Does nest defense behavior vary with differences in landscape features in four species of shrub-nesting birds?

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Summary
This study focused on if landscape features around the nest affect levels of anti-predator behavior in different shrub-land birds. Adult behavior was recorded on day 7 post-hatch, when chicks were removed seven days of age or the nest failed. The species studied were American Robins (AMRO), Gray Catbirds (GRCA), Northern Cardinals (NOCA) and Brown Thrashers (BRTTH). The behavior between the different landscapes of AMROs and GRCA was not significantly different. This shows that the energy difference is not significant enough to deter predatory behavior. However, the NOCAs in less developed areas had a significantly more aggressive behavior. Also, the BRTTHs had a significantly higher behavior score in lower percent grassland/shrub-land areas. This may be due to predation risk and perceived quality of the habitat. Variation in their habitat influenced their behavior.

Introduction
Asian reproductive investment can be reflected in the level of nest-defense behaviors that adult birds exhibit in response to an attempted predation event. Aspects of the nesting habitat may influence parental investment decisions. Habitat value in each area may change due to predation risk and resource availability. The predation risk in higher developed areas is higher than lower developed areas due to higher amounts of small sized mammalian predators. Also mortality rates are higher in higher developed areas due to automobile and building collisions and disease transmission. Resource availability in higher developed areas are higher due to anthropogenic effects such as bird feeders and ornamental landscapes. This increases their survival especially for overwintering birds.

Differences in aggression between species in similar habitats can be due to species diet and species predation risks. Species differ in their food requirements. AMROs, BRTTHs, and NOCAs rely heavily on insects while GRCA relies mostly on seeds. Also, species have different predation risks. In higher developed areas, AMROs and GRCA have a higher survival rate where as NOCAs have a lower survival rate. The increase in canopy cover in GRCA and NOCAs had a negative effect on nest survival where canopy cover had no effect on AMROs.

Grassland/shrub-land habitat is characterized as a combination of long-stemmed grasses and shrubby vegetation that is presumed to provide high quality nesting habitat for the four local species.

Hypothesis
Anti-predator behavior will be different between species of shrub-land birds
If landscape features change then the anti-predator behavior for each species will change.

Methods
From May 5th to July 31st, active shrub-land bird nests were found and monitored at seven locations around Central Illinois. Once located nests were checked every three days until chicks reached seven days of age or the nest failed. On day seven, chicks were removed from the nest as part of another study, and at the time of the first chick removal, adult behavior was recorded. As one person went to collect the nestling, another person recorded the behavior of the adults. The behavior was categorized by the distance the adult was from the nest (Table 1). We calculated the proportion of the landscape that was developed (human structures) and grassland/shrub-land within 500 meters of the nest using the USDA NRCS geospatial data gateway in GIS.

Results
A total of 88 nests were observed for this study. Of the 88, there were 26 American Robins, 23 Brown Thrashers, 23 Gray Catbirds, and 16 Northern Cardinals. We found that BRTHs and GRCAs were significantly more aggressive in defense of their nests than AMROs and NOCAs (Fig. 1). We found no effect of habitat on the behavior of AMROs (p=0.23) or GRCA, although there was a nonsignificant trend for GRCA to behave less aggressively in landscapes with higher proportion of grassland/shrub-land (p=0.06). For BRTHs we found a significant negative effect of grassland/shrub-land on aggression scores (Chi Sq = 4.92, p=0.027), but no effect of developed habitat (Chi Sq = 2.13, p=0.144), whereas for NOCAs we found a significant negative effect of proportion developed habitat (Chi Sq = 5.75, p=0.017), but no effect of grassland/shrub-land habitat (Chi Sq = 0.52, p=0.47).

Discussion
Between Species Differences
AMROs and NOCAs have a significantly lower overall behavior than GRCA and BRTHs. These species aggression difference may be due to differences in food requirement or predation risk. BRTH and GRCAs nests may be more likely to be defended by predators that the adults could successfully drive away compared to AMRO and NOCAs. It may be that GRCAs and BRTHs have shorter nesting periods, and therefore value each nest more highly than NOCAs and AMROs which have longer nesting periods and are therefore willing to take on greater risk to themselves. BRTH and GRCAs are in the same family (Mimidae) so they may exhibit similar behavior because they are phylogenetically closely related.

Landscape features and nest defense behavior
Previous research has demonstrated that NOCAs in highly developed areas experience higher rates of nest predation compared to NOCAs nesting in less developed areas. Adult NOCAs in more developed areas may invest less in each nest attempt, and therefore exhibit reduced nest-defensive behaviors compared to NOCAs nesting in less developed areas. In our study, much of the nest defense, high in proportion developed land may invest more in replacement clutches. Overall, the aggression is based upon the investment in the eggs. NOCAs in lower developed areas put more investment in their current eggs while NOCAs in lesser developed areas put more investment in keeping themselves alive to produce in the future. BRTH’s behavior was significantly higher in low percentage grassland area due to their perceived level of quality of the habitat. BRTHs in these lower quality nesting habitats may have to invest more energy for their offspring to survive. GRCAs had an almost significant correlation between high anti-predator behavior and low percentage grassland area. This may be genetically influenced since GRCA and BRTHs are from the same family.

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References