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NOTES: NESTING PATTERNS OF RED-TAILED HAWKS AND GREAT-HORNED OWLS IN SOUTH-CEN- TRAL KANSAS

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NOTES

NESTING PATTERNS OF RED-TAILED HAWKS AND GREAT-HORNED OWLS IN SOUTH-CENTRAL KANSAS—Red-tailed hawks (*Buteo jamaicensis*) and great-horned owls (*Bubo virginianus*) can influence the nesting behavior of each other through direct competition for nesting sites. For instance, owls begin nesting before hawks and, thus, can use nests from the previous year and prevent hawks from occupying those sites (Orians and Kuhlman 1956, Gilmer et al. 1983, Minor et al. 1993). However, both species sometimes kill the nestlings of the other (Craighead and Craighead 1956, Bosakowski et al. 1989).

The objective of my study was to investigate nesting patterns of these two raptors at the edge of the tallgrass prairie over a 22 yr-period and compare these findings with those from previous studies (Alberta; McInvaille and Keith 1974, Ohio; Kirkley and Springer 1980, North Dakota; Gilmer et al. 1983, Utah; Bosakowski et al. 1989, New York; Minor et al. 1993, New Jersey and New York; Smith et al. 1999). Specifically, I examined the influence of annual population sizes, nest density, distance to the nearest neighboring nest, dispersion of nests and overall pattern of usage on nesting ecology of red-tailed hawks and great-horned owls.

My study occurred across a 104 km^2 area in south-central Kansas. The shape of the study area was rectangular and bisected west to east by highway K-254 from Kechi, Kansas, to the intersection with K-196. Along the highway, there was one range-township section to the north and one to the south, hence the rectangular shape. The land itself consisted of a patchwork of farms, pastures, and houses including three small towns (Kechi, Benton and Towanda). The area represented the western edge of tallgrass prairie of the Flint Hills region.

I located nests from an automobile and on foot (Craighead and Craighead 1956). I drove the perimeter road around each section at least four times looking for any large or new nest. The area consisted mainly of open landscape with tree stands restricted to hedgerows and strips along a creek or river. I used a spotting scope to verify if a bird was incubating on the nest or if nestlings or owlets were present. I approached any large or new nest that had no bird associated with it to the base of the tree to confirm that it was unoccupied. Observations began on 15 March when trees were without foliage and extended to 30 April 1988–2009. The timing of observations corresponded to the peak in nesting activity of red-tailed hawks since 1 April represented the mean and mode for the start of egg-laying (Cress and Langley 1982). I plotted nest locations on an aerial photograph with specific details about the location of that tree. I considered nests that were within 200 m of one another but in a different tree a single nesting site (Gilmer et al. 1983), in which case the geometric center represented the nesting site.

I used the *G* statistic (the ratio of the geometric mean to the arithmetic mean of squared distances) to measure nest dispersion (Bakaloudis et al. 2005, Martinez et al. 2008); a ratio >0.65 represented a regular distribution, whereas a ratio <0.65 indicated a random distribution. I analyzed the mean distance to the nearest neighboring nest (DNN) with a one-way analysis of variance for three groups: owl-hawk, hawk-hawk and owl-owl. I log-transformed [log (x +1)] all distances prior to statistical analysis to normalize variance (Sokal and Rohlf 1981); a pair of nests was used only once.

I recorded a total of 102 nesting sites: at these sites, red-tailed hawks nested a total of 215 times and great-horned owls nested 64 times. Hawks exhibited (mean ± SD) 0.094 ± 0.005 nesting pairs/ km^2 and owls exhibited a density of 0.028 ± 0.004 nesting pairs/km^2. Hawk density estimated during my study was at the lower end of previously reported ranges (e.g., 0.08 –0.89; Gates 1972, Petersen 1979, Kirkley and Springer 1980, Bosakowski et al. 1996). Similarly, owl density estimates from my study also were within previously reported ranges (e.g., 0.016–0.120; Kirkley and Springer 1980, Gilmer et al. 1983, Minor et al. 1993).

Red-tailed hawks averaged 9.77 nests per year and great horned owls averaged 2.91. There was no corresponding increase or decrease in the number of nests as one might expect if one raptor species was having a detrimental effect on the nesting behavior of the other. There was a slight, but non-significant, positive correlation between the number of nests of each (Spearman rank correlation coefficient, $r_s = 0.05$, $n = 21$, $P > 0.05$; Siegel 1956). There was no long-term decline or increase for owls ($F_{1,19} = 1.51$, $P > 0.05$) or for hawks ($F_{1,19} = 0.96$, $P > 0.05$; Fig. 1).

The mean DNN for the three nest pairings were: 5.02 ± 3.02 km (between owls), 2.92 ± 1.68 km (between hawks) and 1.81 ± 1.42 km (between owl and hawk); and differed among the three pairings ($F_{2,\ 270} = 1174.90$, $P < 0.001$). A post-factor Tukey-Kramer method revealed that the mean DNN between owl and hawk nests was significantly less than that between conspecifics of each of species. The mean DNN between owl and hawk (1.93) and between individual hawk nests (2.41) from the Canadian study (McInvaille and Keith 1974) paralleled the data from this study. The mean DNN between owl nests in this study was more than twice that (2.09 km) reported by the Canadian study (McInvaille and Keith 1974). Possibly, the exaggerated rectangular shape of this study area coupled with the low number of owl nests in some years inflated the distance between neighboring owl nests. The important point is that DNN between owl and hawk nests was less than between nests of hawks.

The *G*-statistic between owl and hawk nests was 0.31 which indicates these nests were dispersed randomly ($G < 0.65$). In Alberta, the owl and hawk nests were more dis-

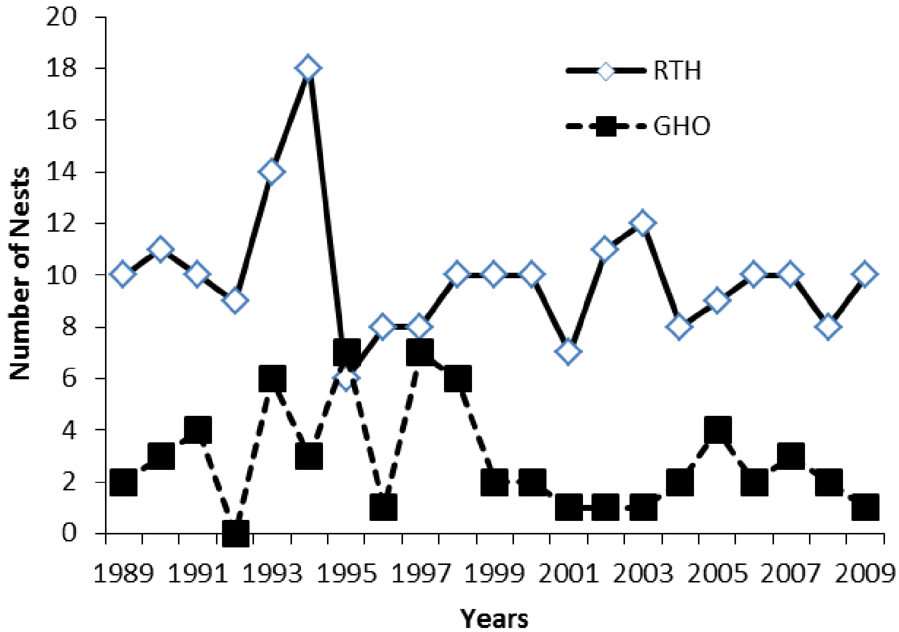

Figure 1. Number of nests of red-tailed hawks and great-horned owls observed in southcentral Kansas, 1998–2009.

persed from one another than random sites, but a different formula was used to estimate dispersion (McInvaille and Keith 1974). The *G*-statistic between owl nests was 0.50 and between hawk nests was 0.54. In both these instances, the nests were dispersed randomly as documented in other raptor species (Martinez et al. 2008). I did not try to account for the possible influence from the distribution and availability of trees used for nesting.

There was clear evidence that owls prevented hawks from using a nesting territory by occupying a nest that hawks had used the previous year. Both species nested at 38 of the 102 nesting sites. At 19 of these 38 (50%) nesting sites, hawks originally occupied nests, followed the next year by owls and then followed hawks the next year. At eight of these 19 nesting sites, the alternating pattern of occupation of the site by the other species occurred twice in succession and at a ninth site this alternating pattern occurred three times. At 10 other of these 38 nesting sites, owls occupied the site first followed the next year by hawks. Prior observations indicated that hawks had not occupied or built nests used by owls. At the remaining nine sites, both raptors used the nesting site, but not in consecutive years. At 29 nesting sites, an owl occupied the territory that a hawk would have used, but did not. At 3 sites, however, both raptors nested within 250 m of one another. In each case, owls occupied nests from the previous year and hawks built new ones.

The pattern of use from year to year follows that previously reported. At sites used exclusively by hawks (n = 102), 33% were used only once and 21% were used more than once. Hawks re-used the same nesting site the next year 52% (75/215) of time, which was similar to that reported in Alberta (51%; McInvaille and Keith 1974). The number of consecutive years that hawks used the same nesting site ranged from 2–7 with a median of two years. At three other sites, hawks nested seven consecutive years. At 25 sites, they nested only twice. Hawks nested at the same site with an absence interval of one or more years 42 times. The interval of absence ranged from 2–14 yrs with a median of two. Hawks constructed a new nest site 38% (81/215) of the time in this study which parallels that reported previously (34%; Gilmer et al. 1983). In this study, an owl used an "old" nest from a red-tailed hawk 55% (35/64) of the time. In New Jersey, owls used old red-tailed hawk nests 39% of the time (Smith et al. 1999) and in North Dakota, owls used old red-tailed hawk nests only 4% of the time but other raptor nests 25% of the time (Gilmer et al. 1983).

Nest density, distance to nearest neighboring nest, and pattern of re-use documented in my study paralleled those reported in earlier studies that had a shorter duration. In contrast to some previous reports (McInvaille and Keith 1974, Bosakowski et al 1989) in Alberta and Utah respectively, red-tailed hawks and great-horned owls appeared to tolerate living in close proximity to one another. This apparent tolerance of one another warrants further investigation. — *William Langley. Butler Community College, El Dorado, KS 67042, USA. Corresponding author email address:* blangley@butlercc.edu.

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