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Use of Crop Fields and Forest by Wintering American Woodcock

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Abstract - During the 1970s–80s, *Scolopax minor* (American Woodcock) on wintering grounds in North Carolina generally used bottomland forests diurnally and fed on earthworms in conventionally tilled soybean fields at night. Researchers surmised the ridges and furrows in conventionally tilled fields provided Woodcock protection from predators and winter weather. Since the 1980s, farmers widely adopted no-till practices for soybean agriculture, and this change in field structure may have altered Woodcock crop field use. We returned to the same area as previous research and conducted a study of Woodcock crop field and forest use in a landscape where crop fields are the dominant open-habitat type. During December 2009–March 2010, we captured and radio-tracked 29 Woodcock. Every 24 hours, we located each radio-marked Woodcock during diurnal and nocturnal periods, and verified the habitat type on foot as either crop field or bottomland forest. We recorded 94% of nocturnal locations in forest, 6% of nocturnal locations in crop fields, and 100% of diurnal locations in forest. Percent of an individual Woodcock's nocturnal locations in crop fields ranged from zero to 44%, with a mean of 6% (± 2% SE). The adoption of no-till technology and associated reduction in ridge and furrow micro-habitat available in crop fields may contribute to the low frequency of Woodcock nocturnal field use. Because Woodcock primarily were relocated in bottomland forests diurnally and nocturnally, forest stands should be conserved when managing agricultural landscapes.

Introduction

Since 1968, *Scolopax minor* Gmelin (American Woodcock; hereafter "Woodcock") in the Eastern and Central Management Regions have experienced a long-term population decline of 0.8% per year, largely attributable to the loss of early-successional forest habitat (Cooper and Rau 2012, Dessecker and McAuley 2001). Fire suppression, urban development, reduced timber harvest, and forest succession following land abandonment have contributed to the loss of early-successional habitat in the eastern United States (Thompson and DeGraaf 2001). Declines in early-successional habitat, combined with high winter mortality relative to summer mortality (Krementz et al. 1994, Pace 2000), make studies exploring Woodcock habitat use on wintering grounds important for management efforts.

Research across the winter range reported Woodcock using a variety of habitat types, including forest (Krementz et al. 1995), pastures, croplands, and old fields (Glasgow 1958), forest openings (Horton and Causey 1979), and fallow fields and seed tree timber harvests (Berdeen and Krementz 1998). Generally,

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wintering Woodcock require habitat with sparse ground cover to allow access to earthworms and facilitate ground movement, and sufficient overhead cover for concealment from predators (Berry et al. 2006). Stribling and Doerr (1985) showed that Woodcock in eastern North Carolina used bottomland forests during the day and conventionally tilled soybean fields at night to feed on earthworms, but their study was based on observations and did not evaluate the frequency of Woodcock field use.

Changes in tillage practices in the decades after Stribling and Doerr's (1985) research altered field structure and possibly Woodcock use of crop fields (Blackman et al. 2012). Conventional-till systems in soybean agriculture created ridge and furrow topography, but no-till agriculture has become a common practice, and soybean fields often are planted in flat, narrow rows (Heiniger et al. 2002, Stribling and Doerr 1985). The ridges and furrows in conventional-till systems likely provided shelter from winter weather and concealment from predators (Stribling and Doerr 1985). However, no-till soybean fields lack ridges and furrows, which may have contributed to a change in Woodcock use of fields at night (Blackman et al. 2012). Therefore, it is important to document current Woodcock winter habitat use to focus habitat management efforts. Our objective was to determine the frequency of diurnal and nocturnal Woodcock field and forest use across the same study area as previous research in an agricultural landscape in eastern North Carolina (Connors and Doerr 1982, Stamps and Doerr 1976, Stribling and Doerr 1985).

Field-site Description

We worked in the same area as previous Woodcock research in eastern North Carolina (Connors and Doerr 1982, Stamps and Doerr 1976, Stribling and Doerr 1985). Our study area included crop fields bordering US Highway 264, and mature mixed bottomland forests south of Lake Mattamuskeet National Wildlife Refuge near New Holland on the Albemarle-Pamlico Peninsula in Hyde County, NC (35° 26'36.61"N, 76°10'10.46"W; Fig. 1). All crop fields used for Woodcock capture were bordered on at least one side by forest, and the distance from capture field to forest never was greater than 200 m. Crop types were no-till soybean planted after corn, no-till soybean planted after wheat, disked corn, undisked corn with mowed stalks, winter wheat, and cotton. No-till soybean fields planted after corn retained the ridge and furrow topography from the previous corn crop, while no-till soybean fields planted after wheat lacked ridge and furrow topography because disking occurred before wheat was planted. Similarly, undisked corn fields retained ridge and furrow topography, while disked corn fields did not. Also, cotton fields had ridge and furrow topography, but were uncommon in the study area.

Methods

Woodcock captures, banding, and radio-transmitter attachment

During December 2009–March 2010, we captured Woodcock in crop fields at night using halogen bulb headlamps and hand-held fishing nets strung with mist netting (Connors and Doerr 1982, Reifenberger and Kletzly 1967, Stribling and Doerr 1985). The hand-held fishing nets were 58.4 cm wide and 55.9 cm long, and net poles were 142.2 cm long. We sexed (Martin 1964) and leg-banded each captured Woodcock with a size-3 USFWS band, and attached a 4.8-g VHF radio-transmitter (Advanced Telemetry Systems, Box 398, Isanti, MN) to the skin on the back between the wings using livestock ID tag cement (Nasco, Fort Atkinson, WI; McAuley et al. 1993). We used a 30-cm-long bellyband to secure the transmitter around the bird's breast (McAuley et al. 1993). We retained Woodcock for no longer than 20 minutes. All capture and handling methods were approved by the Institutional Animal Care and Use Committee at North Carolina State University (IACUC Protocol # 08-130-O).

Telemetry

Every 24 hours, we tracked each Woodcock during a diurnal and nocturnal period and verified the location on foot as either crop field or bottomland forest. In fields, we verified Woodcock locations visually. For forest locations, we walked to the edge between forest and field habitats to confirm the forest location. We collected diurnal locations between 1000 and 1600 hours EST and nocturnal locations between 1900 and 0100 hours EST. We searched for each individual

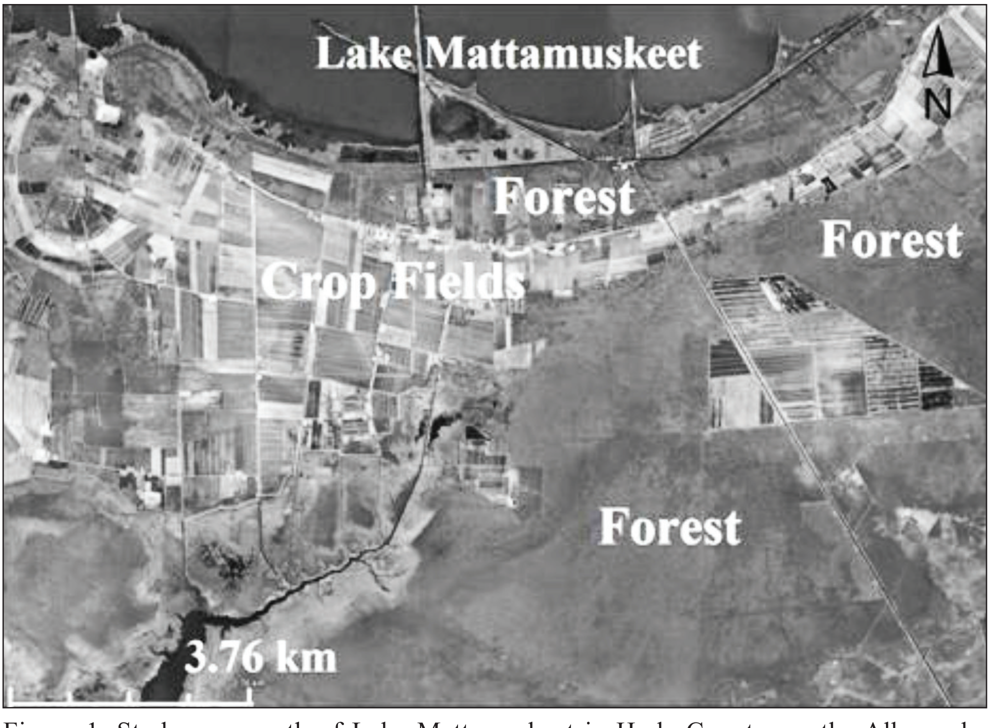

Figure 1. Study area south of Lake Mattamuskeet in Hyde County, on the Albemarle-Pamlico Peninsula of eastern North Carolina. Woodcock were captured in crop fields bordered on at least one side by mature mixed bottomland forest. Woodcock used all forest habitat depicted and primarily used crops fields bordering US-264, located on the northern edge of the crop fields. Previous Woodcock research from the 1970s–80s was conducted in the same study area.

during every diurnal and nocturnal period. Because Woodcock commonly move at dawn and dusk, we began our day and nighttime locations at least 30 minutes after dawn and dusk to ensure that Woodcock had time to move between habitat types (Glasgow 1958). We used a truck-mounted omni-directional whip antenna to initially locate Woodcock and a directional hand-held H-type antenna to obtain locations. We took a minimum of three bearings for each Woodcock location. When a Woodcock remained stationary for more than 48 hours, we determined the status of the bird on foot (i.e., alive, dead, or lost transmitter). Girard et al. (2006) suggested the accuracy of habitat use determination decreased when only one location was recorded per transmitted individual. Therefore, we removed individuals with one location from our dataset. We calculated the mean percent of nocturnal locations in crop fields for all transmitted Woodcock.

Results

Between December 2009 and February 2010, we captured 37 (25 males, 12 females) Woodcock in no-till soybean fields planted after corn (*n* = 21) and undisked corn fields (*n* = 16). All capture fields and subsequent field locations were within 200 m of forested cover types, and primarily in fields bordering US-264. We censored three birds (2 males; 1 female): one because of death at the time of capture, one because of predation within 24 hours after capture, and one because of injuries received during capture and subsequent predation three days after capture. Radio-tracking began on 15 December 2009 and continued until 4 March 2010, when all transmitted Woodcock left the study area. Radio transmitters remained attached to Woodcock for up to three weeks. The number of locations recorded per Woodcock varied from zero to 30, with an average of 12 locations per bird. Five individuals (3 males, 2 females) had less than two locations because they left the study area, lost their transmitters, or their transmitters failed, and were excluded from the data set (Girard et al. 2006). We recorded 100% of diurnal locations in forest (228 locations), 94% of nocturnal locations in forest (179 locations), and 6% of nocturnal locations in undisked corn or no-till soybean fields planted after corn (12 locations) (Table 1). Woodcock were relocated in forest patches north and south of crop fields and always were relocated within 2500 m of their capture field. For the 29 individual Woodcock, the mean percent of nocturnal locations in crop fields was 6% (± 2% SE) with a range of zero to 44% (Table 1).

Discussion

Radio marked Woodcock were caught in no-till soybean fields planted after corn and undisked corn fields, and primarily were relocated in mature bottomland forest. Research from across the wintering range demonstrated diurnal and nocturnal Woodcock use of mature forested habitats with nocturnal use of "open" habitats (e.g., seed-tree harvest areas and fallow old fields [Berdeen and Krementz 1998], pastures [Glasgow 1958], or regenerating clearcuts [Krementz et al. 1995]). Diurnal Woodcock use of forested habitat is much greater than use of open habitats (Horton and Causey 1979, Krementz and Pendleton 1994, Krementz et al. 1995). However, nocturnal use of open-habitat types other than crop fields can be high. For example, two studies reported 44% and 13% of nocturnal Woodcock locations in forest openings in central Alabama, and coastal Georgia and Virginia, respectively (Horton and Causey 1979, Krementz et al. 1995). Although nocturnal use of crop fields and other open-habitat types varies geographically, there is greater use of fields greater than 5 ha and of openings with overhead cover and bare ground to reduce predation risk and facilitate earthworm foraging (Krementz 2000).

The quality of protective cover available in open habitats may influence the frequency of nocturnal Woodcock use. In the Georgia Piedmont, greater nocturnal location rates for Woodcock in seed-tree harvest areas (36%) than in fallow fields (12%) and hay fields (1%) could be partially explained by greater foliage volume in timber harvests and the associated protection from predators (Berdeen and Krementz 1998). Similarly, we recorded greater Woodcock use of

Table 1. Number of diurnal (D) and nocturnal (N) locations per Woodcock in crop fields and bottomland forest, Hyde County, North Carolina, December 2009–March 2010. No diurnal locations were in fields.

Woodcock	D Forest	N Forest	N Field	% crop field N locations
1	4	2	0	0
2	2	3	0	0
3	3	1	0	0
4	1	3	0	0
5	0	3	1	25
6	2	2	0	0
7	6	2	0	0
8	14	8	0	0
9	2	1	0	0
10	12	5	4	44
11	14	9	0	0
12	13	10	0	0
13	6	1	0	0
14	14	14	0	0
15	10	4	1	20
16	8	4	0	0
17	9	4	3	43
18	10	8	0	0
19	6	7	2	22
20	13	12	0	0
21	7	8	0	0
22	9	10	1	9
23	14	11	0	0
24	10	10	0	0
25	15	15	0	0
26	4	4	0	0
27	7	6	0	0
28	7	7	0	0
29	6	5	0	0
Total	228	179	12	

fields with ridge and furrow cover than other field types with no cover (Blackman et al. 2012). The limited overhead cover in crop fields relative to other open-habitat types may explain why we documented infrequent Woodcock use of crop fields compared to greater use rates reported from studies in other open-habitat types.

Additionally, relatively recent changes in tillage practices and associated reductions in cover may have decreased Woodcock use of crop fields. Prior research in our study area reported nocturnal Woodcock use of conventionally tilled soybean fields, where ridge and furrow topography likely provided Woodcock with protection from winter weather and concealment from predators (Connors and Doerr 1982, Stribling and Doerr 1985). However, over the past 30 years, farmers have adopted no-till practices for soybean planting, thereby reducing the amount of ridge and furrow topography in the landscape (Heiniger et al. 2002, Stribling and Doerr 1985). For example, during our study, ridges and furrows (i.e., cover) were present in no-till soybean fields planted after corn and in undisked corn fields. However, 74% of no-till soybean fields were planted after wheat and lacked ridge and furrow topography because disking occurred before the wheat was planted. Also, infrequent use of crop fields cannot be explained by limited food resources because all soybean fields, regardless of tillage practice, contained high food abundance in the form of earthworms (Blackman et al. 2012). In fact, no-till agriculture leaves soil communities with greater numbers of earthworms than in tilled fields (Edwards and Lofty 1982, Smith et al. 2008).

Although trap shyness and weather conditions can influence Woodcock habitat use, they probably were not determinants of habitat use in our study. Woodcock in the Alabama Piedmont did not return to their capture field regularly (Horton and Causey 1979), but other Woodcock telemetry studies did not detect altered behavior attributable to capture (e.g., Krementz et al. 1995, Myatt and Krementz 2007). Woodcock in southern Louisiana were more active on nights with a new moon and warm temperatures than during nights with bright, cold conditions (Glasgow 1958), and birds in central Massachusetts made relatively brief visits to fields on cold, frosty nights when compared to nights with milder weather (Sheldon 1967). However, in our study, transmittered individuals rarely used crop fields on either warm or cold nights, so weather likely did not influence our estimates of field use. Although we did not observe temporal variation in field use, Berdeen and Krementz (1998) noted that Woodcock use of fields decreased as winter progressed.

Although we documented high use of forest, crop fields appear important for some Woodcock. Soybean fields had higher earthworm abundance than other field types, and fields with cover (i.e., ridge and furrow topography) likely provided thermal protection and concealment from predators (Blackman et al. 2012). Additionally, Krementz et al. (1995) suggested fallow fields provide important roosting, courtship, and feeding sites for Woodcock although they are used less than other habitat types. However, the benefits Woodcock gain from crop fields compared to forest deserve further attention. Future research should examine

Woodcock nocturnal winter use of forest and should compare earthworm abundance between crop fields and forested areas used by Woodcock. If forest earthworm abundance is comparable to earthworm abundance in crop fields, the combination of equitable food resources and better cover resources in forests could explain greater location rates in forests than in crop fields. Because the majority of Woodcock locations were in forested areas, Woodcock habitat management should include conservation of forest stands in agricultural landscapes to provide overwintering foraging and roosting sites.

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