Nest Predation: Edge Effects at Work in a Fragmented Prairie

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Abstract

Edges are areas where there is a distributional, behavioral, or abundance change in an organism (Yahner, 1988). Fragmented habitats typically have more edges leading to increased predation and parasitism of nests in the edges. This increased edge and increased edge effects has led to a decline in neotropical migrant birds and ground-nesting birds (Batari & Baldy, 2004). To determine if the Litzsinger Road Ecology Center north and south prairies experience these effects 24 nests were placed into the prairies with 1 egg per nest. The prairies have three types of edge habitats; another prairie, the lawn, or woodland, so 8 nests went into each of the edge habitat areas and then checked on after 7 days and again after 12 days when the final count of nests depredated was taken. Only one nest was depredated after 12 days and it was located in the next to another prairie edge habitat. None of the nests in the lawn or woodland edge habitat were depredated and there were no significant differences between the level of edge effects in the different edge habitats (Kruskal-Wallis One Way ANOVA on Ranks: d.f. = 2, $H = 2.00$, $p = 0.368$). The lack of predation could have been due to no cues to the predator that eggs were available, eggs not being placed in the prairie during primary nesting season, or the extreme weather that occurred during the experiment.

Introduction

Edges are defined as an area where two different landscape elements meet and an area that sees a distribution, behavioral, or abundance change in an organism and fragmented habitats typically include more edge than interior (Yahner, 1988; Batari & Baldy, 2004). Fragmented habitats have been indicated in the recent decline of neotropical migrant birds (Burger, Burger Jr., & Faaborg, 1994). Neotropical birds have been shown to experience the effects on their abundance because of increased nest predation and parasitism (Batari & Baldy, 2004). These edge effects can be prevalent as far as 600m inside the forest as raccoons, cowbirds, crows, and other predators and parasites are able and willing to frequent the interior of the forest to a certain extent (Wilcove, McLellan, & Dobson, 1986).

Most research has been done in deciduous forests and very little in tall grass prairies with ground nesting birds. Only 4% of the world's prairie habitat remains and much of it fragmented (Patten et. al., 2006). Burger, Burger Jr., and Faaborg (1994) studied edge effects in prairies in relation to distance from woodland cover. They found that edge effects were prevalent in the prairie and that birds in the ecotone of prairie to woodland had higher rates of nest predation than those in the interior of the prairie away from the ecotone. Parasitism of nests has been implicated in the decrease of nesting success of ground nesting birds as well and parasitism has been shown to increase the closer the nest is to woodland edges (Patten et. al., 2006). The culprit being the brown-headed cowbird which is known to be the most generalized brood parasite with over 200 hosts (Patten et. al., 2006).

Currently nature reserves are being planned on a large scale, such as Yellowstone to Yukon, to combat these edge effects. The one big versus several small refuges for wildlife hypothesis has been debated in the scientific community. It has been found that one big refuge is better equipped to save more species instead of several small refuges. However, Simberloff and Gotelli (1984) found that rare species are more likely to be found in small sites and that an archipelago of small refuges can harbor more rare species than one big refuge. This indicates that saving small plots of land can be beneficial to certain species and that they should not be discounted in the process of preserving areas and the species that live in them.

In this study I looked at the relation of edge effects in ground nesting prairie birds when artificial nests are placed at different differences to woodland cover, manicured lawn, or another prairie. I aimed to determine if there are higher edge effects on the artificial nests placed nearest the woodland and the those placed nearest the manicured lawn and fewer edge effects when placed near another prairie.

Study Area

The study area is located within the grounds of Litzsinger Road Ecology Center which is a private site under the domain of the Missouri Botanical Garden used for educating area school children and for restoring habitats native to the St. Louis area. The area used for this study is comprised of two prairies separated by a groomed trail and a line of trees used as a burn break roughly 13 meters across. The prairies are bordered by woodland on the eastern side and by manicured lawn on the western side. The north and south sides are bordered by smaller stands of the woodland found more predominantly on the eastern side. The prairies are restored and the north prairie is about five acres while the south prairie is only 3.5 acres (Pretz, 2014). In both of

the prairies there are 127 0.5m by 0.5m plots permanently marked for monitoring of the plant species present in the prairie but we will use for potential nest sites. Common ground nesting birds found in Litzsinger prairies are northern bobwhite and wild turkey (Crank, 2002).

Methods

The study was conducted July 12th through July 26th, 2017. The placements of the 24 artificial nests were randomly selected from a random number table out of the permanent plots already in the prairies but upon entering the prairies several sites had to be changed to the next closest due to not having a visible or accessible post (Figure 1). Ten of the nests were placed in the north prairie on July 12th and ten of the nests were placed in the south prairie on July 13th. I used 24 nests due to time constraints of placing nests and to not overburden the prairies with eggs that may have drawn in more predators. The artificial nests were made on the northeast side of the plot by placing the egg on the ground and circling grasses over and around it in an imitation of the northern bobwhite nests and wild turkey nests with one store bought egg in the nest. Nests were placed specifically on the northeast side of the plot points to avoid impeding other research being conducted on the southwest side of each plot point. They were left out there for 12 days which is half of the incubation period of wild turkeys and northern bobwhites and checked after seven days and at the end of the period (Littman, 2014). If the egg was damaged or missing it was considered depredated.

The nests were grouped into 3 categories based on what edge habitat they were closer to (woodland, lawn, or more prairie). No interior area was tested because previous research indicated that prairies of this size were comprised of all edge with no true interior (Burger, Burger Jr., & Faaborg, 1994). A one-way ANOVA test was used to determine the differences between predation at artificial nest sites closest to the woodland, lawn, or more prairie edge habitats. Three t-tests were also used to compare each edge habitat individually to the other two.

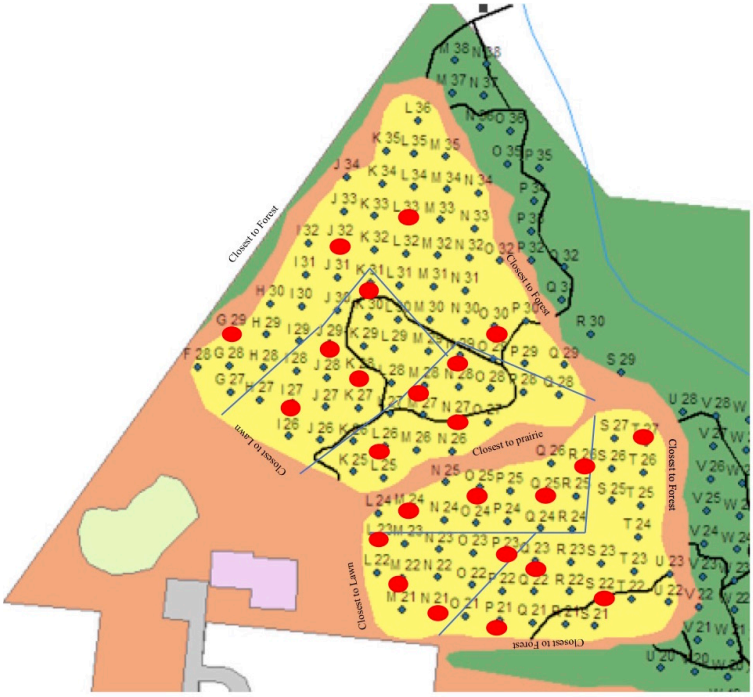

Figure 1. Map of the Litzsinger Road Ecology Center permanent plots. Plots with red circles are the plots with artificial nests placed near them and the blue lines delineate the three different ecotones of the site (prairie, lawn, and woodland) with labels along the edges. Plot I26 was used in lieu of plot I27 due to the thickness of blackberry in the area and not wanting to cut it down. M27 was used in lieu of N27 due to being unable to locate the marker of the plot even with a metal detector. S27 instead of T27 because that post was replaced this year. Q26 instead of Q25 due to grasses being too tall to find post.

Results

During the study four days exceeded 100^{o}F and it rained the evening of the 13th of July. Of the 24 nests placed in the prairie 23 remained after 12 days. The one nest that was depredated was in the prairie treatment (M_P = 0.875, SE = ± 0.125; M_W = 1.00, SE = ± 0.00; M_L = 1.00, SE = ± 0.00). There was no significant difference between the three edge environments and their levels of depredation (Kruskal-Wallis One Way ANOVA on Ranks: d.f. = 2, H = 2.00, p = 0.368) (Figure 2). Each of the edge environments was compared individually to other using Mann-Whitney Rank Sum Tests and no significant differences were found (Mann-Whitney Rank Sum Test: t_{PL} (1) = 64.00 , p = 0.721; t_{WP} (1) = 72.00, p = 0.721; t_{WL}(1) = 68.00, p = 1.00).

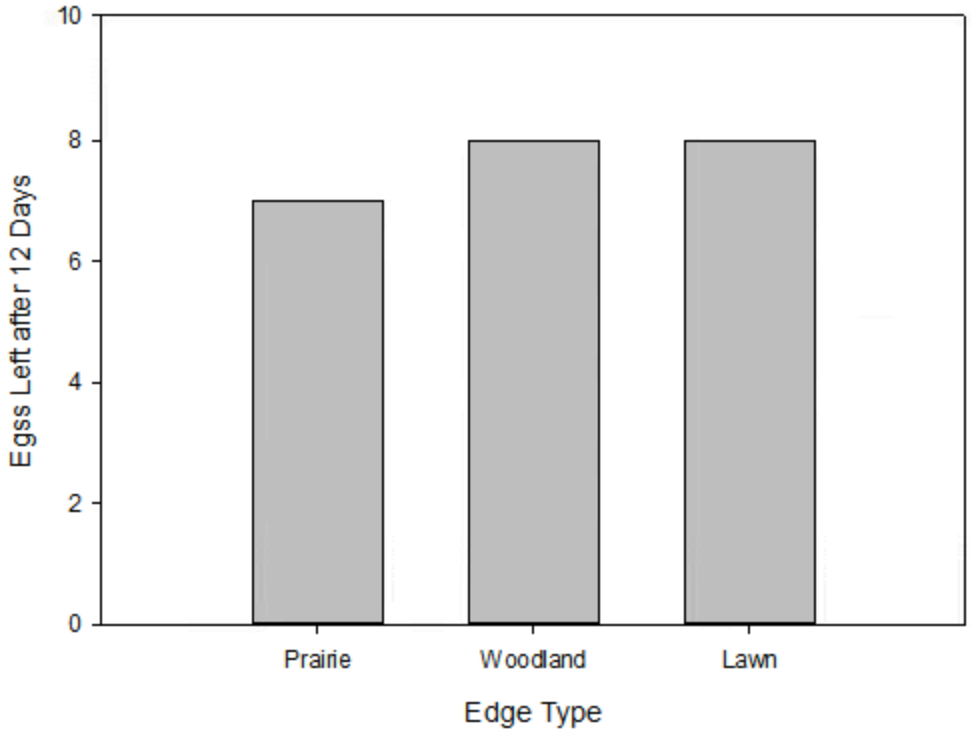

Figure 2. The number of nests still in each edge environment after 12 days. The prairie had edge had one nest depredated while woodland and lawn had no eggs predated. There were no significant differences in predation between edge environments (Kruskal-Wallis One Way ANOVA on Ranks: d.f. = 2, H = 2.00, p = 0.368).

Discussion

This study reflects a lack of edge effects at LREC. Whether there are edge effects or not this site provides opportunity to educate children and works on preservation of native Missouri plants and habitats like prairies, woodlands, and wetlands. With only one nest depredated after 24 were placed in the prairie no edge effects were found. This is likely not the case as the prairies contain less than ten acres total and edge effects can extend upwards of 50 m into an ecosystem and the surrounding woodland increases the amount of edge effects (Burger, Burger Jr., & Faaborg, 1994). There are likely other explanations for the lack of significant edge effects noted in the prairies.

When wild turkeys nest they typically remain with their eggs keeping them warm and protecting them and northern bobwhites will do the same (Dreibelbis et. al., 2008). The eggs placed in the prairie lacked the protection of mother birds but also lacked the potential heat signature or smell from the mother birds as well. Paton (1994) discussed how mammalian predators hunt using olfactory cues and avian predators or parasites utilize visual cues neither of which were present in this study. Wild turkeys and northern bobwhites lay eggs in the spring and while northern bobwhites can lay one to two more clutches throughout the summer it is uncertain if they typically lay multiple clutches in this ecosystem so the predators may not even be on the hunt for eggs (When is bird nesting season, 2015; Sudkamp, 2011).

The weather varied greatly while the nests were in the prairies. The first night all of the eggs were in the prairies it rained washing away the scent left behind from moving through the

prairies to place the eggs. Four of the days, though, were considered a heat advisory for Missouri with heat indices reaching 113^{o}F. This could also have impeded predators or parasites if they were unable to utilize the prairies as hunting grounds in the heat.

Further research aims would start by replicating this experiment in the spring when birds are nesting more often or track ground-nesting bird nests in the spring and see if that yields results. A gradient of eggs could also be placed in the prairies to determine where edge effects increase or decrease if they occur at Litzsinger Road Ecology Center. Winter, Johnson, and Faaborg (2000) found that nest success decreased as distance from shrubby edges decreased in their gradient testing. Varying clutch sizes might also show some effect of edges in the prairies by making them more noticeable to predators. Using quail eggs or non-processed chicken eggs may also mimic natural cues the predators utilize and thus better show edge effects on the site.

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