J. Field Ornithol., 69(2):299–305

MOURNING DOVE NESTING HABITAT AND NEST SUCCESS IN CENTRAL MISSOURI

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Abstract.—Previous Mourning Dove (*Zenaida macroura*) nesting studies conducted in areas containing a mixture of edge and continuous habitats have focused on edge habitats. Consequently, little is known about the potential contribution of continuous habitats to dove production. In this study we evaluated the relative importance of these two extensive habitat types by monitoring the habitat use and nest success of 59 radio-marked doves during 1990–1991 in central Missouri. Of 83 nests initiated by our marked sample, most (81.9%) were located in edge habitats. Although continuous habitats were selected less as nest sites, the proportion of successful nests did not differ significantly from that in edge habitats. Our data indicate that continuous habitats should not be considered marginal nesting habitat. If the intensity of use and nest success that we observed are representative regionally or nationally, continuous habitats could contribute substantially to annual Mourning Dove production because of the high availability of these habitats throughout much of the Mourning Dove breeding range.

HABITAT Y ÉXITO DE ANIDAMIENTO DE *ZENAIDA MACROURA* EN LA PARTE CENTRAL DE MISSOURI

Sinopsis.—Los trabajos previos sobre el anidamiento de la tórtola *Zenaida macroura* en area que contienen una mezcla de borde y habitat continuo han enfocado en los habitats de borde. Consecuentemente, se conoce poco sobre la contribución potencial de habitat continuo en la producción de la tórtola. En este trabajo evaluamos la importancia relativa de estos dos tipos de habitats, monitoreando mediante el uso de radiotransmisores, el uso de habitat y exito de anidamiento de 59 aves. El estudio se llevó a cabo en la parte central de Missouri de 1990–1991. De 83 nidos comenzados por las aves monitoreadas, la mayoria de estos (81.9%) se localizaron en habitats de borde. Aunque los habitats continuos fueron menos seleccionados por las tórtolas, no se encontro diferencia significativa en la proporcion de nidos exitosos entre los dos tipos de habitats. Los datos obtenidos indican que el habitat continuo no debe ser considerado habitat marginal para la especie. Si la intensidad de uso y exito de anidamiento observado en este trabajo son representativos de la situacion regional o nacional, el habitat continuo puede contribuir sustancialmente a la producción anual de esta tórtola, dado la gran disponibilidad del mismo a través de toda la zona utilizada para reproducirse por esta ave.

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Mourning Doves have an extensive breeding range and nest in both rural and urban areas throughout the contiguous United States, Mexico, southern Canada, and portions of Alaska (Aldrich 1993, Tomlinson et al. 1994). As might be expected on the basis of their broad distribution, Mourning Doves use a wide range of habitats for nesting, including arboreal and terrestrial sites (Aldrich and Duvall 1958). Because of this flexibility, it is difficult to describe precisely the characteristics of dove nesting habitat (Eng 1986:411).

Mourning Doves are thought to prefer nesting in trees along woodland/grassland edge (Eng 1986:421, Tomlinson et al. 1994), but in areas where these habitats are absent or limited in availability they commonly nest on the ground in more continuous habitat types such as grasslands and cropfields (Howe and Flake 1989, Soutiere and Bolen 1976). In the Midwest and throughout much of their range, however, Mourning Doves breed in areas containing a mixture of forest, woodland edge, grassland, and cropland habitats. Currently, little is known about how nests are distributed among these habitat types or the relationship between habitat use and nest success in these diverse landscapes.

In the past, most investigators have found Mourning Dove nests by traversing selected sites on foot and visually locating dove nests (Geissler et al. 1982). Because, this technique is time-consuming, searches are typically conducted at sites considered to be likely nest habitat (i.e., shelterbelts, orchards, groves of deciduous shrubs or pines, and landscape plantings) (Blockstein 1986, Geissler et al. 1982, Hanson and Kossack 1963, Westmoreland and Best 1985). With few exceptions (Olson et al. 1991, Schulz and Sheriff 1995, Soutiere and Bolen 1976) continuous habitat types (forest interior, cropfields, grasslands) have rarely been included as nest search plots in studies conducted in mixed habitat ecosystems. Consequently, their contribution to Mourning Dove production is poorly understood.

In order to gain a better understanding of habitat use and nest success by nesting doves in areas containing mixed habitat, we used radio-marked doves to locate nests. Our objective was to determine the relative importance of edge and continuous habitats by comparing use and nest success in these habitat types.

STUDY AREA AND METHODS

Trapping and radio-marking were conducted on a 673-ha study area located on the Davisdale Wildlife Area in central Missouri (39°01.3′N, 92°37.5′W). This area was managed primarily for upland game species and contained cropland and open fields interspersed with blocks of timber and small wooded valleys. Private land surrounding the study area was either intensively grazed or cultivated (Fuemmeler 1992).

Doves were captured using modified Kniffen traps (Reeves et al. 1968). Trap sites were prebaited with white Proso millet for 7 d prior to the first day of trapping for each of five trap periods (16–18 April, 11–20 May, 7–13 June, 9–11 July, and 30 July–8 August) in 1990. During 1991, doves

were trapped in the same manner as in 1990, but trapping periods were longer and baiting occurred continuously throughout the summer. Trapping periods during 1991 were 8–10 April, 8–15 May, 20–26 May, 17–23 June, 15–21 July, and 29 July–18 August.

Each dove used in the nesting study was weighed to the nearest 1.0 g, banded with a USFWS band, fitted with a radio transmitter, and released at the capture site. Radio transmitters (164–165 MHZ) weighed <6.7 g, had a 130-d life expectancy, and were equipped with a mortality switch. Radios were back-mounted and attached using two elastic body loops. All research activities were conducted with applicable state and federal permits.

Radio-marked doves were monitored weekly using ground and/or aerial searches to locate nesting doves and determine nesting habitats. A nest was defined as successful if the nestlings reached 10 d of age and there was no indication of mortality. The 10-d criterion is used by the USFWS (Nichols et al. 1984) because nestlings can fledge at this age (Swank 1955). We assumed that the nests of doves nesting multiple times were independent because Mourning Doves are a multiple-nesting species (Tomlinson et al. 1994) where nest success or failure is not assumed to affect the fate or location of subsequent or future nests.

Nesting habitats were subdivided into four categories: (1) forest edge, fencerows, and small wooded valleys; (2) oldfields or partially wooded pastures; (3) agricultural fields or open pastures; and (4) forest interior (>10 m from the edge of a forest opening). In this paper we refer to habitat categories 1 and 2 as edge habitats and categories 3 and 4 as continuous habitats.

We attempted to use Mayfield's (1961, 1975; Johnson 1979) method to calculate nest survival rates; this method is based on days of exposure and requires a known, consistent nesting period. Instead of Mayfield's method, we calculated nesting success by using methods proposed by Olson et al. (1991). We used chi-square tests to test for significant ($P < 0.10$) differences in nest success among years and habitats.

RESULTS

The nests of 59 radio-marked Mourning Doves were located during the 1990 and 1991 breeding seasons. Doves dispersed widely between trap sites and nesting areas. During 1991, the outermost locations of radio-marked doves bounded an area of 244.0 km^2 (Schulz and Sheriff 1995); outermost locations of dove nests bounded 23.3 km^2 (Fuemmeler 1992).

In 1990, 11 radio-marked Mourning Doves were monitored, and 14 nests were located. Six of these nests were successful and produced nine young. We increased the sample of nesting doves to 69 in 1991 by monitoring 48 radio-marked birds. Thirty-seven percent of these nests were successful and fledged 45 young. The proportion of successful nests did not differ significantly ($\chi^2 = 0.218$, df = 1, $P = 0.64$) between years. Of the 59 doves that nested, 16 attempted >1 nest; 11 attempted two nests, 3 attempted three nests, and 2 attempted four nests. Only 4 of the 16

TABLE 1. Nesting habitats and nest success of 59 radio-marked Mourning Doves on Davisdale Wildlife Area, Missouri, during 1990–1991.

Habitat type	No. of nests (% in habitat type)	Successful nests (% nest success by habitat)
Edge Habitats		
Forest edge, fencerows, and small wooded valleys	43 (51.8)	10 (23.2)
Partially wooded pastures and oldfields	25 (30.1)	15 (60.0)
Subtotal	68 (81.9)	25 (36.8)
Continuous Habitats		
Agricultural fields and open pastures	8 (9.6)	4 (50.0)
Forest interior	7 (8.4)	2 (28.6)
Subtotal	15 (18.1)	6 (40.0)
Total	83 (100.0)	31 (37.3)

doves that attempted multiple nests nested in similar habitat types and nesting substrate on subsequent nesting attempts.

Habitats containing large amounts of woody vegetation edge in or adjacent to grasslands were used most frequently as nest sites by Mourning Doves, accounting for 81.9% of all nests (Table 1). Of the habitats classified as edge, those containing more widely spaced trees and shrubs (partially wooded pastures and oldfields) contained 43 nests compared to habitats with trees and shrubs in more linear arrangements (forest edge, fencerows, and small wooded valleys) which contained 25 nests.

The continuous habitat types (agricultural fields, open pastures, and forest interior) were used less frequently than edge habitats, but in the aggregate, they accounted for 18.1% of the nests. Even though nesting doves used continuous habitats less frequently, the proportion of successful nests in these habitats did not differ significantly ($\chi^2 = 0.055$, df = 1, $P = 0.82$) from nests in edge habitats.

DISCUSSION

Previous studies have documented that Mourning Doves nest over a broad geographic area (Aldrich 1993, Tomlinson et al. 1994) and in a wide range of habitats (Sayre and Silvy 1993). Our current knowledge of dove nesting habitat is based largely upon walk-searches conducted in various types of preferred or likely nesting habitat in trees and/or shrubs (Blockstein 1986, Geissler et al. 1982, Hanson and Kossack 1963, Westmoreland and Best 1985). Although walk-searches probably provide a reasonable assessment of nesting activity in specific habitats, the technique is labor intensive and, therefore, other potentially important nesting habitats are not searched (Hanson and Kossack 1963, Schulz and Sheriff 1995).

In most studies conducted in areas containing a mixture of edge and continuous habitat types, nest searching effort has focused on edge hab-

itats because that is where nest densities are found to be highest. Continuous habitats are typically excluded or less intensively sampled because of lower nest density and, as a consequence, are often viewed as marginal (Fuemmeler 1992). Continuous habitats, however, constitute a large proportion of available Mourning Dove habitat throughout much of their breeding range and, therefore, continuous habitat could contribute significantly to Mourning Dove production even if nest densities in these habitats were relatively low and/or nest success was different. Extensive portions of the 14 state Central Management Unit (CMU) are characterized by large expanses of continuous habitats and yet contain the highest breeding densities of Mourning Doves. Therefore, continuous habitat must be playing a larger role in annual mourning dove production and recruitment than previously considered. The 1997 Mourning Dove call-count survey data (Dolton and Smith 1997) show that 3 CMU states have the highest breeding population indices in the United States (Kansas 66.0, Nebraska 33.2, North Dakota 41.2) based on the number of birds heard per route, and the entire CMU has the highest breeding index of the three management regions (CMU 23.3, Eastern Management Unit 15.6, Western Management Unit 9.5).

Our data show that doves used the entire spectrum of habitat types for nesting, ranging from ground nests in open fields to canopy nests in the interior of forests. The results supported previous work attesting to the importance of edge habitats to nesting Mourning Doves (Eng 1986:421) because this category contained 81.9% of the nests. Although continuous habitats constituted the greatest proportion of the study area, they were used less frequently and accounted for 18.1% of all nests initiated by the radio-marked sample of doves. Also, 75% of doves that attempted >1 nest selected either a different habitat type and/or nest substrate; this supported our assumption of independence among nests.

Continuous habitats could be considered marginal despite relatively high use if doves selecting them experience low nest success relative to those using edge habitats (Olson et al. 1991). Comparison of our nest success data, however, showed no significant differences between nests in continuous and edge habitats and, therefore, continuous habitats may not be marginal. It should be noted, however, that because of the small number of nests in the continuous habitat category, the power of the chi-square test for comparing differences in nest success between habitats was low. Further studies are needed with 100–200 radio-marked doves to evaluate nest success and survival estimates in edge and continuous habitat types with more statistical power. Future research is also needed to investigate the extent to which continuous habitats are used in other portions of the Mourning Dove range, e.g., the Eastern or Western Management Unit states.

One important void in our current understanding of Mourning Dove nesting ecology is the degree to which nesting habitat selection is influenced by habitat availability. This shortcoming has undoubtedly arisen because doves use such a wide range of sites for nesting (Aldrich and

Duvall 1958, Aldrich 1993) that it has been impractical to determine how nests are distributed among habitats so that habitat selection relative to availability could be evaluated. Although telemetry provided information on the distribution of nests among habitats, the long dispersal distances of doves between trap sites and their nests made it impractical to validly assess the relationship between habitat use and availability. The area bounded by the outermost locations of nests exceeded 23 km^2 (Fuemmeler 1992). Even if the amount of habitat was determined for each habitat category in this area, nest densities would be so low that it is doubtful that any biologically meaningful relationships between habitat use and availability could be established.

Despite the preceding limitation, the results of this study confirm the potential importance of continuous habitats to breeding Mourning Doves. Because cropfields, open fields, and forest interior habitats constitute a substantial fraction of the habitat available to Mourning Doves in the Midwest and throughout much of their breeding range, these habitats probably contribute significantly to annual production. It is important, therefore, that these habitat types be given appropriate consideration in management decisions and future research relating to Mourning Dove nesting habitat.

ACKNOWLEDGMENTS

We thank R. R. George and D. L. Hallett for their help initiating funding for this study, and numerous field technicians for their assistance. This cooperative research was supported by the CMU states, Indiana and Illinois in the Eastern Management Unit, U.S. Fish and Wildlife-Migratory Bird Management Office, Wildlife Management Institute, Missouri Cooperative Fish and Wildlife Research Unit (Biological Resources Division, U.S. Geological Survey; Missouri Department of Conservation; The School of Natural Resources, University of Missouri; and Wildlife Management Institute), and the Edward K. Love Fellowship. Additional funding was provided by the Missouri Department of Conservation, Federal Aid in Wildlife Restoration Project W-13-R-47.

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Received 16 Apr. 1997, accepted 13 Aug 1997.