrow	3	3	2	0.500	
Eastern Bluebird	4	3	4	0.333	
Grasshopper Sparrow	1	3	1	0.333	Y
Lark Sparrow	4	3	4	0.333	
Loggerhead Shrike	1	3	1	0.333	
Mourning Dove	4	3	3	0.444	
Nashville Warbler	1	3	1	0.333	
Northern Cardinal	7	3	4	0.583	
Northern Mockingbird	3	3	3	0.333	
Painted Bunting	2	3	1	0.667	

Scissor-tailed Flycatcher	7	3	4	0.583	
Tufted Titmouse	7	3	5	0.467	
Yellow-billed Cuckoo	1	3	1	0.333	
PRICEC (7 ha)					
Black-chinned Hummingbird	1	3	1	0.333	
Brown-headed Cowbird	1	3	1	0.333	
Carolina Chickadee	5	3	3	0.556	
Carolina Wren	3	3	3	0.333	
Dickcissel	7	3	2	1.167	Y
Eastern Bluebird	1	3	1	0.333	
Greater Roadrunner	2	3	2	0.333	
Grasshopper Sparrow	7	3	2	1.167	Y
Lark Sparrow	6	3	3	0.667	
Mourning Dove	4	3	2	0.667	
Northern Cardinal	25	3	7	1.190	
Red-bellied Woodpecker	1	3	1	0.333	
Ruby-crowned Kinglet	2	3	2	0.333	
Song Sparrow	4	3	1	1.333	
Spotted Towhee	1	3	1	0.333	
Scissor-tailed Flycatcher	8	3	5	0.533	
Upland Sandpiper	1	3	1	0.333	Y
White-crowned Sparrow	29	3	3	3.222	
White-eyed Vireo	2	3	2	0.333	
White-throated Sparrow	1	3	1	0.333	

Avian Abundance on Restored Sites (2007)					
WILLIS (29 ha)					
Barn Swallow	6	10	2	0.300	
Brown-headed Cowbird	1	10	1	0.100	
Black Vulture	1	10	1	0.100	
Carolina Chickadee	2	10	2	0.100	
Carolina Wren	3	10	2	0.150	
Cliff Swallow	38	10	4	0.950	
Common Yellowthroat	1	10	1	0.100	
Dickcissel	75	10	4	1.875	Y
Eastern Bluebird	2	10	2	0.100	
Eastern Meadowlark	64	10	7	0.914	Y
Great Egret	1	10	1	0.100	
Grasshopper Sparrow	13	10	4	0.325	Y
House Wren	2	10	1	0.200	
Killdeer	2	10	2	0.100	
Lark Sparrow	8	10	3	0.267	
Loggerhead Shrike	4	10	2	0.200	Y
Mourning Dove	14	10	6	0.233	
Northern Bobwhite	21	10	7	0.300	
Northern Cardinal	11	10	6	0.183	
Northern Mockingbird	26	10	7	0.371	
Northern Rough-winged Swallow	2	10	1	0.200	
Painted Bunting	4	10	2	0.200	
Red-bellied Woodpecker	1	10	1	0.100	
Red-winged Blackbird	13	10	5	0.260	
Savannah Sparrow	5	10	3	0.167	Y
Sedge Wren	1	10	1	0.100	
Song Sparrow	2	10	1	0.200	
Scissor-tailed Flycatcher	22	10	7	0.314	
Upland Sandpiper	11	10	2	0.550	Y
White-crowned Sparrow	7	10	2	0.350	
Yellow-billed Cuckoo	2	10	2	0.100	
DRBILL (29 ha)					
Carolina Chickadee	7	5	4	0.350	
Carolina Wren	1	5	1	0.200	
Dickcissel	56	5	4	2.800	Y
Eastern Bluebird	1	5	1	0.200	
Eastern Meadowlark	9	5	2	0.900	Y
Grasshopper Sparrow	8	5	3	0.533	Y
Killdeer	3	5	3	0.200	
Lark Sparrow	5	5	3	0.333	
Mourning Dove	7	5	5	0.280	
Northern Cardinal	11	5	6	0.367	
Northern Mockingbird	5	5	4	0.250	
Painted Bunting	4	5	2	0.400	
Savannah Sparrow	8	5	2	0.800	Y
Scissor-tailed Flycatcher	7	5	4	0.350	
White-crowned Sparrow	2	5	1	0.400	
Yellow-billed Cuckoo	1	5	1	0.200	

THRONRIDGE (17.6 ha)					
Brown-headed Cowbird	9	6	5	0.300	
Blue Grosbeak	2	6	1	0.333	
Carolina Chickadee	3	6	2	0.250	
Carolina Wren	2	6	2	0.167	
Dickcissel	43	6	2	3.583	Y
Eastern Bluebird	33	6	7	0.786	
Eastern Kingbird	1	6	1	0.167	
Eastern Meadowlark	4	6	2	0.333	Y
Eastern Phoebe	3	6	3	0.167	
Field Sparrow	1	6	1	0.167	Y
Grasshopper Sparrow	5	6	3	0.278	Y
Indigo Bunting	4	6	2	0.333	
Lark Sparrow	16	6	5	0.533	
Mourning Dove	2	6	1	0.333	
Northern Cardinal	8	6	5	0.267	
Northern Mockingbird	1	6	1	0.167	
Painted Bunting	1	6	1	0.167	
Red-bellied Woodpecker	2	6	2	0.167	
Red-winged Blackbird	1	6	1	0.167	
Savannah Sparrow	12	6	4	0.500	Y
Song Sparrow	21	6	3	1.167	
Tufted Titmouse	1	6	1	0.167	
WOLFR (17.3 ha)					
Blue-gray Gnatcatcher	7	5	4	0.350	
Brown-headed Cowbird	1	5	1	0.200	
Black Vulture	1	5	1	0.200	
Carolina Chickadee	12	5	5	0.480	
Carolina Wren	8	5	7	0.229	
Coopers Hawk	1	5	1	0.200	
Downy Woodpecker	1	5	1	0.200	
Grasshopper Sparrow	2	5	2	0.200	Y
Mourning Dove	19	5	6	0.633	
Northern Cardinal	23	5	7	0.657	
Painted Bunting	9	5	4	0.450	
Ruby-crowned Kinglet	1	5	1	0.200	
Scissor-tailed Flycatcher	9	5	6	0.300	
Tufted Titmouse	1	5	1	0.200	
Upland Sandpiper	2	5	1	0.400	Y
White-eyed Vireo	9	5	6	0.300	
PRICER (12 ha)					
American Crow	1	2	1	0.500	
Dickcissel	20	2	2	5.000	Y
Eastern Meadowlark	2	2	2	0.500	Y
Field Sparrow	3	2	2	0.750	Y
Grasshopper Sparrow	19	2	4	2.375	Y
Killdeer	1	2	1	0.500	
Lark Sparrow	1	2	1	0.500	
Northern Cardinal	1	2	1	0.500	
Northern Mockingbird	3	2	2	0.750	
Red-winged Blackbird	7	2	4	0.875	
Savannah Sparrow	4	2	2	1.000	Y
Scissor-tailed Flycatcher	4	2	3	0.667	

SPREADLY (5 ha)				
Blue-gray Gnatcatcher	1	2	1	0.500
Blue Jay	3	2	1	1.500
Carolina Chickadee	2	2	2	0.500
Carolina Wren	20	2	1	10.000
Cattle Egret	2	2	1	1.000
Chipping Sparrow	4	2	1	2.000
Downy Woodpecker	1	2	1	0.500
Eastern Bluebird	3	2	2	0.750
Lark Sparrow	1	2	1	0.500
Mourning Dove	8	2	2	2.000
Northern Cardinal	3	2	3	0.500
Red-bellied Woodpecker	1	2	1	0.500
Red-winged Blackbird	1	2	1	0.500
Song Sparrow	4	2	2	1.000
Tufted Titmouse	3	2	3	0.500
White-crowned Sparrow	2	2	1	1.000
White-eyed Vireo	2	2	2	0.500

APPENDIX B

Avian Abundance on Exotic Sites (2008)					
ROB (33.8 ha)	Total Birds	PointCountPoints	Visits Detected	Abundance	Grassland Obligate
American Crow	11	9	3	0.407	
Barn Swallow	5	9	1	0.556	
Blue-gray Gnatcatcher	2	9	1	0.222	
Brown-headed Cowbird	6	9	4	0.167	
Carolina Chickadee	18	9	5	0.400	
Carolina Wren	17	9	5	0.378	
Dickcissel	1	9	1	0.111	Y
Downy Woodpecker	5	9	4	0.139	
Eastern Bluebird	26	9	5	0.578	
Eastern Meadowlark	4	9	4	0.111	Y
Killdeer	1	9	1	0.111	
Lark Sparrow	2	9	2	0.111	
Mourning Dove	4	9	2	0.222	
Northern Cardinal	44	9	5	0.978	
Northern Mockingbird	3	9	3	0.111	
Northern Parula	1	9	1	0.111	
Painted Bunting	25	9	5	0.556	
Pileated Woodpecker	1	9	1	0.111	
Red-bellied Woodpecker	6	9	2	0.333	
Red-shouldered Hawk	3	9	2	0.167	
Red-winged Blackbird	1	9	1	0.111	Y
Scissor-tailed Flycatcher	4	9	2	0.222	
Tufted Titmouse	6	9	4	0.167	
White-eyed Vireo	6	9	4	0.167	
Yellow-billed Cuckoo	1	9	1	0.111	
BOYDA (29.7 ha)					
Barn Swallow	3	11	1	0.273	
Brown-headed Cowbird	4	11	3	0.121	
Blue Jay	1	11	1	0.091	
Carolina Chickadee	2	11	2	0.091	
Carolina Wren	10	11	4	0.227	
Cassin’s Sparrow	1	11	1	0.091	
Cedar Waxwing	21	11	1	1.909	
Chipping Sparrow	2	11	1	0.182	
Common Yellowthroat	1	11	1	0.091	Y
Dickcissel	53	11	3	1.606	Y
Eastern Meadowlark	26	11	5	0.473	
Eastern Phoebe	3	11	1	0.273	
Grasshopper Sparrow	12	11	3	0.364	Y
Killdeer	2	11	2	0.091	
Lark Sparrow	5	11	4	0.114	
Mourning Dove	8	11	3	0.242	
Northern Cardinal	15	11	5	0.273	

Northern Mockingbird	1	11	2	0.045	
Painted Bunting	2	11	1	0.182	
Red-bellied Woodpecke	1	11	1	0.091	
Savannah Sparrow	7	11	3	0.212	Y
Tufted Titmouse	1	11	1	0.091	
Upland Sandpiper	4	11	2	0.182	Y
White-crowned Sparrow	1	11	1	0.091	
White-eyed Vireo	2	11	1	0.182	
AUSITNE (24.5 ha)					
Barn Swallow	98	10	3	3.267	
Bobolink	1	10	1	0.100	Y
Carolina Chickadee	2	10	1	0.200	
Cattle Egret	84	10	2	4.200	
Carolina Wren	2	10	1	0.200	
Cedar Waxwing	50	10	1	5.000	
Cliff Swallow	86	10	3	2.867	
Dickcissel	130	10	4	3.250	Y
Eastern Bluebird	1	10	1	0.100	
Eastern Kingbird	2	10	1	0.200	
Eastern Meadowlark	35	10	5	0.700	Y
Grasshopper Sparrow	32	10	3	1.067	Y
Killdeer	8	10	4	0.200	
Lark Sparrow	2	10	1	0.200	
Mourning Dove	2	10	1	0.200	
Northern Cardinal	10	10	5	0.200	
Painted Bunting	5	10	3	0.167	
Red-bellied Woodpecker	1	10	1	0.100	
Red-winged Blackbird	4	10	2	0.200	
Savannah Sparrow	15	10	2	0.750	Y
Scissor-tailed Flycatcher	7	10	4	0.175	
Tufted Titmouse	2	10	1	0.200	
Turkey Vulture	2	10	1	0.200	
Upland Sandpiper	26	10	2	1.300	Y
BOYDB (17.8 ha)					
Barn Swallow	40	7	3	1.905	
Blue-gray Gnatcatcher	1	7	1	0.143	
Brown-headed Cowbird	6	7	4	0.214	
Blue Jay	3	7	2	0.214	
Blue-winged Teal	19	7	4	0.679	
Carolina Chickadee	9	7	3	0.429	
Cattle Egret	54	7	2	3.857	
Carolina Wren	6	7	4	0.214	
Cedar Waxwing	42	7	5	1.200	
Dickcissel	22	7	3	1.048	Y
Eastern Phoebe	7	7	5	0.200	
European Starling	2	7	2	0.143	
Grasshopper Sparrow	2	7	2	0.143	Y
Indigo Bunting	1	7	1	0.143	
Killdeer	6	7	2	0.429	

Lark Sparrow	1	7	1	0.143	
Lesser Yellowlegs	5	7	2	0.357	
Mourning Dove	1	7	1	0.143	
Northern Cardinal	21	7	5	0.600	
Northern Mockingbird	2	7	3	0.095	
Painted Bunting	1	7	1	0.143	
Red-bellied Woodpecker	2	7	2	0.143	
Red-shouldered Hawk	1	7	1	0.143	
Savannah Sparrow	64	7	4	2.286	Y
Tufted Titmouse	6	7	4	0.214	
Upland Sandpiper	19	7	2	1.357	Y
White-crowned Sparrow	2	7	2	0.143	
White-eyed Vireo	1	7	1	0.143	

Avian Abundance on Restored Sites (2008)					
BIGWOODS (26.6 ha)					
American Crow	1	12	1	0.083	
Barn Swallow	7	12	2	0.292	
Blue-gray Gnatcatcher	7	12	4	0.146	
Brown-headed Cowbird	13	12	3	0.361	
Blue Jay	4	12	3	0.111	
Brown Thrasher	1	12	1	0.083	
Carolina Chickadee	21	12	5	0.350	
Carolina Wren	15	12	5	0.250	
Cedar Waxwing	85	12	2	3.542	
Common Yellowthroat	22	12	4	0.458	Y
Dickcissel	25	12	3	0.694	Y
Downy Woodpecker	2	12	1	0.167	
Eastern Bluebird	7	12	2	0.292	
Eastern Kingbird	3	12	1	0.250	
Eastern Phoebe	7	12	1	0.583	
Grasshopper Sparrow	1	12	1	0.083	Y
House Wren	2	12	2	0.083	
Indigo Bunting	8	12	2	0.333	
Lincoln’s Sparrow	7	12	2	0.292	
Mourning Dove	10	12	4	0.208	
Nashville Warbler	1	12	1	0.083	
Northern Cardinal	41	12	5	0.683	
Northern Mockingbird	4	12	3	0.111	
Painted Bunting	31	12	3	0.861	
Pileated Woodpecker	1	12	1	0.083	
Red-bellied Woodpecker	10	12	4	0.208	
Red-shouldered Hawk	2	12	2	0.083	
Red-winged Blackbird	5	12	4	0.104	Y
Savannah Sparrow	9	12	4	0.188	Y
Sedge Wren	25	12	3	0.694	Y
Scissor-tailed Flycatcher	13	12	5	0.217	
Tufted Titmouse	18	12	5	0.300	
White-crowned Sparrow	8	12	2	0.333	
Western Kingbird	2	12	2	0.083	
White-eyed Vireo	27	12	5	0.450	
Yellow-billed Cuckoo	2	12	1	0.167	
AUSTINR (22.5 ha)					
Barn Swallow	1	8	1	0.125	
Blue-gray Gnatcatcher	5	8	4	0.156	
Blue Grosbeak	1	8	1	0.125	
Carolina Chickadee	16	8	4	0.500	
Carolina Wren	4	8	2	0.250	
Chipping Sparrow	1	8	1	0.125	
Common Yellowthroat	4	8	3	0.167	Y

Dickcissel	54	8	3	2.250	Y
Downy Woodpecker	1	8	1	0.125	
Eastern Bluebird	1	8	1	0.125	
Eastern Phoebe	4	8	3	0.167	
Great-crested Flycatcher	1	8	1	0.125	
Great Egret	1	8	1	0.125	
Indigo Bunting	22	8	4	0.688	
Killdeer	1	8	1	0.125	
Lark Sparrow	1	8	1	0.125	
Northern Cardinal	24	8	5	0.600	
Northern Mockingbird	1	8	1	0.125	
Painted Bunting	13	8	4	0.406	
Pileated Woodpecker	1	8	1	0.125	
Red-bellied Woodpecker	1	8	1	0.125	
Ruby-crowned Kinglet	1	8	1	0.125	
Red-tailed Hawk	1	8	1	0.125	
Ruby-throated Hummingbird	1	8	1	0.125	
Red-winged Blackbird	4	8	2	0.250	Y
Savannah Sparrow	2	8	2	0.125	Y
Sedge Wren	18	8	3	0.750	Y
Tufted Titmouse	10	8	3	0.417	
White-crowned Sparrow	2	8	1	0.250	
White-eyed Vireo	6	8	4	0.188	
TATUM (21.9 ha)					
Brown-headed Cowbird	12	9	3	0.444	
Carolina Chickadee	1	9	1	0.111	
Carolina Wren	1	9	1	0.111	
Dickcissel	187	9	4	5.194	Y
Eastern Kingbird	1	9	1	0.111	
Grasshopper Sparrow	2	9	2	0.111	Y
Killdeer	1	9	1	0.111	
Lark Sparrow	1	9	1	0.111	
Mourning Dove	4	9	3	0.148	
Northern Cardinal	6	9	5	0.133	
Painted Bunting	1	9	1	0.111	
Red-bellied Woodpecker	2	9	2	0.111	
Red-winged Blackbird	2	9	2	0.111	Y
Savannah Sparrow	2	9	1	0.222	Y
Sedge Wren	18	9	4	0.500	Y
Scissor-tailed Flycatcher	2	9	1	0.222	
Upland Sandpiper	5	9	2	0.278	Y
White-eyed Vireo	1	9	1	0.111	
PRICED (15.4 ha)					
Barn Swallow	1	7	1	0.143	
Brown-headed Cowbird	1	7	1	0.143	
Carolina Chickadee	1	7	1	0.143	
Carolina Wren	1	7	1	0.143	
Dickcissel	87	7	3	4.143	Y
Eastern Meadowlark	14	7	4	0.500	Y
Grasshopper Sparrow	4	7	2	0.286	Y

Killdeer	1	7	1	0.143	
Loggerhead Shrike	3	7	3	0.143	Y
Mourning Dove	3	7	2	0.214	
Northern Cardinal	3	7	1	0.429	
Red-winged Blackbird	51	7	5	1.457	Y
Savannah Sparrow	4	7	2	0.286	Y
Sedge Wren	12	7	3	0.571	Y
Scissor-tailed Flycatcher	3	7	2	0.214	
Upland Sandpiper	8	7	3	0.381	Y
White Ibis	1	7	1	0.143	
ROSE (11.4 ha)					
Blue-gray Gnatcatcher	2	5	2	0.200	
Brown-headed Cowbird	2	5	1	0.400	
Blue-winged Teal	6	5	2	0.600	
Carolina Chickadee	1	5	1	0.200	
Carolina Wren	1	5	1	0.200	
Cedar Waxwing	5	5	2	0.500	
Common Yellowthroat	4	5	2	0.400	Y
Dickcissel	84	5	5	3.360	Y
Eastern Meadowlark	10	5	4	0.500	Y
Mourning Dove	3	5	2	0.300	
Northern Cardinal	6	5	4	0.300	
Northern Mockingbird	1	5	1	0.200	
Red-winged Blackbird	43	5	5	1.720	Y
Savannah Sparrow	3	5	1	0.600	Y
Sedge Wren	11	5	2	1.100	Y
Sora	1	5	1	0.200	
Scissor-tailed Flycatcher	2	5	2	0.200	
Tufted Titmouse	2	5	2	0.200	
White-eyed Vireo	1	5	1	0.200	
Yellow Warbler	1	5	1	0.200	
WEISER (8.8 ha)					
American Crow	1	4	1	0.250	
Blue-gray Gnatcatcher	6	4	5	0.300	
Brown-headed Cowbird	7	4	4	0.438	
Blue Jay	1	4	1	0.250	
Carolina Chickadee	2	4	2	0.250	
Carolina Wren	14	4	5	0.700	
Chipping Sparrow	1	4	1	0.250	
Eastern Bluebird	4	4	2	0.500	
House Wren	3	4	2	0.375	
Mourning Dove	16	4	4	1.000	
Nashville Warbler	2	4	2	0.250	
Northern Cardinal	33	4	5	1.650	
Northern Mockingbird	4	4	2	0.500	
Painted Bunting	9	4	3	0.750	
Pine Warbler	1	4	1	0.250	
Red-bellied Woodpecker	2	4	1	0.500	
Savannah Sparrow	1	4	1	0.250	Y

Scissor-tailed Flycatcher	1	4	1	0.250	
Tufted Titmouse	12	4	4	0.750	
White-eyed Vireo	16	4	5	0.800	
White-throated Sparrow	1	4	1	0.250	
Yellow Warbler	1	4	1	0.250	
WHITE (3.7 ha)					
Barn Swallow	1	2	1	0.500	
Brown-headed Cowbird	3	2	2	0.750	
Carolina Chickadee	2	2	2	0.500	
Common Yellowthroat	1	2	1	0.500	Y
Dickcissel	27	2	4	3.375	Y
Eastern Phoebe	2	2	2	0.500	
Grasshopper Sparrow	1	2	1	0.500	Y
Lark Sparrow	5	2	2	1.250	
Mourning Dove	6	2	2	1.500	
Northern Cardinal	4	2	3	0.667	
Red-bellied Woodpecker	1	2	1	0.500	
Red-tailed Hawk	1	2	1	0.500	
Savannah Sparrow	3	2	1	1.500	Y
Sedge Wren	2	2	1	1.000	Y
Upland Sandpiper	1	2	1	0.500	Y
White-eyed Vireo	1	2	1	0.500	

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