

WINTER BIRD DENSITIES AND EASTERN WOOD-PEWEE BREEDING DEMOGRAPHY ACROSS A SAVANNA-WOODLAND-FOREST GRADIENT IN THE MISSOURI OZARKS

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ABSTRACT

Savanna and woodland habitats were historically prevalent in the midwestern United States, and efforts to restore these communities are growing. Better knowledge of the responses of breeding and non-breeding birds to restoration of savanna and woodland is needed to inform management. Our objective was to determine densities of common winter migrants and resident birds in savannas, woodlands, and non-managed forests in the Missouri Ozark Highlands. We estimated detection probabilities and densities using distance and time-removal models to obtain robust density estimates. We surveyed 561 points along 42 transects, with 10-minute unlimited-radius point counts at 10 sites across the Missouri Ozarks December-February, 2009-2011. We fit distance models for 14 species and time-removal models for 6 species. Detection probabilities varied between distance and time-removal models and were affected by covariates such as observer, temperature, wind, vegetation type (savanna, woodland, and forest), and distance. Generally, restoration did not have a substantial impact on most winter birds, because density did not vary greatly for species across savanna, woodland, or non-managed forest. Dark-eyed Junco and Eastern Bluebird were the only species with considerably higher densities in restored savanna or woodland.

We also studied the breeding demography of the Eastern Wood-Pewee (*Contopus virens*; hereafter Pewee), because it breeds across a gradient of wooded habitats ranging from open-canopy savanna, to woodland, to closed-canopy forest. Our objectives were to determine relationships between temporal factors and habitat structure and breeding demography and densities of the Pewee across the savanna-woodland-forest vegetation gradient during the breeding season. We determined nest success,

clutch size, fledge rate, and breeding densities of the Pewee across the vegetation types and tested for effects of year, stage, ordinal date, nest height, percent stocking, and percent forest in a 10-km radius. We conducted point counts at 906 points at 15 sites and estimated detection probability and density of Pewees using distance models to examine the effects of observer, type of detection, minutes since sunrise, habitat type, day of year, and distance on detection probability. We found and monitored 310 nests at 13 study sites across the Missouri Ozark Highlands from 2009-2011. Nest stage had a strong effect on daily survival rate. Period survival increased with decreasing forest cover in a 10-km radius. Daily survival rate was 0.977 (95% CI: 0.972, 0.981), average clutch size was 2.568 (95% CI: 2.456, 2.679; n=111), and average fledge rate was 2.2 (95% CI: 2.034, 2.366; n=65) young per nest. Only 4 (1.25%) nests were parasitized by Brown-headed Cowbirds (*Molothrus ater*). Average feeding rate was 7.89 visits per hour (n=56), and frequency of parent visits to the nest was positively correlated with nestling age ($p=0.049$). We recorded 20 cases of double brooding in the Pewee, and some successful nests were reused for a second brood. Pewee densities were greater in woodland and forest vegetation types compared to savanna. In general, restoration did not have a substantial impact on Pewee nest survival, because survival did not vary greatly across savanna, woodland, or non-managed forest. Given the negative effect of stocking on clutch size, weak negative effect on nest survival, and lower densities in savanna, we suggest Pewees are well-adapted to intermediate stocking levels found in woodland.