Urban Naturalist

No. 15 2018

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Cover Photograph: Three male Great-tailed Grackles display to each other in a Sherman, TX parking lot. Photograph © Jason D. Luscier.

URBAN NATURALIST

The ***Urban Naturalist*** (ISSN # 2328-8965) is published by the Eagle Hill Institute, PO Box 9, 59 Eagle Hill Road, Steuben, ME 04680-0009. Phone 207-546-2821, FAX 207-546-3042. E-mail: office@eaglehill.us. Webpage: www.eaglehill.us/urna. Periodical postage paid in Steuben, ME and additional mailing offices. **Special issue proposals are welcome**. On-line secure subscription ordering: rate per year - $20 regular, $15 students, $80 organizations. **Authors**: submission guidelines are available at www.eaglehill.us/una. **Co-published journals:** The *Northeastern Naturalist* (ISSN 1092-6194 [print], ISSN 1938-5307 [online]), the *Southeastern Naturalist* (ISSN 1528-7092 [print], ISSN 1938-5412 [online]), and the *Caribbean Naturalist* (ISSN 2326-7119), journals with separate Boards of Editors. The Eagle Hill Institute is a tax exempt 501(c)(3) nonprofit corporation of the State of Maine (Federal ID # 010379899).

Effects of Urbanization on Great-tailed Grackle Habitat Use and Nest Success in Sherman, Texas

Jason D. Luscier*

Abstract - Throughout the 1900s, *Quiscalus mexicanus* (Great-tailed Grackle) expanded its range northward from South America, Central America, and Mexico up to the south-central United States. High densities in cities present nuisance problems in commercial and residential areas. Urban activities compound the problem by providing more nesting sites and food for these birds; however, little is known about their specific habitat requirements. I evaluated reproductive patterns in the city core, suburban residential neighborhoods, managed city parks, and commercial areas of Sherman, TX, USA, so as to formulate recommendations for managing populations. The Great-tailed Grackle daily nest survival rate (95% confidence interval) based on 659 nests was 98.1% (97.4–98.6%), translating to an overall seasonal nest success rate of 47.1% (34.8–58.4%). Nests were more commonly found in exotic vegetation in commercial areas than in any other urban habitat type. In order to reduce the nuisance presented by dense aggregations of this species and to remove competition to native wildlife, future management should focus on removing non-native vegetation and supporting landscaping dominated by native vegetation.

Introduction

Quiscalus mexicanus Gmelin (Great-tailed Grackle, hereafter GTGR) is a large colonial blackbird native to northern South America, Central America, and Mexico (Wehtje 2003). Throughout the 1900s, this species expanded its range northward following irrigation and tree planting associated with agriculture and urbanization (Arnold and Folse1977, Christensen 2000, Dinsmore and Dinsmore 1993). Wehtje (2003) reported that this increase in area occupied the species may have been as high as 5530% between 1880 and 2000. Now GTGR is quite common and abundant in many urban areas in the south central and southwestern United States (Johnson and Peer 2001, King 2010). Current reports from birdwatchers show the GTGR distribution extending west to California and as far north as Canada (eBird 2012).

GTGR is a habitat generalist in that it is primarily an omnivorous scavenger (Johnson and Peer 2001). Davis and Arnold (1972) reported that GTGR diet varied within a population by the birds' sex, age, and size, relating to varying abilities to search for and catch prey or scavenge for seeds and fruit. This high degree of omnivory and its ability to avoid intraspecific competition allow the GTGR to exploit highly disturbed areas like urban habitats (Wehtje 2003). Urban activities can provide increased access to novel foods that may help to avoid competition with other

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Manuscript Editor: Madhusudan Katti

species or conspecifics (Ryder et al. 2010). These conditions have allowed GTGR populations to rapidly increase and spread throughout urban areas of the south-central United States (Wehtje 2003).

GTGRs are quite reproductively active across the urban landscape, nesting in large colonies in urban parking lots, city parks, and residential areas (Wehtje 2003). They have 1–2 broods between mid-March and mid-July each year (Johnson and Peer 2001). In more natural locations (i.e., outside of urban areas), GTGRs nest primarily in marshes consisting of *Typha latifolia* L. (Cattail) and *Schoenoplectus* spp. (Rchb.) Palla (Bulrush) (Johnson and Peer 2001). Under such natural conditions, Guillory et al. (1981) reported hatching success rates of 55–89% and fledging rates of 36–93%. Few studies have examined how breeding success varies across urban characteristics (Wehtje 2003); however, breeding within a city may enhance reproductive success due to fewer native nest predators as well as access to high quantities of food (Adams et al. 2006, Wehtje 2003).

High densities with urban populations of GTGR result in a number of nuisance problems throughout commercial areas (e.g., parking lots of grocery stores, shopping malls, restaurants, etc.) and residential and green-space areas (e.g., backyards, city parks, etc.) (Johnson and Peer 2001). Birds in densely aggregated urban roosts result in bird excreta accumulating in public places potentially causing issues with urban sanitation and disease transmission. Furthermore, they are very vocal at night and thus keep people awake, and even instill a fear (i.e., ornithophobia) in many people (Adams et al. 2006, Johnson and Peer 2001). Urban activities such as landscape planning, waste management and littering, and irrigation compound the problem by providing more nesting sites and access to food and water (Adams et al. 2006).

There have been many nuisance-management practices implemented in response to increased GTGR populations in urban areas of Texas. For example, firearms, trapping, and pesticides have been used for lethal eradication (Johnson and Peer 2001). Pyrotechnics, sonic booms, bright objects (e.g., reflective tape), and predator decoys have been used as scare tactics (Adams et al. 2006, Tipton et al. 1989). City managers have even tried simply trimming branches from trees to discourage GTGRs from roosting in particular areas (Johnson and Peer 2001). While these management activities temporarily affect distributions of birds, they do not directly address the factors supporting high densities of GTGRs in a city.

Ultimately, little is known about specific GTGR habitat use in urban areas (Johnson and Peer 2001). The main objective of my study was to evaluate the habitat characteristics associated with GTGR breeding success in the city of Sherman, TX, USA, in order to inform urban planning regimes for managing this species. I evaluated nest-survival patterns in the core of the city (i.e., city center), commercial areas, residential areas, and managed green spaces. Specifically I evaluated nest survival in relation to specific habitat variables within each of these 4 major urban habitat types.

Field-site Description

During the breeding season of 2011, I estimated daily nest survival and overall seasonal nest success of GTGRs in the City of Sherman in Grayson County (Zone 14 S 721778 East 3724324 North). Sherman is ~100 km north of the Dallas–Fort Worth metroplex and has a population of 38,521 people (US Census Bureau 2010). Grayson County is within the Blackland Prairie and Cross Timbers ecoregions (Gould et al. 1960). Historically the Blackland Prairie was dominated by native tall-grass species such as *Andropogon gerardii* Vitman (Big Bluestem), *Schizachyrium scoparium* (Michx.) Nash (Little Bluestem), *Sorghastrum nutans* (L.) Nash (Indian-grass), and *Panicum virgatum* L. (Switchgrass), and the eastern region of the Cross Timbers included savannah and woodland habitat types that contained *Quercus stellata* Wangenh. (Post Oak), *Q. marilandica* Münchh. (Blackjack Oak), *Juniperus virginiana* L. var. *virginiana* (Eastern Redcedar), *Prosopis* spp. L. (mesquite), and other species (Texas Parks and Wildlife Department 2014). However, these patterns have been greatly altered in the urban landscape. Dominant vegetation throughout Sherman includes non-native species such as *Pyrus calleryana* Decne. (Bradford Pear), *Photinia ×fraseri* Dress (Fraser's Photinia, commonly referred to as Red-tip Photinia), *Ulmus parvifolia Jacq.* (Chinese Elm), *Pinus* spp. (pine), and *Lagerstroemia indica* L. (Crapemyrtle), and native species such as *Ulmus americana* L. (American Elm), *Q. shumardii* Buckley var. *shumardii* (Shumard Oak), other *Quercus* spp. (live oaks), *Sapindus saponaria* L. var. *drummondii* (Hook. & Arn.) L.D. Benson (Western Soapberry), Eastern Redcedar, and Cattail.

Throughout the city of Sherman, I evaluated breeding distributions of GTGRs in 4 major urban habitat types (as defined by Adams et al. 2006): (1) the highly urbanized city center, (2) commercial areas, (3) residential areas, and (4) managed habitat patches (Fig. 1). The highly urbanized city center (hereafter, city center) included the main downtown square, county courthouse, and multiple banks, shops, and restaurants. Commercial areas were regions throughout the city with high levels of human activity, including the major shopping district along Highway 75. Residential areas included neighborhoods with single-family homes and apartment complexes with varying degrees of landscaping (i.e., some locations were heavily landscaped, others were very sparsely vegetated and heavily mowed). Lastly, managed habitat patches included green spaces that were actively maintained (e.g., grass mowed, trees trimmed, etc.) like city parks, cemeteries, and the Austin College campus; this urban habitat type had the greatest vegetational heterogeneity including grasses, shrubs, and trees.

Methods

Nest searching and nest survival estimation

I evaluated the reproductive success of GTGRs in Sherman by evaluating both daily nest survival (hereafter, nest survival) and overall seasonal nest success (hereafter, nest success). Three observers systematically searched for nests within the 4 habitat types throughout Sherman. In order to identify GTGR nesting areas, all 3 observers drove together in 1 car on all primary and secondary roads throughout the entire city. We noted areas of GTGR activity and then spent time in all of these regions on foot observing specific nesting behavior and locating nests. Thus, the main nest-searching efforts occurred in regions where GTGRs were initially observed from roads. At initial nest detection, we recorded the number of eggs, hatchlings, or fledglings present. We monitored the nests every 2–6 days (Martin and Geupel 1993) in order to estimate the success of each nest. The overall monitoring period

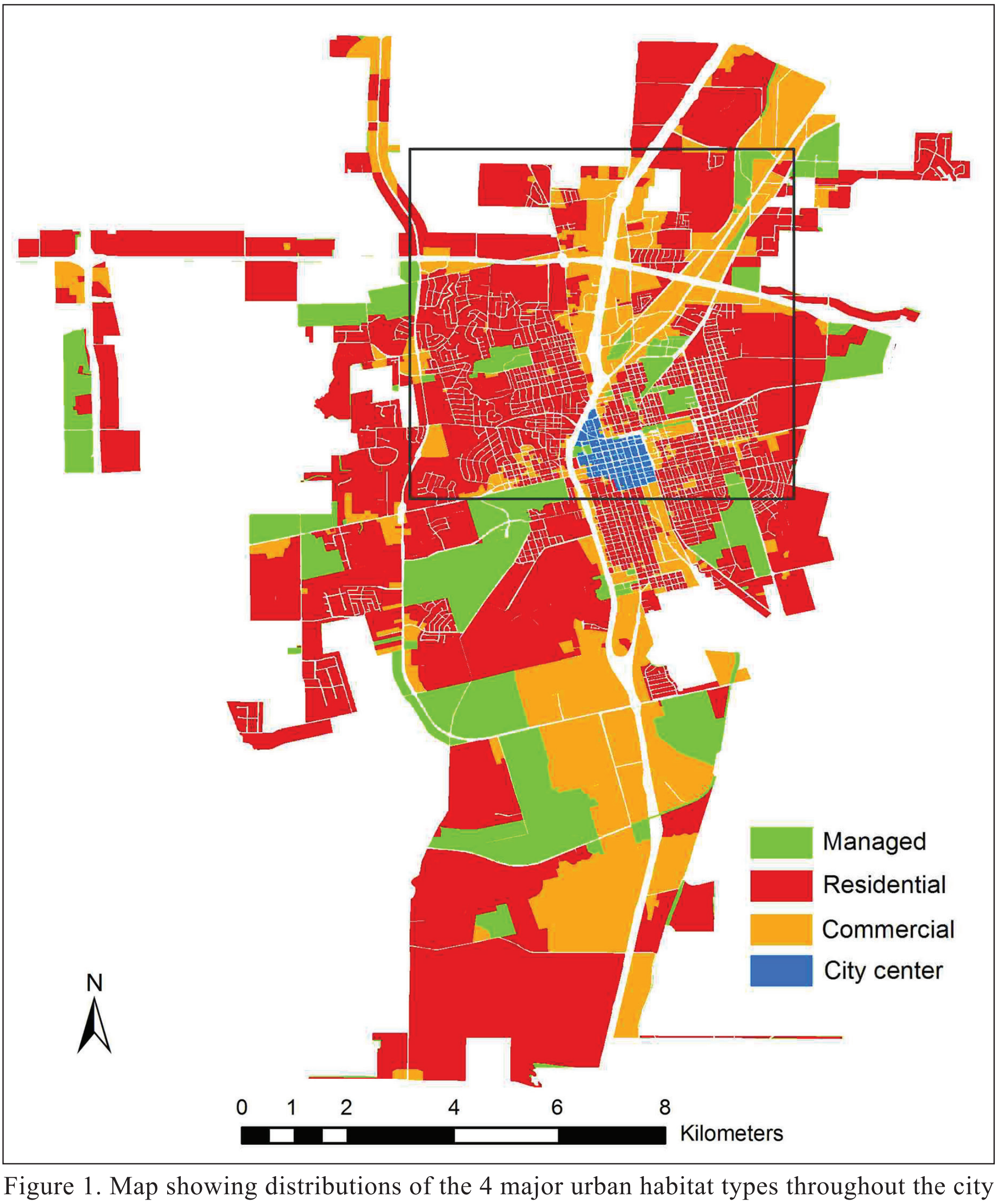

Figure 1. Map showing distributions of the 4 major urban habitat types throughout the city of Sherman, Grayson County, TX, USA. The black square outline marks the region of the city within which Great-tailed Grackle nests were located.

included 40 days from 16 May 2011 through 24 June 2011. To reduce our disturbance of nesting activity, we started each monitoring occasion by observing the behavior of nesting birds from a distance (~5–10 m) for 20 min. After this initial observation period, we approached each nest or colony of nests to directly observe the numbers of eggs or chicks present. Direct observation at nests did not exceed 10 min (and was typically <5 min) in order to minimize disturbance. Consequently, each monitoring occasion lasted ≤30 minutes. A nest was determined successful when at least 1 juvenile successfully fledged the nest. A nest was considered failed if there was no activity due to circumstances other than fledging (e.g., the nest was destroyed by a storm, or eggs/nestlings were predated).

I used program MARK (White and Burnham 1999) to estimate nest survival and nest success by ranking a candidate set of models that might explain GTGR nest survival, including various combinations of the habitat variables measured at each nest site (Table 1). I used Akaike's information criterion corrected for small sample size (AIC_c) to rank the candidate models for nest survival. Models with <2 ΔAIC_c from each other were considered equally plausible. AIC_c weights (w_i) are considered the weight of evidence that supports the likelihood of the model. Evidence ratios can determine the relative likelihood of a model fitting the data (Burnham and Anderson 2002). Model-averaged estimates were considered among models that were equally plausible given the data. Nest success for the entire monitoring period was computed by multiplying the nest survival rates for each day of the 40-day period (Dinsmore et al. 2002). For example, if nest survival did not change

Table 1. Candidate models for evaluating Great-tailed Grackle nest survival ($\hat{S}$) during 2011 in highly urbanized, commercial, residential, and managed habitats throughout the city of Sherman, TX, USA.

Model notation	Model description
$\hat{S}$(.)	Nest survival was constant (single estimate) across all variables
$\hat{S}$(Colony)	Nest survival varied by colony size
$\hat{S}$(DistNet)	Nest survival varied by distance (m) to nearest neighboring nest
$\hat{S}$(Species)	Nest survival varied by the species of vegetation
$\hat{S}$(VegHght)	Nest survival varied by the height (m) of the vegetation
$\hat{S}$(NestHght)	Nest survival varied by nest height (m)
$\hat{S}$Parking.)	Nest survival varied by parking lot area (km^2) within a 1-km radius
$\hat{S}$(DistTrash)	Nest survival varied by distance (m) to nearest small trash receptacle (e.g., sidewalk garbage can)
$\hat{S}$(DistDump)	Nest survival varied by distance (m) to large trash receptacle (e.g., dumpster)
$\hat{S}$(DistWater)	Nest survival varied by distance (m) to nearest water source
$\hat{S}$(*T*)	Nest survival varied over time during the 40-day survey period
$\hat{S}$(*TT*)	Nest survival followed a quadratic trend through the 40-day survey period
$\hat{S}$(Species + Colony)	Nest survival varied by the species of vegetation and the size of the colony
$\hat{S}$(DistDump + DistTrash)	Nest survival varied by proximity to both small trash receptacles and large dumpsters
$\hat{S}$(Global)	Nest survival varied by additive combination of all above mentioned variables

across the period and was estimated to be 0.95, then nest success would be 0.13 (0.95 multiplied 40 times for the 40 days in the period).

Habitat characteristics

At each nest location, we measured 10 habitat variables as potential explanatory variables for nest survival: species of nest vegetation, nest vegetation diameter at breast height (dbh, in cm), nest vegetation height (m), nest height (m), colony size (number of nests), parking lot area (km^2) within a 1-km radius, as well as distance (m) to nearest nest, nearest small trash receptacle (e.g., a sidewalk garbage can), nearest large trash receptacle (e.g., dumpster), and nearest water source. These variables were chosen based on a careful examination of the literature regarding factors affecting GTGR breeding distributions (Johnson and Peer 2001, Selander and Giller 1961, Wehtje 2003). A colony was defined as a grouping of nests within the same individual plant or contiguous grouping of plants (e.g., a grouping of trees with overlapping crowns was considered a contiguous grouping of plants). Water sources were defined as any permanent body of water (e.g., retention pond, stream, roadside ditch, etc.). For each colony location, we also measured these same 10 habitat characteristics at randomly selected locations within a 1-km radius. We used ArcGIS to generate a random point within a 1-km radius of each colony, and we measured these habitat variables for the nearest suitable vegetation without nests.

Comparisons among estimates

For comparing among nest survival and nest success estimates, and mean habitat variables, I evaluated confidence intervals around differences between estimates by calculating the variance of differences using the formula

$$Var(\overline{x}_1 - \overline{x}_2) = Var(\overline{x}_1) + Var(\overline{x}_2) - 2Cov(\overline{x}_1, \overline{x}_2),$$

which simply summed the variances of and subtractied the covariance between the parameter estimates being compared; Gerard et al. 1998). I used this variance estimate to compute 85%, 90%, and 95% confidence intervals around differences. Following an approach used by Skagen et al. 2005, I computed these variable-width confidence intervals to indicate the strength of comparisons among estimates. A comparison was considered to have no difference if the 85% confidence interval included zero, weak difference when the 85% confidence interval did not include zero but higher confidence intervals did, moderate difference when the 90% confidence interval did not include zero but the 95% confidence interval did, and strong difference when the 95% confidence interval did not include zero.

Results

We located and monitored a total of 659 nests representing 36 colonies: 560 nests in commercial regions and 99 nests in managed areas (Fig. 2). We did not locate any GTGR nests in the city center or in residential areas of Sherman. Most of the detected nests were located in Bradford Pear trees and Fraser's Photinia shrubs (Table 2). Only 99 were located in native vegetation. The largest colony size was

220 nests in a large cluster of Fraser's Photinia that stretched ~185 m across the back of a Lowe's® Home Improvement store. We found multiple colonies of only 2 nests in American Elm and Bradford Pear. We found 1 colony of 32 nests in a small Cattail marsh (area = 522 m^2). Otherwise, all other nests were found in more urban settings (e.g., trees or shrubs lining parking lots, strip malls, major roads, etc.). Overall, the average (SE; min–max) colony size found in native vegetation was 8 (3; 1–32) nests and in non-native vegetation was 21 (10; 1–220) nests. Nests varied in height from 1 m in Cattails to as high as 13 m at the top of a Shumard Oak. There were strong differences in habitat variables between nest and no nest locations: vegetation at nests was taller with thicker dbh, was closer to trash, and was in regions with less parking lot area (Table 3). Overall, other nest habitat variables differed minimally from the characteristics of available habitat.

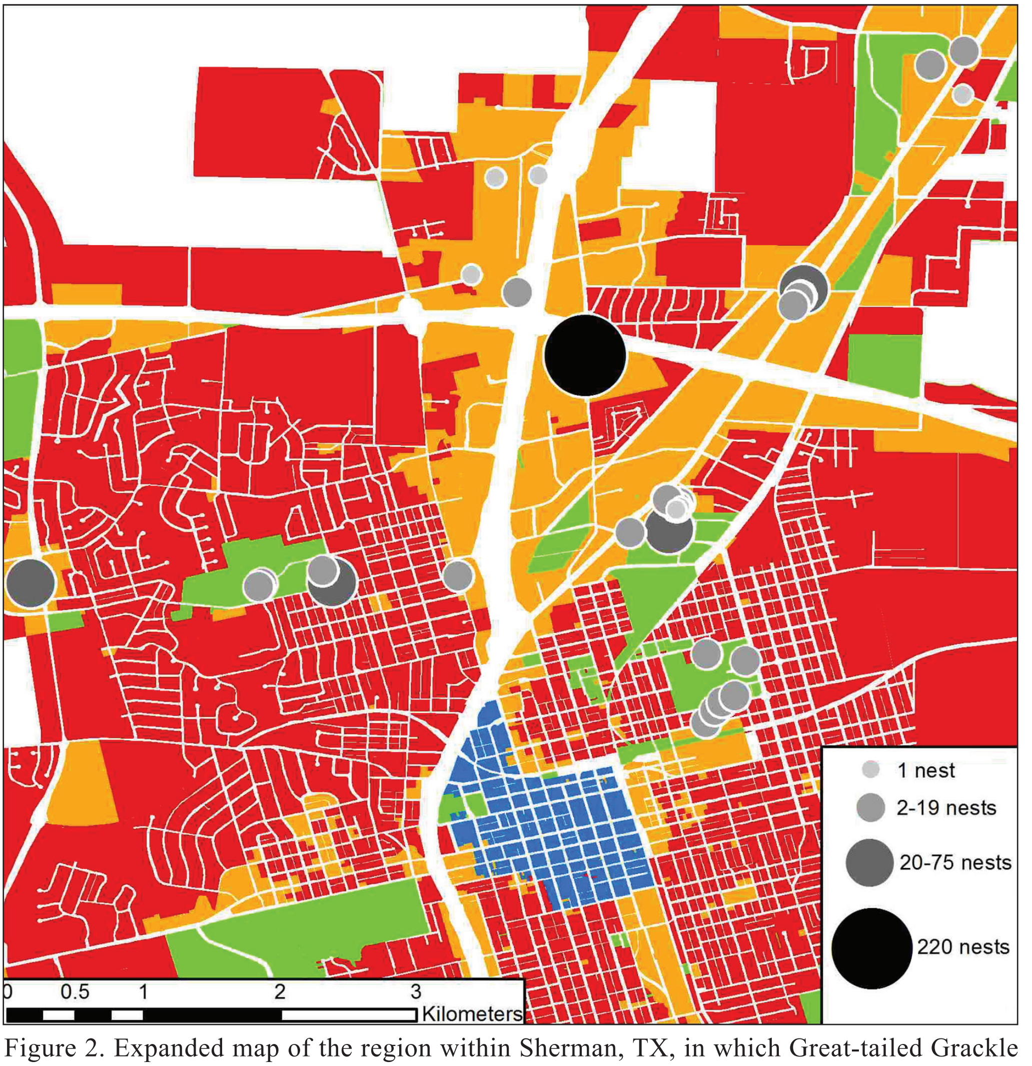

Figure 2. Expanded map of the region within Sherman, TX, in which Great-tailed Grackle (GTGR) nests were located, showing distributions of GTGR colonies by size throughout the city.

Nest survival model-selection results revealed 2 candidate models as having equally strong support from the data (Table 4). The first model included effects from colony size on nest survival but the magnitude of this effect was biologically trivial ($\hat{\beta}_{colony}$ = 0.003, SE = 0.001), and the second model included effects from parking lot area ($\hat{\beta}_{parking}$ = 1.677, SE = 0.898; Fig. 3) on nest survival and nest success. The difference (95% confidence interval) in nest success at minimum versus maximum parking lot area was 0.201 (0.010–0.393). This lower 95% confidence

Table 2. Numbers of Great-tailed Grackle nests (n = 659) and colonies by vegetation type throughout Sherman, Texas during the 2011 breeding season.

	Number of nests	Number of colonies	Average colony size (min–max)
Native vegetation:			
Cattail	32	1	32
Shumard Oak	17	2	9 (1–16)
Live oak (*Quercus* sp.)	16	4	4 (4–4)
Western Soapberry	13	2	7 (4–9)
American Elm	12	4	3 (2–6)
Eastern Redcedar	9	4	2 (1–6)
Non-native vegetation:			
Bradford Pear	280	13	12 (1–25)
Fraser's Photinia	255	3	78 (1–220)
Chinese Elm	19	1	19
Pinus spp.	5	1	5
Crapemyrtle	1	1	1

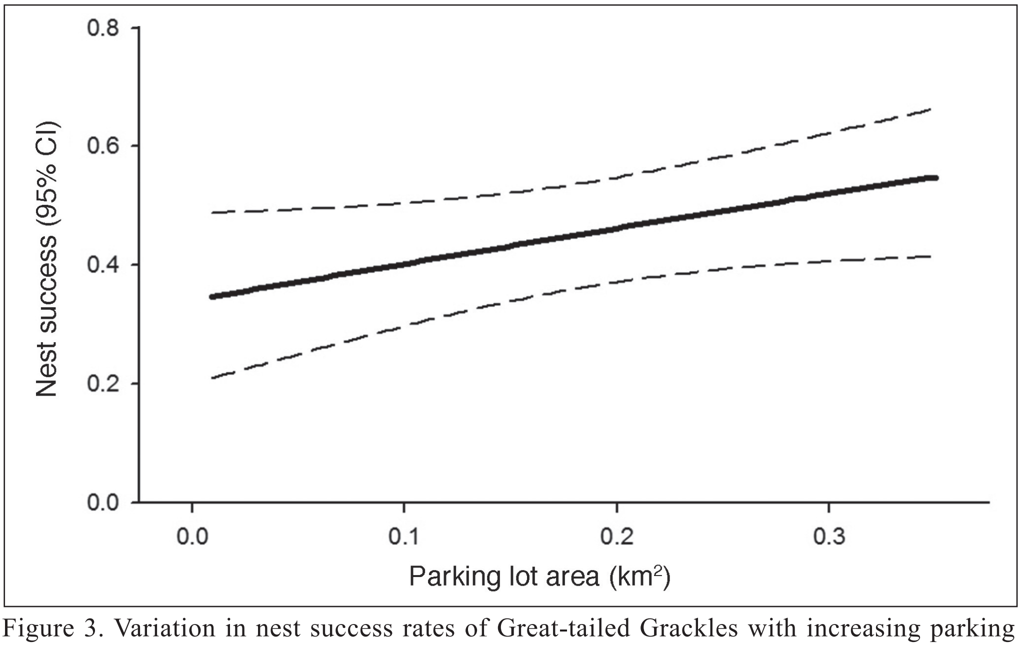

Figure 3. Variation in nest success rates of Great-tailed Grackles with increasing parking lot area within a 1-km radius of nest location. The dashed lines indicate 95% confidence intervals around nest success estimates.

Table 3. Average habitat variables at nests and at random locations without nests in highly urbanized, commercial, residential, and managed habitats combined. * indicates confidence intervals with lower limits greater than 0.0, demonstrating strong differences in habitat variables at nests versus locations without nests.

	Means (SE; range)			Confidence intervals		
Variable	Nests	No nests	Difference (SE)	85%	90%	95%
DBH (cm)	40.1 (1.8; 9.9–75.7)	32.0 (2.8; 12.2–68.8)	8.1 (3.4)	3.3–13.0	2.6–13.6	1.5–14.7*
Tree height (m)	7.3 (0.3; 1.5–15.6)	5.0 (0.2; 1.6–8.7)	2.4 (0.4)	1.9–2.9	1.8–3.0	1.7–3.1*
Dist to nearest dumpster (m)	100.8 (7.7; 4.4–230.4)	90.1 (7.5; 5.9–213.3)	10.7 (10.8)	-4.8–26.3	-7.0–28.5	-10.4–31.9
Dist. to nearest trash (m)	92.8 (7.0; 1.0–179.7)	173.0 (16.1; 5.1–392.2)	80.2 (17.6)	54.9–105.5	51.2–109.1	45.7–114.7*
Dist. to nearest water (m)	855.1 (76.3; 0.0–1950.0)	895.7 (72.1; 20.0–1620.0)	40.6 (104.9)	-110.5–191.7	-132.0–213.2	–165.0–246.3
Parking lot area (km^2)	0.14 (0.01; 0.01–0.35)	0.28 (0.02; 0.04–0.35)	0.14 (0.02)	0.11–0.17	0.10–0.18	0.10–0.18*

limit indicated that nest success was only at least 3% greater at maximum versus minimum parking lot area. While differences between the minimum versus maximum estimates were strong, the magnitude of the lower 95% confidence limit did not indicate strong evidence towards biological significance. While these top 2 models suggested effects from colony size and parking lot area on nest survival, the constant model also had strong support with an AIC_c value less than 2.0 different from the model including effects from parking lot area. Overall nest success was relatively high and consistent across all variables included in the candidate models. Models incorporating effects from other habitat variables had ΔAIC_c values >2.50, indicating that these models were less plausible than the top 2 models. There was little evidence for temporal effects on nest survival. Also, models that included variation in nest survival by plant species were the least plausible (i.e., evidence ratios ≥ 22.00), indicating little variation in nest survival by vegetation type.

Overall, nest survival estimates were quite high and were relatively consistent across variables. The model-averaged estimate (95% confidence interval) for nest survival was 0.981 (0.974–0.986). The overall nest success for our 40-day period was 0.471 (0.348–0.584). The lower limit of this 95% confidence interval indicates that at least 229 GTGR nests (34.8% of 659 total nests) were successful during the 2011 breeding season. The typical GTGR clutch size is 4 eggs (Johnson and Peer 2001), so 229 nests likely translates to ~916 fledglings

Discussion

GTGR populations have grown and expanded with increased urbanization across the landscape in the south-central US. In the city of Sherman, TX, my results

Table 4. Nest survival model selection results for GTGRs during the 2011 breeding season in Sherman, TX, USA. w_i = AIC_c weights. ΔAIC_c = difference between the AIC_c of the model and the lowest AIC_c value of any of the models (468.83). k = number of parameters. Evidence ratio = the weight of the model with the lowest ΔAIC_c value divided by w_i.

Model	-2Log (L)	k	ΔAIC_c	w_i	Evidence ratio
Ŝ(Colony)	464.83	2	0.00	0.30	1.00
Ŝ(Parking)	465.80	2	0.97	0.19	1.63
Ŝ(.)	469.31	1	2.48	0.09	3.45
Ŝ(Global)	453.29	9	2.51	0.09	3.51
Ŝ(DistTrash)	468.22	2	3.39	0.06	5.45
Ŝ(DistWater)	468.23	2	3.41	0.05	6.04
Ŝ(DistDump)	468.51	2	3.68	0.05	6.30
Ŝ(NestHght)	468.80	2	3.97	0.04	7.28
Ŝ(VegHght)	468.85	2	4.02	0.04	7.47
Ŝ(*T*)	469.11	2	4.28	0.04	8.49
Ŝ(DistNet)	469.30	2	4.47	0.03	9.36
Ŝ(DistDump + DistTrash)	467.98	3	5.15	0.02	13.15
Ŝ(*TT*)	468.91	3	6.08	0.01	20.93
Ŝ(Species + Colony)	458.97	8	6.18	0.01	22.00
Ŝ(Species)	462.87	7	8.07	0.01	56.68

indicate that these birds appear to nest in primarily urban habitats with high human activity (i.e., commercial areas). This finding is consistent with data from other cities throughout Texas (Johnson and Peer 2001). The lack of nests detected in residential areas and the city center supports this hypothesis because both of these regions of Sherman have less daily human activity than the commercial regions and the heavily used city parks. The city center was historically the commercial hub for Sherman, but businesses moved to the Highway 75 commercial corridor to the north. The most significant finding of this research was the overall high estimated nest survival rate that remained relatively constant across a suite of urban habitat variables. Although there was little variation in estimated nest survival across habitat variables, the ubiquitously high rates are in agreement with the hypothesis that the success of birds in urban habitats may be enhanced due to decreased predation and increased access to food (Adams et al. 2006, Wehtje 2003).

GTGRs nested primarily in non-native vegetation, principally in Bradford Pear and Fraser's Photinia. Selander and Giller (1961) reported that GTGRs often nested in live oak and *Ulmus crassifolia* Nutt. (Cedar Elm) in central Texas; however, over 5 decades after the publication of this information, I found only 3 nests occurring in these 2 plant species in Sherman during 2011. The greater frequency of nesting in non-native vegetation may indicate a shift in nest-site selection in urban areas associated with city landscape planning. City planners and landscapers in Sherman have planted exotic vegetation for aesthetic reasons (e.g., colorful blossoms during spring, thick foliage during summer, etc.). For example, Bradford Pear trees are commonly planted in city parks, shopping center parking lots, and residential areas because these trees grow quickly and produce thick foliage. Consequently, this species has become invasive outside urban and suburban areas throughout much of the country (Vincent 2005). Exotic vegetation tends to dominate commercial areas of urban habitats. GTGRs likely select nest sites in vegetation with thick foliage for adequate cover, making these exotic plant species more desirable. However, exotic vegetation has been reported to negatively affect native bird populations. Borgmann and Rodewald (2004) reported that exotic shrubs have a negative effect on reproductive success of native birds in urban landscapes in central Ohio, USA. To reduce the numbers of GTGRs breeding in urban areas and to support increased breeding success of native avifauna, urban planners could focus on native vegetation in city landscaping (adding to the litany of support for the use of native vegetation in landscaping; Borgmann and Rodewald 2004, Mills et al. 1989). Also, future research regarding GTGR breeding biology should specifically measure and evaluate the thickness of the foliage in nest vegetation on success.

Based on model-selection results, the 2 variables that showed positive effects on nest survival were parking lot area and colony size. Overall, nest survival was relatively consistent across habitat variables, and thus the magnitude of these effects on nest survival was biologically trivial. Any positive effects of parking lots on nest survival may be due to a decrease in nest predators. Parking lots are open tracts of land with few (if any) places for predator concealment. Also, a large parking lot functions the same as an open field in that both environments allow birds to easily identify predators from a far distance away from a nest. Parking lots also provide the advantage of offering more anthropogenic food due to high human traffic. However, in this study there was less parking lot area in proximity to GTGR nests compared with regions with no nests (as indicated by the comparisons between habitat variables). This finding might be due to the fact that regions of greater parking lot area have less vegetation for nesting; consequently, GTGR nest distribution may reflect the interplay of the benefits offered by parking lot area and those by increased vegetational cover. Also, nest distributions and success may be enhanced by colony size. Colony size is known to be related to increased breeding success due to safety in numbers (Lack 1968, Wittenberger and Hunt 1985); however, the trivial magnitude of this effect in this study is likely due to the overall high and ubiquitous nest survival across all variables.

A major limitation of this study is a lack in understanding about the dynamics of urban nest predators in the city of Sherman. While I found high nest success in commercial areas and managed green spaces in the city of Sherman, nest predation is typically the most important driver of nest success (Martin 1992, Ricklefs 1969), especially in urban areas (Ryder et al. 2010). In general, many of our native predators tend to avoid the urban core of a city (Adams et al. 2006, Wehtje 2003); however, urban areas typically have anthropogenically enhanced alien predator populations (e.g., cats and dogs) that may have deleterious effects on bird populations (Marzluff et al. 2001). While I did not directly measure nest predation of GTGRs in Sherman, I found very few nests with evidence of predation. Also, I did not detect a single nest predator during our population surveys or our nest monitoring periods. Regardless, this is a critical consideration, especially in the ever-changing urban landscape. Future research should evaluate the nest-predator dynamics of urban GTGRs by using colony or nest cameras to directly observe activity.

GTGRs are successful in urban habitats of Sherman, TX, and thus they represent a pest species for the city. It seems clear that these birds heavily utilize the non-native vegetation planted in the city. In order to reduce the numbers of GTGRs nesting and congregating in urban habitats, city planners could focus their landscape plans on planting native vegetation and eliminating non-native vegetation. GTGRs still nest in native vegetation and thus this will not completely eliminate nesting habitat, but this will likely support smaller colony sizes and thus reduced population densities in urban areas of Sherman.

Acknowledgments

I thank the Austin College Biology Department, a Cullen Foundation grant, and the Howard McCarley Biology Student Research Award for help with funding this project. I am grateful to A.W. Handoyo and C.S. Herrera for their help in the field and with reviewing earlier drafts of this manuscript. I thank P. Goldman, L. Goran, R. Dierking, J. Cullity, and J. D'Agastino for their comments on earlier versions of this manuscript.

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