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CHARACTERISTICS OF SPRING AND FALL BLACKBIRD ROOSTS IN THE NORTHERN GREAT PLAINS

George M. Linz
USDA, APHIS, Wildlife Services, National Wildlife Research Center, Great Plains Field Station, 2110 Miriam Circle, Bismarck, ND 58501, USA, george.m.linz@aphis.usda.gov

Richard S. Sawin
Department of Biological Sciences, North Dakota State University, Stevens Hall, Fargo, ND 58105, USA

Mark W. Lutman
Department of Biological Sciences, North Dakota State University, Stevens Hall, Fargo, ND 58105, USA

H. Jeffrey Homan
USDA, APHIS, Wildlife Services, National Wildlife Research Center, Great Plains Field Station, 2110 Miriam Circle, Bismarck, ND 58501, USA

Linda B. Penry
USDA, APHIS, Wildlife Services, National Wildlife Research Center, Great Plains Field Station, 2110 Miriam Circle, Bismarck, ND 58501, USA

See next page for additional authors

Authors
George M. Linz, Richard S. Sawin, Mark W. Lutman, H. Jeffrey Homan, Linda B. Penry, and William J. Bleier

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GEORGE M. LINZ, USDA, APHIS, Wildlife Services, National Wildlife Research Center, Great Plains Field Station, 2110 Miriam Circle, Bismarck, ND 58501, USA
RICHARD S. SAWIN, Department of Biological Sciences, North Dakota State University, Stevens Hall, Fargo, ND 58105, USA
MARK W. LUTMAN, Department of Biological Sciences, North Dakota State University, Stevens Hall, Fargo, ND 58105, USA
H. JEFFREY HOMAN, USDA, APHIS, Wildlife Services, National Wildlife Research Center, Great Plains Field Station, 2110 Miriam Circle, Bismarck, ND 58501, USA
LINDA B. PENRY, USDA, APHIS, Wildlife Services, National Wildlife Research Center, Great Plains Field Station, 2110 Miriam Circle, Bismarck, ND 58501, USA
WILLIAM J. BLEIER, Department of Biological Sciences, North Dakota State University, Stevens Hall, Fargo, ND 58105, USA

Abstract: To successfully reduce blackbird (Icteridae) damage to sunflower crops in the northern Great Plains, wildlife damage managers must be able to identify sites where large roosts could form in spring and fall. In 1998 and 1999, we measured several habitat and land-use characteristics of spring and fall blackbird roosts. Our objective was to quantify the relationship between roost formation and wetland habitat and land-use. We used data from 7 spring roosts and 12 fall blackbird roosts to set search guidelines that might increase the efficacy of locating potential roost sites in the Prairie Pothole Region of the northern Great Plains. Analysis of land use with aerial photography and on-site measurements of wetlands showed that roosts were usually established in larger-sized wetlands with sufficient standing water to produce large robust stands of cattail (*Typha* spp.). Large roosts often formed near harvested cornfields in spring and near ripening sunflower in fall.

Key words: blackbirds, cattails, northern Great Plains, Prairie Pothole Region, sunflower, *Typha* spp.

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INTRODUCTION

Blackbirds, including red-winged blackbirds (*Agelaius phoeniceus*), common grackles (*Quiscalus* quiscula), and yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), are known in the northern Great Plains for their predation on sunflower. Each spring, an estimated 52 million blackbirds migrate north into the northern Great Plains of the United States and southern Canada to nest (Peer et al. 2003). In fall, these birds and their progeny, totaling 75 million, drift southward feeding on sunflower and other grain crops. During both migratory periods, these birds prefer cattail-choked (*Typha* spp.) wetlands as night roosts because they provide shelter from severe weather and predators. Local habitat characteristics of wetland roosts and surrounding land-use might be useful for making *a priori* predictions of locations of active blackbird roosts. To be useful, predictive habitat characteristics should be practical to assess and consistent over relatively long periods of time. In this paper, we assess the practicality of using intrinsic and extrinsic site characteristics to predict use of wetlands as roost sites. The objective of our study was to find spring and fall blackbird roosts in the northern Great Plains and identify habitat and land-use traits common to these roosts. This knowledge should increase our ability to predict the locations of potential roosts based on the presence or absence of certain habitat and land-use variables. Wildlife managers and agricultural producers could implement damage management techniques more efficiently if accurate predictions of potential roost sites were available. For example, sunflower producers who plant near cattail-dominated wetlands might implement a management program by treating the wetland with glyphosate-based herbicide to eliminate the potential fall roost site and thus reduce the chances of significant bird damage (Linz and Hanzel 1997). On the other hand, wildlife managers could implement population management at spring roost sites to reduce numbers in the pre-breeding population (Linz et al. 2002a, 2002b).

METHODS

Study Areas

Spring 1998 and 1999.--We searched for spring migratory roosts in a 9-county area in east-central South Dakota (Figure 1). This area was chosen because it is considered to be the most northern region where migrating flocks of blackbirds are large enough to warrant a baiting program (Sawin 1999). Eastern South Dakota lies in the Coteau Des Prairies physiographic region in the Prairie Pothole Region (PPR) of the northern Great Plains. The landscape is characterized by low, rolling hills and a variety of glacial till deposits; undrained lakes and small wetland basins abound (Johnson and Higgins 1997). Formerly unbroken tall-grass prairie, the land now consists mainly of pasture and row crops. Shelterbelts and windbreaks divide expansive field crops and surround farmsteads and residential areas. Corn and soybean are the principal crops in eastern South Dakota, comprising 92% of the planted crops. The annual long-term average temperature and precipitation in eastern South Dakota are 6.7^{o} C and 58.4 cm, respectively (SDASS 2001).

Fall 1998 and 1999.--We searched for migratory blackbird roosts in Stutsman County, North Dakota (Figure 1). Stutsman County is located in the PPR and consists of many wetlands, croplands, and in the western part of the county, rangeland. Currently, Stutsman County is one of the top producers of sunflowers in the state, producing 117,000,000 kg per year (NDASS 2000). On average, Stutsman County receives 43.2 cm of rainfall per year and has an average temperature of 5.7^{0} C (NDASS 2000). The growing season for Stutsman County is about 125 days and typically starts around 15 May, the average date of last frost, and ends around 20 September, average date of first frost (NDASS 2000). This growing season, coupled with ample precipitation, makes the region a highly productive agricultural area.

Figure 1a. Location of 7 spring-migratory blackbird roosts in east-central South Dakota occupied in both 1998 and 1999.

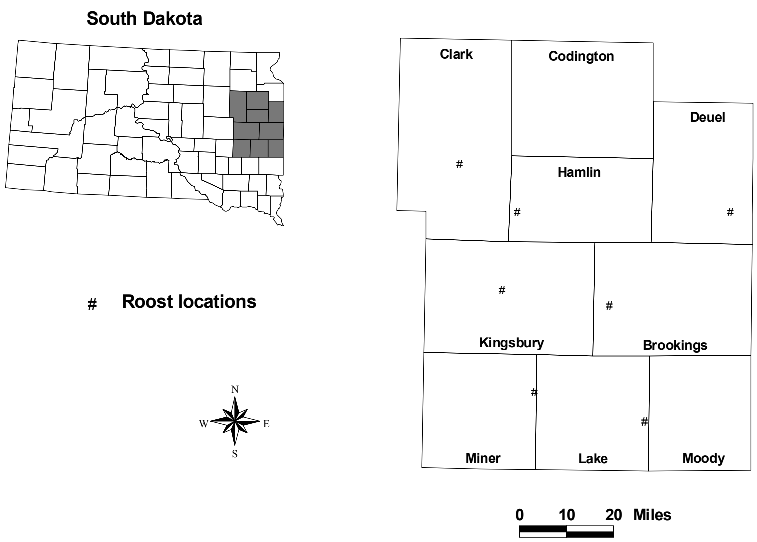
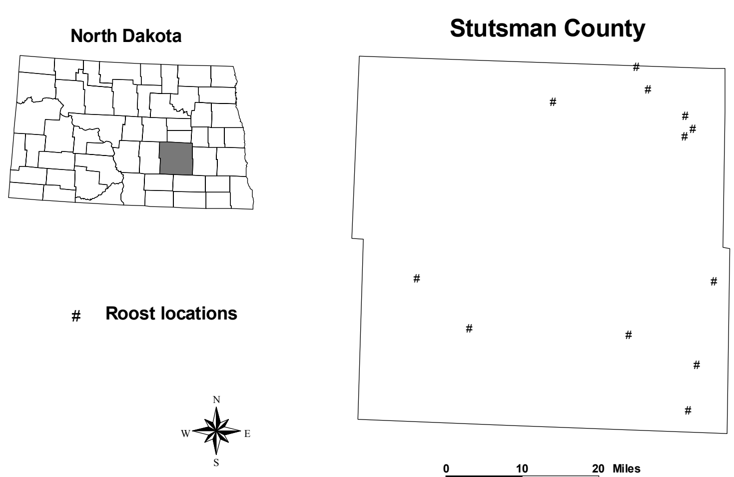


Figure 1b. Location of 12 fall-migratory blackbird roosts in Stutsman County, North Dakota occupied in both 1998 and 1999.



Roost Detection

We found candidate roosts by following evening flight-lines or by aerially surveying wetlands during the day and checking for blackbird activity in the mornings and evenings. The aerial surveys were conducted with a fixed-wing airplane. We verified roost size by counting birds departing and entering the roost in the mornings and evenings, respectively, using standardized block-count methods (Meanley 1965). A minimum of 20 ha of emergent vegetation was needed to admit wetlands into the spring roost study, and >10 ha was needed for entry in the fall study. Minimum peak counts of 50,000 and 10,000 were required for spring and fall roosts, respectively. The spring counts were conducted between mid-March and late-April 1998-1999; the fall counts between mid-August and mid-September 1998-1999.

Habitat Analyses

In 1998 and 1999, color aerial photographs of the spring and fall roosts were taken at elevations between 1,280 m and 3,140 m above ground level. The aerial photographs were converted to digital images and analyzed using a PC-based Geographic Information System (ARC/INFO; version 7.1.2 Environmental Systems Research Institute, Inc., Redlands, CA). The images were georeferenced, rectified, and projected to Albers conic equal-area projections. This projection provides an accurate cartographic representation of both distance and area.

Upland areas surrounding the wetland basin were removed before classifying the area coverage (ha) of open water and emergent vegetation in each wetland. An on-site visual assessment of the classified image was done to determine if each classified image was roughly accurate. One hundred pixels from each habitat type were randomly selected to perform the accuracy assessment. We characterized landscape features surrounding the spring roosts by using Landsat data classified by crop type by the National Agricultural Statistics Service Spatial Analysis Research Section. Land use within a 16-km radius of each roost wetland was determined by GIS. We used 4 habitat categories: (1) corn; (2) wetland; (3) all cultivated (corn, small grain, soybean); and (4) other (shelterbelts/ woodlots, roads, buildings, town, and fallow fields).

For analysis of habitats surrounding the fall roosts, we used 1.6 km x 3.2 km aerial photographs obtained from the Stutsman County Farm Services Agency in Jamestown, North Dakota. We estimated habitat coverage within a 4.8 km radius surrounding the wetland roost sites using a non-mapping technique (Marcum and Loftsgaarden 1980). The photographs were projected on to a 60-cm X 60-cm grid, and 21 random points per 1.6 km X 1.6 km quadrat were surveyed to assess the surrounding habitat. We used 4 habitat categories: (1) sunflower; (2) wetland; (3) all cultivated (small grain, sunflower, and soybean); (4) other (shelterbelts/woodlots, roads, buildings, town, and fallow fields). Coverage of open water and emergent vegetation within the wetland basins of fall roost sites were analyzed according to methods described for the spring roost study.

RESULTS

Spring.--Wetland area (158 ∀ 61 ha, 95% C.I.) and percentages of open water (30 ∀ 14%, 95% C.I.) and emergent vegetation (70 ∀ 14%, 95% C.I.) in the 7 spring roosts varied little between study years (Table 1).

Table 1. Habitat variables within and around spring roosts in 1998 and 1999 in east-central South Dakota.

	Year					
	1998		1999		Years Combined	
Category	Mean	95% CI	Mean	95% CI	Mean	95% CI
Wetland size (hectares)	154	91.1-216.6	162	98.1-226.8	158	97.0-219.4
Percentage of wetland covered by open water	28	13.0-42.6	32	17.2-46.2	30	15.6-44.0
Percentage of wetland covered by emergent vegetation	72	57.4-87.0	68	53.8-82.8	70	56.0-84.4
Percentage of land planted to corn within 16 km radius of roost	26	19.3-32.2	23	17.4-29.1	24	18.5-30.5
Percentage of land cultivated within 16 km radius of roost	59	53.7-65.2	57	49.0-64.8	58	51.4-64.9
Percentage of land covered by wetlands	14	9.4-18.6	12	5.1-18.1	13	7.3-18.3
Maximum number of blackbirds using roost	144,279	10,187-278,370	110,114	15,238-204,991	127,196	14,482-239,910

Similarly, use of land surrounding the wetlands was similar between years, with percentages of land planted to corn and all cultivated crops combined, averaging 24% (∀ 6.5%, 95% C.I.) and 58% (∀ 6.9%, 95% C.I.), respectively. Wetlands comprised 13% (∀ 5.3%, 95% C.I.) of the surrounding landscape. Blackbird numbers in spring roosts averaged 144,000 and 110,000 in 1998 and 1999, respectively.

Fall.--Wetland area (94 ∀ 71 ha, 95% C.I.) and percentages of open water (51 ∀ 11%, 95% C.I.) and emergent vegetation (49 ∀ 11%, 95% C.I.) found in 12 fall roosts also varied little between study years (Table 2). Use of land surrounding the wetlands was only measured in 1998. Wetlands covered 20% of the surrounding land, whereas sunflower and all cultivated crops combined covered 17% (∀ 3.2%, 95% C.I.) and 51% (∀ 6.9%, 95% C.I.) of the land area, respectively. Blackbird numbers in spring averaged 27,000 and 14,000 in 1998 and 1999, respectively.

Seasonal Comparison.--Aerial coverage of wetlands harboring spring blackbird roosts was 68% ($\bar{x}$ =158 ha) larger than fall ($\bar{x}$ = 94 ha) roosts (Table 3). Emergent vegetation covered 70% of the spring roost wetlands and only 49% of the fall roost wetlands. The remaining portions of the wetlands were comprised of open water. Blackbird roosts were 6 times larger ($\bar{x}$ =127,000 ha) in the spring than in the fall ($\bar{x}$ = 21,000 ha).

Table 2. Habitat variables within and around fall roosts in 1998 and 1999 in central North Dakota.

	Year					
	1998		1999		Years Combined	
Category	Mean	95% CI	Mean	95% CI	Mean	95% CI
Wetland size (hectares)	90	22.2-158.4	97	21.2-173.5	94	23.1-164.5
Percentage of wetland covered by open water	51	40.6-62.2	51	39.8-62.2	51	40.4-62.0
Percentage of wetland covered by emergent vegetation	49	37.8-59.4	49	37.8-60.2	49	38.0-59.6
Percentage of land planted to sunflower within 4.8 km radius of roost	17	14.2-20.3	-	-	-	-
Percentage of land cultivated within 4.8 km radius of roost	51	43.7-57.5	-	-	-	-
Percentage of land covered by wetlands	20	15.7-23.9	-	-	-	-
Maximum number of blackbirds using roost	27,375	15,185-39,565	14,017	4,307-23,727	20,696	9,095-32,296

DISCUSSION

The combination of cattail-dominated wetlands and grain crops provides a high quality stopover point for resident and migrating blackbirds. In March and April, blackbirds migrating through east-central South Dakota typically roost in large wetlands with dense emergent vegetation and feed primarily in harvested cornfields (Linz et al. 2002b). In August and September, blackbirds migrating through central North Dakota typically roost in smaller wetlands and primarily feed in ripening sunflower fields (Lutman 2000).

Patterns of wetland type and abundance vary across the PPR of the northern Great Plains (Batt et al. 1989). As a result, some locales are more likely than others to attract blackbird roosts. East-central South Dakota and central North Dakota are two areas in the PPR that consistently contain large blackbird roosts (Barras 1996, Sawin 1999, Lutman 2000). At the highest level of choice, migrating blackbirds are probably constrained by the general features of the landscape as they proceed along the migration route. Inside of this scale, however, a more refined choice is made based upon the intrinsic features within a particular location (Hutto 1985). Thus, roost-site selection can be viewed as a hierarchical series of decisions made at a variety of spatial and temporal scales, similar to other habitat-use decisions made by birds (Johnson 1980, Hutto 1985).

Table 3. Flock numbers and habitat variables within and around fall roosts in central North Dakota and spring roosts in east-central South Dakota in 1998 and 1999.

	Season			
	Fall[1]		Spring[2]	
Category[1]	Mean	95% CI	Mean	95% CI
Wetland size (hectares)	94	23.1-164.5	158	97.0-219.4
Percentage of wetland covered by open water	51	40.4-62.0	30	15.6-44.0
Percentage of wetland covered by emergent vegetation	49	38.0-59.6	70	56.0-84.4
Percentage of land planted to sunflower[3] or corn[4]	17	14.2-20.3	24	18.5-30.5
Percentage of land cultivated	51	43.7-57.4	58	51.0-65.0
Percentage of land covered by wetlands	20	15.7-23.9	13	7.3-18.3
Maximum number of blackbirds using roost	20,696	9,095-32,296	127,196	14,482-239,910

[1]Roosts located in central North Dakota
[2]Roosts located in east-central South Dakota
[3]Percentage of land planted within a 4.8 km radius of the roost
[4]Percentage of land planted within a 16.0 km radius of the roost

We found that most spring and fall blackbird roosts occurred in semipermanent wetlands with large expanses of dense emergent vegetation and abundant food available in the surrounding landscape. Although these similarities were present to a certain degree in spring and fall roosts, we did observe that fall roosts were notably smaller in number of birds per roost, wetland size, and ratio of open water: emergent vegetation. It was not unexpected to us that the number of birds per fall roost was smaller compared to spring, because the fall migration is a much more disorganized process than is the spring migration.

Differences in wetland size and open water: emergent vegetation ratios were perhaps a reflection of the inherent landscape pattern differences between east-central South Dakota and central North Dakota. Wetlands for the latter were 20% of the surrounding landscape, whereas wetlands comprised only 13% of the South Dakota study area. Lastly, the proximity of an easily available food resource might influence roost-cite choice, particularly in late summer and early fall when crops are ripening (Meanley 1965, Eiserer 1984, Lutman 2000). Having a food resource next to a roost site makes foraging more energy efficient for blackbirds and maximizes their feeding time and calorie intake. Otis and Kilburn (1988) showed that cattail-dominated wetlands near sunflower fields were attractive to blackbirds. Therefore, it is not surprising that many sunflower fields planted close to roosts often receive more damage than fields further away.

The exact point at which roosting habitat becomes unattractive to blackbirds does not seem easy to predict. Changes in roost size from year to year might be related to changes in the quality of the wetland itself, or the habitat that surrounds it. Land use around potential roost wetlands might affect spring roost status, but probably not to the degree that it affects fall roost selection, particularly the nearness of a preferred food source (Sawin 1999, Lutman 2000). During fall, many more small-sized wetlands are available, unlike spring, when roost choice is limited mainly to the larger-sized wetlands. Likewise, the number of blackbirds at a roost is affected by wetland size, amount of cattails, and water depth. Of all factors, water-depth (and concomitantly, cattail coverage) perhaps is the most important characteristic governing selection of a fall roost site (Meanley 1965, Lutman 2000). We have never found stable roosts in wetlands lacking standing water in the northern Great Plains. Periodic fluctuations in water levels throughout this region result in successional changes in wetlands that alter the distribution and abundance of quality roosting habitat (Van Der Valk and Davis 1979, Weller 1975). The location and size of active roosts will shift to reflect these climatically-induced habitat changes. Some wetlands serve as roosts for a number of consecutive years, while others last for only one season (Barras 1996, Sawin 1999, Lutman 2000).

Management Implications

In the spring, look for roosts in large cattail-dominated wetlands that have harbored blackbirds in previous years. In the fall, search for roosts in wetlands located near sunflower fields. The best method of finding these roosts is to first aerially survey the landscape for likely locations and then follow-up with ground inspection. Aerial searches require approximately one-sixth of the time required for ground surveys and provide a much better overview of the landscape in the study area. First-time searchers will find it useful to view previously identified roosts from the air and on the ground in order to become familiar with the appearance of potential roost wetlands. Conduct early season roost estimates as they are good indicators that a substantial roost might be forming.

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