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EFFECT OF PERCH SITES ON MOURNING DOVE NEST DISTRIBUTION

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ABSTRACT.—We examined the effect of natural and artificial perch sites on Western Mourning Dove (*Zenaida macroura marginella*) nest density in shrubby habitat. Nest density in shrubs was strongly correlated with the density of natural perch sites. This relationship occurred in 2 vegetation types with differing shrub composition. The correlation was stronger in areas with a homogenous shrub layer. Nest density was also higher in plots with artificial perch sites than in adjacent control plots. Nest density increased between years in plots where artificial perch sites were constructed but remained the same in adjacent control plots. Knowledge of perch-site effects has practical management applications in areas where doves nest in shrubby habitat. The possibility exists that perch sites could be managed for nest density in these habitats.

Key words: artificial perches, Mourning Dove, nest density, nest distribution, nesting, perch sites, Zenaida macroura marginella.

Mourning Doves are one of the most abundant bird species in the U.S. (Peterjohn et al. 1994). Historically, populations have prospered in areas of human presence, but over the last 37 years, Mourning Dove populations in the western U.S. have gradually declined (Dolton and Holmes 2002). Ostrand et al. (1998) documented a population decline in the Fillmore, Utah, area between the early 1950s and the early 1990s. Meyers (1994) documented a concurrent decrease in nest density for the same area. For both time periods, nesting near Fillmore occurred primarily in shrubby vegetation (Dahlgren 1955, Meyers 1994). The quantity of shrubby habitat has remained stable in this area, but the number of trees has declined (Meyers 1994). Although trees were not important for nest sites, we hypothesized that they may have been important for perching areas.

Many researchers have speculated on the importance of perch sites in avian habitat (Kendeigh 1941, Hilden 1965, Zimmerman 1971, Wiens 1973). Territorial birds in general rely heavily on singing for territorial defense (Welty 1982:280). Mourning Doves use perch sites for 2 reasons: (1) mate attraction before nest-site selection and (2) territory maintenance afterward (Frankel and Baskett 1961, Jackson and Baskett 1964). Our observations from systematic nest surveys in the Fillmore area show that Mourning Dove nests are invariably placed near prominent perches.

Several researchers have examined perch-site selection for grassland birds (Castrale 1983, Witter and Cuthill 1992), and a few studies have looked at perch-site effects on bird presence or density during the breeding season (Lack 1933, Lack and Venables 1939, Harrison and Brewer 1979, Knodel-Montz 1981). However, we found no studies that have tested the effect of perch sites on nest densities. We used 2 methods to examine whether a relationship existed between perch sites and nest density in our study area. First, we correlated nest density with the density of naturally occurring perch sites. Second, we introduced artificial perch sites into the nesting habitat and recorded changes in nest density.

STUDY AREA AND METHODS

The study area was located about 2 km northwest of Fillmore, Utah, in an area called the Old Fields. The site was at the eastern edge of an arid basin (Pahvant Valley), with an annual rainfall of 37.9 cm. Chalk Creek, which runs through the site, was diverted into irrigation canals, and the doves nested in these riparian areas. The concentrated area of research consisted of approximately 12.6 km of

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riparian vegetation (8.1-km irrigation canal and 4.5-km creek) branching through approximately 570 ha of farmland. This riparian vegetation consisted of a continuous line of shrubs interspersed with trees. A few small areas along the irrigation canals contained a 2nd-story, closed canopy.

Vegetation differed between the creek and the irrigation canals. Predominant vegetation along the irrigation canals included willow (*Salix* spp.), squawbush (*Rhus trilobata*), wild rose (*Rosa* sp.), and golden currant (*Ribes aureum*). Vegetation along Chalk Creek largely consisted of squawbush, occasionally interspersed with single, tall (≥5 m) trees, such as willow, cottonwood (*Populus* spp.), locust (*Robinia* spp.), and boxelder (*Acer negundo*).

Natural Perch Sites and Nest Density

We searched for Mourning Dove nests once per week 15 April–5 September 1992 and 1 May–5 September 1993 (i.e., the entire breeding season). We found nests by walking the riparian corridors and flushing nesting doves by agitating the vegetation with an aluminum pole. We measured all vegetation and structures (e.g., trees, telephone poles) ≥5 m tall with a clinometer. These were defined as perch sites. All nests and perch sites were plotted onto aerial photographs and then transferred to orthophotos.

All riparian areas were partitioned into contiguous plots. Although most of the habitat was linear, some shrubs were scattered outside the vegetation line. To capture these areas with a consistent distance from plot center, we used circular plots. Numbers of perch sites and nests in each plot were compared with a Pearson's correlation. This design created some effective overlap because perch sites near plot boundaries may have affected neighboring plots. Larger plots created fewer boundary effects, so the analysis was run using both 200-m and 400-m-diameter plots to examine the effect of plot size. We also analyzed the data after removing plots devoid of nests. Doing so removed plots that were unsuitable for nesting based on reasons other than lack of perch sites. Plots that contained closed-canopy tree cover >25% were excluded because of 2 added variables: (1) cover and (2) an additional type of nest substrate.

Artificial Perch Sites and Nest Density

We constructed artificial perches in 16 riparian plots from 4 to 13 May 1993. Perches consisted of two 5.1×5.1-cm stakes 4.3 m high with a 30-m length of rope running between them. Each plot contained 2 sets of stakes with the rope running lengthwise on either side of the riparian vegetation, offset 15 m (Fig. 1). Plots extended 15 m beyond each end of the perch sites and were 75 m long. Perches were placed on the outer edge of the shrubby vegetation (12.5 m ± 5.6 m across) and protruded 1.5–3 m above the shrub canopy. Experimental plots (i.e., those containing artificial perches) and control plots were placed randomly in a paired design with a 50-m buffer zone between them. Plots were placed at least 50 m away from trees or power lines.

Nest searches in the plots and buffers were conducted once per week over the entire breeding season the year before the study and the year of the study. Only active Mourning Dove nests were recorded. Comparisons of nests in experimental plots with nests in control plots were made with a Poisson regression employing a repeated function (SAS Institute, Cary, NC). This technique is analogous to a paired *t* test but is used for count data with a Poisson distribution.

Doves are indeterminate nesters (i.e., a single pair will produce many nests in sequence throughout the season), and subsequent nests in the same plot may be from the same pair that previously nested there; therefore, subsequent nests may not be independent. We assumed that any subsequent nest produced in the same plot was a renesting attempt, and comparisons were made with and without these additional nests. To calculate power, we used the formula for a paired *t* test. A Poisson regression has similar or slightly less power (SAS Institute, Cary, NC).

RESULTS

Natural Perch Sites and Nest Density

We recorded 90 nests, 78% of which occurred in shrubs or on the ground. Mourning Dove nest density and perch site density were correlated ($r = 0.72$, $n = 33$, $P < 0.001$; Fig. 2). The relationship was stronger along Chalk Creek ($r = 0.85$, $n = 11$, $P = 0.001$) than

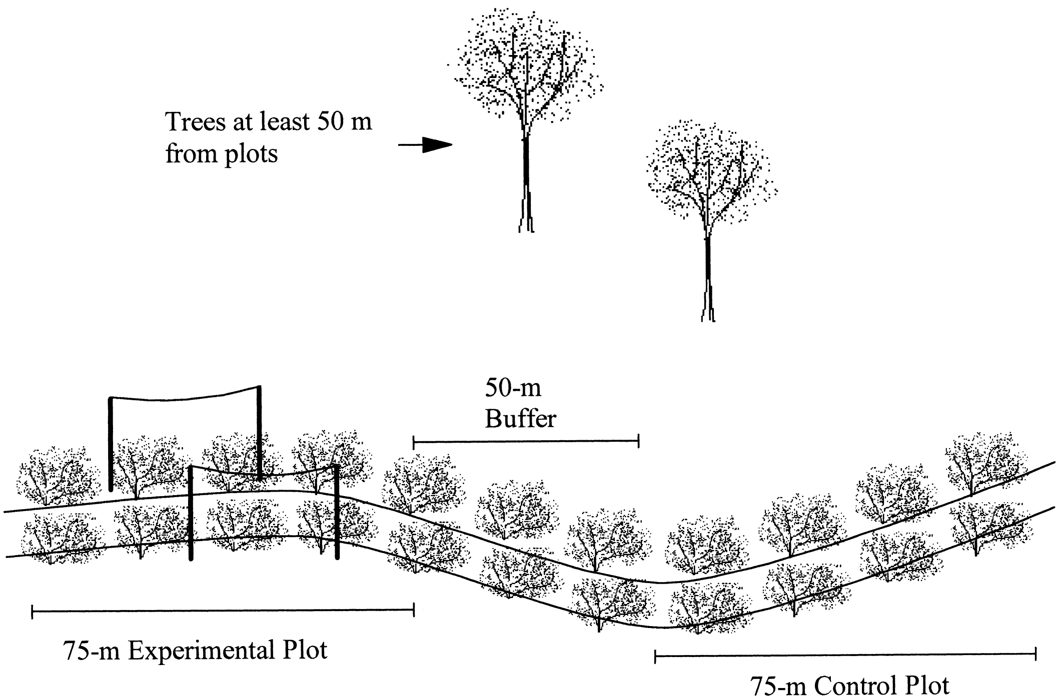

Fig. 1. Experimental design for introduction of artificial perch sites into Mourning Dove nesting habitat, Fillmore, Utah, 1993.

along the irrigation canals (r = 0.67, n = 22, P = 0.001). The correlation remained significant when plots barren of nests (r = 0.65, n = 24, P < 0.001) were omitted, and strengthened when plot size was increased to 400 m in diameter (r = 0.81, n = 11, P = 0.003). The correlation between number of nests and perch sites remained significant (r = 0.61, n = 33, P < 0.001) with all tree-borne nests removed from analysis.

The highest percentage of nests occurred in squawbush, which accounted for 86% of nests along the creek and 13% along the irrigation canals. Willow was the next most important plant type, accounting for 20% of nests along irrigation canals. Mean nest height was 1.7 m ± 1.2 m.

Artificial Perch Sites and Nest Density

We found 9 Mourning Dove nests in experimental plots, 4 in control plots, and 5 in buffer areas. Highest nest density occurred in a buffer area situated between adjacent experimental plots. Power for these data was low (β < 0.23 at α = 0.05), so statistical significance was set at P = 0.10 to reduce the chance of type II errors.

Of 11 sites surveyed in the pretreatment year, 2 nests occurred in the experimental plots and 4 in the control plots. Following perch-site construction in the 2nd year, nests in experimental plots increased to 7 (Z = 2.175, P = 0.03) while nests in control plots decreased to 2 (Z = –1.132, P = 0.26). For the year of the study only, significantly more nests occurred in experimental plots than in control plots (Z = 2.025, P = 0.043) when renests were excluded. When these nests were included, no significant difference occurred (Z = 0.279, P = 0.12).

All nests occurred in or around shrubby habitat. Thirteen nests occurred in squawbush, 2 in sagebrush, 2 in willow shrub, and 1 on a fenceline overgrown with willow and bedstraw (*Galium triflorum*). Mean nest height was 1.0 m ± 0.3 m. Paired experimental and control plots had similar vegetation type and

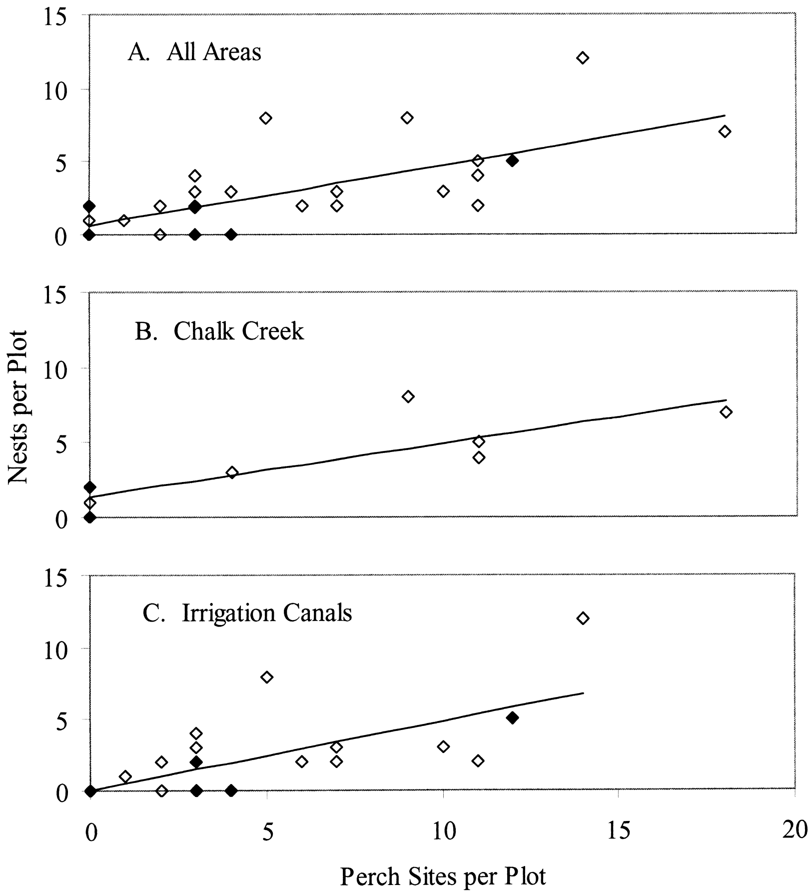

Fig. 2. Relationship between perch sites and Mourning Dove nests, Fillmore, Utah, 1993. Solid markers indicate multiple occurrences.

structure. Because pairs were close together, the riparian vegetation generally did not change along the length of the experimental unit.

DISCUSSION

Natural Perch Sites and Nest Density

The correlation between nests and perches was significant for both creek and canal habitat, suggesting that natural perch sites positively affected nest density. Because plots were contiguous and plot boundaries were somewhat arbitrary, there was potential for lack of independence along plot borders. This effect would tend to lower the level of correlation, however, because areas near plot borders may have affected neighboring plots and obscured within-plot effects. As a result, the actual correlation may have been higher than what we measured. As noted, the correlation between nests and perch sites increased with increasing plot size, supporting this hypothesis.

The correlation remained strong after excluding tree-borne nests, suggesting that trees were important mainly as perch sites rather than nest substrates. The correlation also remained strong after we excluded plots barren of nests. This test removed any plots that may have been unsuitable for nesting due to reasons other than a lack of perch sites.

Chalk Creek showed the strongest relationship between perches and nest density. As noted, vegetation differed between the creek and the irrigation canals. The creek contained a homogenous vegetation structure, mainly a squawbush-lined bank, which was lightly influenced by human manipulation. Conversely, irrigation canals were predominantly willow but also contained more diverse shrub species. In addition, canals often displayed radical vegetation shifts at property borders. The lower correlation along irrigation canals may have reflected this variation. That is, many irrigation canal plots may have contained marginal nesting habitat, whereas all creek plots contained similar vegetation. Chalk Creek, therefore, should represent the clearest picture of perch-site effects. The results show that the differing vegetation between the creek and irrigation canals probably affected nest density, but that perch sites appeared to be a larger factor in determining nest-site selection.

Effect of Artificial Perch Sites on Nest Density

Overall nest density in the experimental and control plots was low. Despite the low power that resulted, between-year comparisons showed positive effects of artificial perches. Same-year comparisons were somewhat conflicting, but the low power greatly increased the chance of failing to detect a difference. In these instances the absence of statistical significance must be interpreted with caution (Cherry 1998, Johnson 1999). Taken together in consideration of statistical power, the between-year and within-year results suggest that artificial perches positively affected nest density at our study site.

Additional evidence for perch-site effects exists in the buffer data. Buffer areas produced more total nests than control areas even though buffer areas were smaller (50 m vs. 75 m). Buffer areas were adjacent to or between perch-site plots, and perch sites may have influenced these areas. Larger experimental plots may be necessary in future experiments to cover these adjacent areas.

In summary, data from the natural correlation indicate a positive relationship between perch sites and nest density. In addition, between-year comparisons from the artificial perch sites suggest a positive perch-site effect. Same-year comparisons from the artificial perch sites were conflicting but marginally significant as well. Overall, we conclude that perch sites appear to have a positive effect on nest density, and we suggest that they are an important habitat component for nest-site selection for Mourning Doves within our study area. We suggest further investigation with larger experimental plots and a larger and sturdier perch-site design. A better understanding of the role of perch sites on nesting doves could lead to practical management tools for nesting doves in shrubby landscape.

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