

Is the predation rate on Eurasian Tree Sparrows (*Passer montanus*) using nest boxes influenced by prescribed burns on a small urban prairie?

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The Eurasian Tree Sparrow (*Passer montanus*) is an Old World Sparrow found throughout most of temperate Europe and the UK, Southeast Asia, North Africa, the Middle East, China, Japan, Siberia, northern India and Taiwan. (Chipper Woods Bird Observatory 2009) Taxonomically, Eurasian Tree Sparrows are in the Passeridae family and the Passeriformes order (Sibley 2001). Old World Sparrows and New World Sparrows are not closely related (Sibley 2001). Eurasian Tree Sparrows are social birds that prefer open fields with shrubby vegetation, especially agricultural areas (Cordero 1993). These ground feeding birds primarily live on a diet of weed, corn, millet, wheat and sunflower seeds, grass seed and seed shoots (Chipper Woods Bird Observatory 2009) but feed their offspring a diet of insects and arachnids during the spring and summer months (Sibley 2001).

Breeding season begins in April for the Eurasian Tree Sparrow and ends in July (Baicich and Harrison 1997). These birds are cavity nesters, using tree holes, nest boxes or other manmade structures to build their nests (Sibley 2001). These birds create an orb-shaped nest with the outer layer composed of coarse grass material and the inner portion lined with down and finer vegetative matter (Baicich and Harrison 1997). Eurasian Tree Sparrows can have up to 4 broods per year, though 2-3 broods is the average. Each clutch consists of 1-8 oval eggs (but the average is closer to 4-5 eggs) and incubation lasts 11-14 days. The altricial young fledge around 12-14 days (Baicich and Harrison 1997).

The House Sparrow (*Passer domesticus*), also in the Passeridae family, is an aggressive nest competitor with the Eurasian Tree Sparrow (Sibley 2001) and will displace the latter species from a given habitat (Cordero 1993). Though both birds are able to adapt to many habitats, the House Sparrow appears to prefer urban areas (Cordero 1993) while the Eurasian Tree Sparrow will occupy more rural, agricultural areas (Sibley 2001). However, the Tree Sparrow will move into parks and suburban areas when pushed out of their preferred habitat by their House Sparrow cousins (Cordero 1993).

On April 25th 1870, Carl Daenzer and a Mr. Kleinschmidt (Buckner 2009) released 20 Eurasian Tree Sparrows in addition to several European Goldfinches, Bullfinches, Chaffinches, Greenfinches and Linnets in Lafayette Park (WGNSS 1998). German immigrants largely comprised this part of St. Louis and it was popular during this time period to release European birds in the hopes the introduced birds would control the existing insect population and give the immigrants a little taste of home in their new city (WGNSS 1998). However, the Eurasian Tree Sparrows were the only birds that survived the release and quickly established a breeding population concentrated near the breweries in south St. Louis (Buckner 2009). It is speculated that the initial success of the Eurasian Tree Sparrow was due to the absence of their aggressive cousin the House Sparrow, which did not arrive in St. Louis until 1878 (Cecil 2002). Once the House Sparrow reached St. Louis, the Eurasian Tree Sparrow population boom slowed but the species extended their range to the Illinois cities of East St. Louis, Alton, Grafton and Belleville, all within about 20 miles of their original point of release (Cecil 2002).

The Eurasian Tree Sparrow expansion has occurred mostly in Illinois, slowly spreading north and east from St. Louis (Cecil 2002). There have only been 2 sightings of the Eurasian Tree Sparrow in the western portions of Missouri. One occurred on November 15, 1986 in Montgomery County about 75 miles west of St. Louis and another in Columbia Missouri during their 1995-96 Christmas Bird Count (Cecil 2002). In March 1987 a pair of Eurasian Tree Sparrows was sighted at West Branch in Cedar County Iowa (Cecil 2002). There were no records for 2 more years, and then 10 were found in Des Moines County in December 1989 (Cecil 2002). Iowa's first nesting was confirmed in Burlington in 1993. The Eurasian Tree Sparrow currently has breeding populations in Lee, Des Moines, Louisa and Muscatine counties (Cecil 2002). Back home in St. Louis, the Eurasian Tree Sparrows are commonly found in St. Louis County and City, the floodplains of eastern St. Charles County and in Calhoun and Madison counties of Illinois (WGNSS 1998).

A small breeding colony of Eurasian Tree Sparrows lives on the property of Litzsinger Road Ecology Center, where this study took place. Litzsinger Road Ecology Center (LREC) 10 miles west of downtown St. Louis sits on 13.75 hectares of combined bottomland forest, restored prairie and urban creek (Litzsinger Road Ecology Center 2009). Under the direction of the Missouri Botanical Garden, LREC has been restoring 4.85 hectares of tall grass prairie since 1989 through the planting of native prairie forbs and grasses and using yearly burns to destroy non-native plants. After spending time at Litzsinger, I wanted to learn whether or not a small piece of restored prairie was beneficial to nesting songbirds. Are frequent burns beneficial to the birds? Are predation rates influenced by the frequency and location of the burns? Does the small size of the prairie greatly impact the birds in terms of predation? One study found that smaller tracts of prairie supported less diversity and incidents of predation were higher (Winter et al 2000).

Procedure

The majority of the LREC prairie is divided into a north and south area with a row of trees and shrubs acting as the dividing line. On the east side of the prairies and woodland is another small plot of prairie called the "Pasture Prairie". The Pasture Prairie is 0.44 ha and contains 3 nest boxes. The South Prairie is 1.09 ha and has 5 nest boxes while the North Prairie is 1.78 ha and contains 3 nest boxes. LREC burns each prairie plot (North, South and Pasture) every other year. The staff usually aims to burn the plots during the winter but can burn as late as spring depending on staffing availability and weather. The South and Pasture Prairies were burned November 2007 while the North Prairie was burned in December 2008.

The nest boxes were checked weekly April through July 2008-2009. Adult Eurasian Tree Sparrows were banded if found sitting on a nest and chicks were banded close to fledging, around 9-10 days of age. The bands used were colored plastic measuring 2.80mm in diameter. The left leg was banded with one color signifying the year (2008 was pink, 2009 was purple) and the right leg was banded with a color combination unique to each bird.

Each nest box height and distance from forest or prairie edge was measured and the tallest piece of vegetation and its distance from the nest box was measured (Table 1). The nest boxes were unpainted cedar using a Bluebird Nest box design (1.90cm thick wood was used, floor measured 10x10 cm, 17.8cm depth and entry hole 3.8 cm).

Box	Location	Box Hgt	Vegetation
1	Pasture Prairie; Outside prairie, 1.9 m from prairie edge/6.2 m from driveway edge	1.6 m	Predominantly mowed grass. Tallest plant (Goldenrod 1.9 m) 1.8 m away
2	Pasture Prairie; In prairie, 1.6 m from prairie edge/8.2 m from mowed path	1.6 m	Tall vegetation around box. Tallest plant (Cup Plant 3 m) less than 1m from box.
3	Pasture Prairie; Outside prairie 5.8 m from prairie edge.	1.3 m	Predominantly mowed grass. Tall tree 14.7 m from box with closest branch 8.9 m away from box
4	South Prairie; On forest edge 4.8 m away from prairie edge.	1.8 m	Tree and shrubs around box. Closest tree (Butternut) 3.6 m from box with a branch 2.4 m in front of box.
5	South Prairie; In prairie 7.6 m from forest edge.	1.5m	Tallest vegetation (Big Bluestem 1.8 m) less than one meter from box.
6	South Prairie; In prairie 4.4 m from forest edge.	1.5 m	Tall vegetation around box. Tallest (Pale Indian Plantain 2.7 m) 1.5 m from box.
7	South Prairie; On prairie edge.	1.5 m	Moderately tall vegetation around box. Tallest plant (unknown <i>sp</i> 1.83 m) 0.76 m from box.
8	South Prairie; In prairie 6.4 m from Burn Line, 74.7 m from forest edge.	1.5 m	Tall vegetation around box. Tallest (Big Bluestem 2.2 m) less than 2 m from box.
9	North Prairie; In prairie 2.7 m from Burn Line, 34.8 m away from prairie edge	1.5 m	Predominantly moderately tall vegetation around box. Tallest (Big Bluestem 2.7 m) 1.2 m from box.
10	North Prairie; On forest edge 4.5 m from prairie edge.	1.3 m	Oak trees around box. Closest oak 1.7 m from box with branch 0.76 m from box.
11	North Prairie; In prairie 14.9 m from forest edge	1.6m	Moderately tall to tall vegetation around box. Tallest (Big Bluestem 1.9 m) less than 1 meter from box.

Table 1 – Nest box locations and descriptions of nearby vegetation at LREC. Vegetation data collected in 2009.

Results

A hatching success rate for this paper is defined as the number of chicks that successfully hatched from the total number of eggs. Hatching success rate did not take into account those chicks that were predated or died of unknown causes. A nest was considered predated if all or a portion of a nest containing eggs or chicks was gone when either was present during the previous week's visit and the chicks were obviously not old enough to fledge within a week's time. Probable fledge success rate is defined as those

chicks that successfully left the nest, taking into account dead and predated chicks. Because fledging events were rarely observed, the term probable fledging is used and the nest was considered a success if the chicks were absent the week following banding.

In 2008, the overall the hatching success was 52%, predation was 43% and probable fledging success was 44% of the 52% of birds that hatched (Figure 1). The fate of a small percent of chicks (8%) was termed “uncertain” because it was not clear if the chicks fledged or were predated. Half the clutches laid in the Pasture Prairie experienced predation events while the hatching success was 61% and the probable fledging success was 44%. The predation rate fell slightly outside the standard deviation on the Pasture Prairie for the 2008 breeding season (Table 2) but this could be attributed to the fact that Nest box #1 was not checked during the 2008 season because it could not be reached with a step ladder. This situation was rectified over the winter and the box was able to be monitored during the 2009 season. The South Prairie experienced a 42% predation rate, the hatching success rate was 26% and probable fledging success rate was 31%. For 2008 the North Prairie had a 38% predation rate, 70% hatching success rate and 44% probable fledging success rate (Figure 2).

After the 2008 nesting season, LREC staff and volunteers placed raccoon baffles on each nest box in attempts to negate predation but the overall predation rate increased to 52% in 2009. The hatching success rate was 53%, probable fledging success rate was 42% and there was a 5% unknown fate of chicks for the 2009 season (Figure 1). In terms of predation rate per prairie, 33% of the clutches laid in the Pasture Prairie experienced predation events, 86% of the clutches in the North Prairie were predated and 36% of the clutches laid in the South Prairie were predated (Figure 2). The hatching success rate for the Pasture Prairie was 67%, 62% in the South Prairie and 30% for the North Prairie. The probable fledging success rates are as follows: 50% in the Pasture Prairie, 55% in the South Prairie and 22% in the North Prairie.

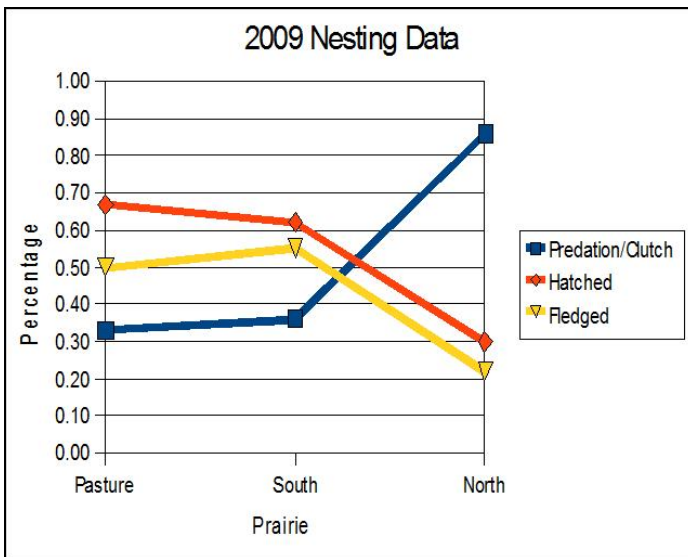


Figure 1- Success rates for Eurasian Tree Sparrow clutches at LREC in 2009

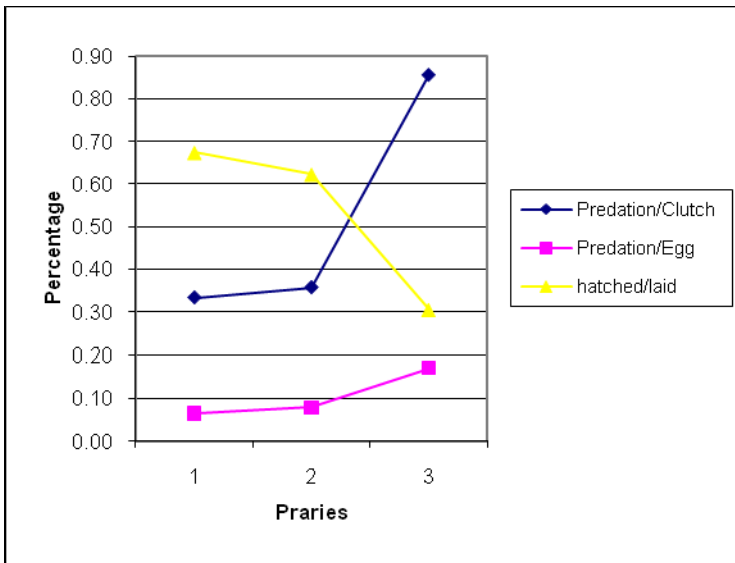


Figure 22 – Success rates for Eurasian Tree Sparrow clutches at LREC in 2008. 1=Pasture Prairie; 2=South Prairie; 3=North Prairie.

2008	Pasture Prairie	South Prairie	North Prairie	Mean	Standard Deviation
Predation/Clutch	0.5	0.42	0.38	0.43	0.06
Hatched	0.61	0.26	0.7	0.52	0.23
Probable Fledged	0.44	0.31	0.44	0.44	0.08

Table 2– Reproductive success rates in 2008.

2009	Pasture Prairie	South Prairie	North Prairie	Mean	Standard Deviation
Predation/Clutch	0.33	0.36	0.86	0.52	0.3
Hatched	0.67	0.62	0.3	0.53	0.2
Probable Fledged	0.5	0.55	0.22	0.42	0.18

Table 3– Reproductive success rates in 2009.

Discussion

Predation remained fairly constant for the Pasture and South Prairies in 2008 and 2009 ($t = 0$, $df = 18$, P one-tail 0.5). However, the raw data suggests the North Prairie was affected by its 2008 burn. A t-test assuming unequal variances was performed to

determine the significance of the North Prairie's predation rate and the results suggested the differences in predation rate was a random occurrence and more observation is needed ($t = -1.04$, $df = 3$, P one-tail 0.19). The t-test may not be appropriate due to the small dataset. While more study is needed on the link between prescribed burns and predation rates at LREC, other prairie burn studies have shown that fire may affect nest success through changes in vegetation height and density, potentially providing nest predators with either easier or harder access to nests (Reinking 2005).

Although the recent burn appears to be the explanation for the high predation rate on the North Prairie, nest box location, vegetation height and density are the other variables that should be considered. The studies done on the nesting success of grassland birds in fragmented habitats had conflicting results and the differences in local predator communities and interacting effects of vegetation and predator type have complicated the interpretation of field data (Dion et al 2000). One study suggested birds nesting in smaller prairie fragments or near an edge have lower nesting success rates than those nesting in larger habitat fragments (Winter et al 2000). Activity patterns of both small and mid-sized carnivores were significantly higher within 50m of a forested edge than at greater distances (Winter et al 2000). With the exception of Nest box #8, all of the nest boxes on the prairies are less than 50m from a forest edge (Table 1) but are fitted with raccoon baffles. The animals likely preying upon the boxes would be snakes

Other studies suggest distance to edge seemed to be of less importance to the survival of nests than fragment size and vegetation characteristics at the nest (Winter et al 2000) and nesting success rates may be greater in areas burned in the fall than in spring-burned areas (Heikert et al 2009). The hatches per egg laid and probable fledge rates were higher for the South Prairie in 2009 but the predation rate was nearly the same in 2008 and 2009 (See tables 2 and 3). It is not clear why the hatching success rates were higher from one year to the next. The South Prairie is 1.09ha whereas the North Prairie is 1.78ha. Both prairies contain the same vegetation species (Goldenrod, Echinacea sp, Big Bluestem etc) but the dominant vegetation species and vegetation density may be different around each box and could play a role in the hatching, fledging and predation rates. More research will be needed for this observation. Several studies have found a high percentage of small mammals prey upon those nests found in tall vegetation versus those nests located in areas with sparse vegetation and larger animals tend to predate nests located in tall vegetation (Dion et al 2000).

The size of each prairie plot and the number of nest boxes on each plot were also limiting factors in this study. The same predator could be hitting all of the boxes. The territory size of the Eurasian Tree Sparrow was not studied and thus it is unknown how the interactions between birds competing for nesting locations and food play into nesting success. Saturating each plot with nest boxes would increase sample size and rule out whether or not territory aggression plays a factor in nesting success and predation rates.

In conclusion, only one of the three prairies burned experienced a higher predation rate but all boxes had higher hatching per egg laid and probable fledging success rates during the years the prairies were not burned. Many factors could be responsible but more study is needed before any assumptions can be made.

LREC is a unique urban oasis. The Ecology Center sits in a large neighborhood on a busy street less than 5 miles from a major interstate. All researched studies took place on large fragmented prairies not located within the confines of a city. The overall

nesting success by the bird species unique to St. Louis proves that habitat restoration, no matter the size or location is a worthwhile endeavor. Organizations such as LREC and independent landowners benefit from continued research on breeding bird response to habitat management and size. Improved land management increases biodiversity and ensures future generations a beautiful and habitable city.

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