AVIAN POPULATIONS AND HABITAT USE ON WEST CENTRAL ILLINOIS GRASSLANDS 1989-1990

by

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Introduction

Purpose

This study was conducted as part of my senior research project at Bradley University in Peoria Illinois. The project was suggested by Jim Heim, Illinois Department of Conservation Natural Heritage Biologist, who conducted several censuses of grasslands in West Central Illinois and detected several Illinois endangered and threatened avian species.

The purpose of this project is to document the presence, diversity, and habitat use of avian species on several different types of West Central Illinois grasslands.

Historical Background

The central portion of the North American continent was dominated by different types of prairies and prairie wetlands in pre-settlement times. At this time Illinois consisted of approximately 22 million acres of prairie, 14 million acres of forest, and 1 million acres of wetlands (McClain, 1986). Avian species dependant on these large tracts of unbroken grasslands were very abundant.

The destruction of the early Illinois prairies began in earnest after John Deere invented the moldboard plow in the 1840's. The vast tracts of unbroken prairie were soon plowed up and fragmented into a patchwork of farms and settlements. Much

of this acreage was converted to artificial prairie in the form of pastures and hayfields. Many grassland bird species adapted to these new artificial prairies, and were able to co-exist with man.

It is the destruction and elimination of these artificial grasslands in the past several decades that has caused the populations of many grassland bird species to decrease drastically. Many grassland bird species have become rare, threatened, or endangered.

Graber and Graber (1963) documented that most grassland bird species were about as numerous in 1956-1958 as they were in 1906-1909. But subsequent surveys taken by them in 1978 and 1979 revealed that many grassland bird populations (Upland Sandpiper, Bobolink, Meadowlark, Dickcissel, Grasshopper Sparrow, Savannah Sparrow, and Henslow's Sparrow) had drastically fallen by 84%-98% of their 1956-1958 levels (Illinois Natural History Survey Report 227, 1983). The Grabers attributed these declines to the loss of managed grassland acreage which was converted to corn and especially soybean acreage. The conversion of substitute grasslands to other uses was as rapid as 50% per decade. The avian population declines came not only from habitat loss, but also from decreased population densities on available grasslands.

Further, the remaining grasslands were small in size and isolated from other similar habitats. Few of these tracts were

large enough to support avian species requiring large expanses of unbroken grassland such as the Short-eared Owl and Northern Harrier (Bowles, et al., 1983). The loss of habitat affected many other avian species, demonstrated by one-third of the avian species on the Illinois Threatened and Endangered Species lists using grasslands at some point in their life histories.

West Central Illinois is one area where relatively large tracts of grassland still exist. There are many thousand acres of reclaimed surface stripped mines that are mainly grasslands or grasslands in early successional stages.

The purpose of this study is to document the presence, diversity, and habitat use of avian species on these reclaimed surface-mined lands located near Canton Illinois and at Banner Marsh State Fish and Wildlife Area.

Methods

The variable width transect method (VWTM), as described by Emlen (1971), was used to determine the densities of avian populations on the grassland transects. A full discussion of the VWTM is contained in Appendix A.

Description of Study Areas

Eight transects were established on reclaimed surface-stripped coal mines in northeastern Fulton County and southwestern Peoria County located in West Central Illinois (Map 1). Three transects (4-6) were established on lands owned by The Nature Conservancy, and three (1-3) on land owned by the Freeman United Coal Mining Company. These transects are located in northeastern Fulton County, lying northwest of the city of Canton Illinois. Transects seven and eight were established at Banner Marsh State Fish and Wildlife Area, located in southwestern Peoria county, about 18 miles southwest of Peoria Illinois.

Transects established on land owned by the Freeman United Coal Mining Company (Map 2) are located in Sections 9 and 10 of Canton Township (T.7N.-R.4E.). The Freeman United Coal Mining Company generously granted permission for research to be conducted on their property.

Transects established on land owned by The Nature Conservancy (Map 3) are located in Section 16 of Canton Township (T.7N.-R.4E.). The Nature Conservancy was very cooperative in granting permission to conduct research on their property.

Transects established on Banner Marsh State Fish and Wildlife Area are indicated on Map 4. Banner Marsh lies between Route 24 and the Illinois River, and extends for approximately 5 miles in a northeast to southwest direction along the Illinois River from Kingston Mines on the northern end, and Banner on the southern.

Maps 4-10 are the specific transect maps upon which the detections were marked, and are in Appendix C.

Three different management strategies were employed on the transects. Transects 1,4,and 6 were used for grazing by stock cows. Transects 5 and 8 were cut for hay, while transect 2 was seeded with wheat but never harvested. Transects 3 and 7 were unused or undisturbed grasslands and were not disturbed during the census period and, in the case of transect 3, for many years prior.

In Appendix B, each transect is described in detail with references to the following factors: length, vegetation type, topography, amount of water present, amount of shrubs and trees present, current management strategy, and other pertinent information.

Results

A total of 87 species were detected during the study period. These include detections made on the transects before and after the eight summer breeding censuses conducted from the last week of May until the third week of July.

Table 1 follows Bohlens (1989) definitions in listing the species recorded on the transects as well as their status on the transects as a migrant (M), permanent resident (PR), summer resident (SR), visitor (V), winter resident (W), endangered species (E), or threatened species (T). The transect(s) on which each species was detected is also indicated.

55 species were either summer or permanent residents, 19 were migrants, 9 were visitors, and four were winter residents.

With respect to habitat type, 21 species are considered grassland or early succession species, while 30 species are considered wetland species.

Seven Illinois Endangered Species were detected (Pied-billed Grebe (M), Great Egret (V), American Bittern (SR), Bald Eagle (V), Northern Harrier (W), Short-eared Owl (W), and Upland Sandpiper (SR)), while one Illinois Threatened Species was detected (Henslow's Sparrow (SR)).

Tables 2-9 provide data summaries from the individual transects. The calculated density of each species per census is listed, as well as the total population densities, number of species detected, and Shannon-Weiner diversity index (H').

Table 10 provides a summary of the total avian population densities, number of species detected, and H' for each transect. The range of values, mean value, and standard deviations are listed.

In the first three columns of tables 11-18, the observed number of detections per species, the percent of total detections, and the numerical ranking of each species is listed. In columns four through six of these tables, the number of calculated detections using the VWTM (Variable Width Transect Method), the percent of total VWTM detections, and the VWTM ranking are listed.

Table 19 provides a summary for each species of the number of detections, percent of total detections, and ranking using both observed and VWTM detections.

The species comprising 80% of the avian community population using observed and VWTM detections are listed in tables 20-27.

Table 1

Avian Species List with Residence Classification and Where Detected
(M=Migrant, PR=Permanent Resident, SR=Summer Resident, V=Visitor, W=Winter Resident, E=Endangered, T=Threatened)

Avian Species	Transect Number 1	2	3	4	5	6	7	8
*Pied-billed Grebe(M,E)							X	
*American Bittern(SR,E)	X			X		X		
Great Blue Heron(V)	X	X	X	X		X	X	X
*Great Egret(V,E)	X	X	X	X		X	X	X
Green-backed Heron(SR)	X	X	X	X		X	X	X
Black-crowned Night Heron(V)			X					
White-fronted Goose(M)							X	
Canada Goose(SR)	X		X	X			X	X
Wood Duck(SR)				X		X		
Green-winged Teal(M)				X		X		
American Black Duck(M)	X							
Mallard(SR)	X		X	X	X		X	X
Blue-winged Teal(SR)	X		X		X	X	X	
Ring-necked Duck(M)	X							
Lesser Scaup(M)	X		X	X		X		
Common Golden-eye(M)	X			X				
Bufflehead(M)				X		X		
Common Merganser(M)				X				
Turkey Vulture(V)							X	X
*Bald Eagle(V,E)							X	X
*Northern Harrier(W,E)	X		X	X	X	X	X	
Sharp-shinned Hawk(V)			X					
Red-tailed Hawk(PR)	X	X	X	X	X	X	X	X
Rough-legged Hawk(W)	X						X	X
American Kestral(PR)								X
Northern Bobwhite Quail(PR)	X	X	X	X	X	X	X	X
Ring-necked Pheasant(PR)	X	X	X	X	X	X	X	X
American Coot(SR)				X				
Killdeer(SR)	X	X	X	X	X	X	X	X
Greater Yellowlegs(M)	X			X			X	
Lesser Yellowlegs(M)	X							
Willet(M)	X							
Spotted Sandpiper(SR)	X		X		X		X	X
*Upland Sandpiper(SR,E)	X	X	X	X	X	X		
Least Sandpiper(M)			X					X
Pectoral Sandpiper(M)							X	
Short-billed Dowitcher(M)			X					
Ring-billed Gull(V)	X			X				
Rock Dove(V)		X		X				
Mourning Dove(PR)	X	X	X	X		X	X	X
*Short-eared Owl(W,E)	X			X	X	X		
Common Nighthawk(V)		X	X		X			
Belted Kingfisher(SR)	X		X			X		X
Red-headed Woodpecker(PR)								X
Northern Flicker(PR)			X	X			X	
Least Flycatcher(SR)	X	X						

Table 1 (cont)

Avian Species List with Residence Classification and Where Detected
(M=Migrant, PR=Permanent Resident, SR=Summer Resident, V=Visitor, W=Winter Resident, E=Endangered, T=Threatened)

Avian Species	Transect Number 1	2	3	4	5	6	7	8
Great-crested Flycatcher(SR)							X	
Eastern Kingbird(SR)	X		X	X		X	X	X
Horned Lark(PR)	X	X	X	X		X	X	X
Tree Swallow(SR)	X	X	X	X	X	X	X	X
Rough-winged Swallow(SR)	X	X	X	X	X	X	X	X
Bank Swallow(SR)	X	X	X	X	X	X	X	X
Cliff Swallow(SR)	X	X	X	X	X	X	X	X
Barn Swallow(SR)	X	X	X	X	X	X	X	X
Blue Jay(PR)	X			X				X
American Crow(PR)	X			X	X	X	X	X
Black-capped Chickadee(PR)			X		X			
White-breasted Nuthatch(PR)							X	
Eastern Bluebird(M)								X
American Robin(SR)	X	X	X	X		X	X	X
Gray Catbird(SR)				X			X	
Brown Thrasher(SR)	X		X	X		X		
European Starling(PR)	X		X	X			X	
Yellow Warbler(M)	X			X				
Common Yellowthroat(SR)						X		X
Northern Cardinal(PR)	X		X	X		X		X
Rose-breasted Grosbeak(SR)			X					
Indigo Bunting(SR)								X
Dickcissel(SR)	X	X	X	X	X	X	X	X
American Tree Sparrow(WR)				X				
Chipping Sparrow(SR)				X				
Field Sparrow(PR)							X	X
Savannah Sparrow(SR)	X	X		X	X			
Grasshopper Sparrow(SR)	X	X	X	X	X	X		X
*Henslow's Sparrow(SR,T)			X					
Song Sparrow(PR)	X	X		X	X	X	X	X
Swamp Sparrow(PR)				X				
Bobolink(SR)	X			X	X			
Red-winged Blackbird(PR)	X	X	X	X	X	X	X	X
Eastern Meadowlark(PR)	X	X	X	X	X	X	X	X
Western Meadowlark(PR)	X	X		X			X	
Brewer's Blackbird(PR)	X			X				X
Common Grackle(PR)	X		X	X		X	X	X
Brown-headed Cowbird(PR)	X	X	X	X	X	X	X	X
Orchard Oriole(SR)	X		X				X	
Northern Oriole(SR)	X						X	X
American Goldfinch(PR)	X	X	X	X	X	X	X	X

*=Endangered or Threatened Avian Species

Table 2

Transect 1 Data Summary

Species	Date Censused 5/23	6/2	6/11	6/19	7/3	7/9	7/14	7/16
	Avian Density (Number of birds/40 ha)							
American Bittern	-	-	-	-	-	-	0.5	-
Great Blue Heron	-	1.0	1.0	1.5	-	-	0.5	-
Great Egret	0.5	0.5	1.0	-	-	0.5	-	0.5
Green-backed Heron	0.5	-	-	0.5	-	0.5	-	-
Canada Goose	21.5	7.5	-	-	2.5	4.5	-	-
Mallard	8.0	4.0	3.5	4.5	1.0	4.5	4.0	2.5
Blue-winged Teal	1.0	0.5	2.5	2.0	1.0	2.5	2.5	2.5
Red-tailed Hawk	-	-	-	-	-	0.5	-	-
Bobwhite Quail	4.0	3.0	4.0	7.0	-	5.0	3.0	3.0
Ring-necked Pheasant	1.8	-	-	2.7	-	3.6	-	0.9
Killdeer	15.0	14.5	10.0	12.0	7.5	9.0	9.5	7.5
Greater Yellowlegs	0.5	-	-	-	-	-	-	-
Lesser Yellowlegs	1.0	-	-	-	-	-	-	-
Willet	-	0.5	-	-	-	-	-	-
Spotted Sandpiper	1.0	0.5	-	0.5	-	-	0.5	-
Upland Sandpiper	2.0	5.0	4.0	3.0	1.0	4.0	3.0	2.0
Mourning Dove	1.0	1.5	2.5	2.0	-	4.5	2.0	5.0
Least Flycatcher	0.5	-	-	-	-	-	-	-
Eastern Kingbird	-	-	1.0	-	0.5	-	-	1.5
Horned Lark	0.9	0.9	0.9	1.8	-	3.6	-	4.5
American Robin	4.0	2.5	4.0	3.0	1.5	3.0	-	2.5
Brown Thrasher	-	-	0.5	-	-	-	0.5	-
European Starling	-	-	0.5	-	-	1.5	-	-
Dickcissel	0.75	0.75	7.5	5.3	3.0	6.0	4.5	-
Savannah Sparrow	-	-	0.5	1.5	1.0	3.0	1.5	3.5
Grasshopper Sparrow	113.0	121.5	124.4	124.4	97.9	124.4	109.3	146.9
Song Sparrow	-	-	0.5	-	-	0.5	-	0.5
Bobolink	-	2.0	3.0	-	1.5	1.0	2.0	-
Red-winged Blackbird	46.5	25.1	24.5	29.0	25.1	42.9	29.3	28.3
Eastern Meadowlark	55.8	55.5	33.4	38.1	40.8	57.2	44.9	46.3
Western Meadowlark	-	2.6	-	-	-	-	.65	-
Brewers Blackbird	-	-	0.5	1.0	-	-	1.0	-
Common Grackle	5.0	1.0	1.0	2.0	-	2.0	-	-
Brown-headed Cowbird	5.0	7.0	24.5	9.5	6.0	13.5	5.0	12.0
Orchard Oriole	0.5	-	-	-	-		-	-
Northern Oriole	-	-	-	-	-	0.5	-	-
American Goldfinch	-	-	1.0	-	-	0.5	-	-
Number of birds per 40 ha	289.4	256.9	255.8	251.5	190.8	297.1	224.1	267.9
Number of species	23	21	24	20	14	26	19	17
H'	2.725	2.492	2.674	2.582	2.156	2.820	2.408	2.250

Table 3

Transect 2 Data Summary

Species	Date Censused 5/31	6/2	6/13	6/19	7/9	7/11	7/14	7/16
	Avian Density (Number of birds/40 ha)							
Great Blue Heron	-	-	-	2.0	-	-	-	2.0
Great Egret	-	1.0	-	2.0	-	2.0	-	-
Green-backed Heron	-	-	-	-	2.0	-	-	-
Red-tailed Hawk	-	-	-	-	2.0	-	-	-
Bobwhite Quail	2.0	-	8.0	-	-	4.0	-	8.0
Ring-necked Pheasant	3.6	-	3.6	-	-	-	3.6	-
Killdeer	16.7	2.0	14.0	8.0	10.0	16.0	8.0	10.0
Upland Sandpiper	2.0	8.0	8.0	-	4.0	-	4.0	-
Rock Dove	2.0	-	-	-	-	6.0	-	-
Mourning Dove	-	4.0	12.0	4.0	10.0	4.0	-	-
Nighthawk	-	-	-	-	-	-	-	2.0
Least Flycatcher	2.0	-	-	-	-	-	-	-
American Robin	-	2.0	2.0	-	-	-	2.0	-
Dickcissel	67.8	103.7	57.0	75.3	45.8	75.3	69.2	100.5
Savannah Sparrow	-	3.6	10.8	7.2	-	10.8	14.4	7.2
Grasshopper Sparrow	22.7	-	33.8	15.1	-	45.2	15.1	22.7
Song Sparrow	2.0	-	-	2.0	-	-	2.0	-
Red-winged Blackbird	69.1	35.1	75.4	50.2	54.4	71.2	67.0	83.7
Eastern Meadowlark	88.9	12.2	76.2	45.8	65.3	81.6	87.0	92.6
Western Meadowlark	-	2.6	-	2.6	-	-	2.6	-
Brown-headed Cowbird	36.3	20.0	42.0	24.0	-	30.0	76.0	38.0
American Goldfinch	2.0	4.0	-	4.0	-	6.0	-	6.0
Number of birds per 40 ha	317.1	198.2	342.8	242.2	193.5	352.1	351.0	372.7
Number of species	13	12	12	13	8	12	12	11
H'	2.657	2.230	2.964	2.780	2.190	2.860	2.657	2.629

Table 4

Transect 3 Data Summary

Species	Date Censused 5/31	6/2	6/13	6/19	6/29	7/6	7/14	7/16
	Avian Density (Number of birds/40 ha)							
Great Blue Heron	1.0	2.0	-	-	1.0	2.0	-	1.0
Great Egret	-	-	-	1.0	1.0	-	1.0	1.0
Green-backed Heron	1.0	-	-	1.0	1.0	-	1.0	-
Black-crowned Night Heron	-	1.0	-	-	-	-	-	-
Canada Goose	-	2.0	4.5	5.0	-	3.0	4.0	4.0
Mallard	7.0	2.5	6.0	4.0	6.0	4.0	2.0	4.0
Blue-winged Teal	3.0	2.0	2.0	-	2.0	2.0	-	4.0
Sharp-shinned Hawk	-	1.0	-	-	-	-	-	-
Red-tailed Hawk	-	-	-	-	-	-	2.0	-
Bobwhite Quail	8.0	16.0	4.0	-	-	10.0	10.0	-
Pheasant	-	2.0	4.0	-	-	-	4.0	-
Killdeer	9.0	8.0	20.0	8.0	13.0	7.0	9.0	6.0
Spotted Sandpiper	1.0	-	5.0	-	-	3.0	1.0	2.0
Upland Sandpiper	2.0	6.0	-	-	2.0	2.0	-	4.0
Least Sandpiper	-	-	-	-	-	-	-	2.0
Short-billed Dowitcher	-	-	-	-	-	-	-	1.0
Mourning Dove	3.0	1.5	4.0	2.0	5.0	8.0	2.0	10.0
Nighthawk	-	-	-	-	1.0	-	-	-
Belted Kingfisher	-	-	1.0	-	1.0	2.0	-	1.0
Northern Flicker	-	1.0	-	-	-	1.0	-	-
Eastern Kingbird	2.0	3.0	2.0	3.0	3.0	1.0	3.0	2.0
Black-capped Chickadee	-	1.0	-	-	-	-	-	-
American Robin	13.0	5.0	-	4.0	3.0	-	4.0	8.0
Brown Thrasher	1.0	2.0	1.0	-	-	-	-	-
European Starling	-	1.0	-	-	-	-	1.0	-
Northern Cardinal	-	-	-	-	-	1.0	-	1.0
Rose-breasted Grosbeak	-	1.0	-	-	1.0	-	-	-
Dickcissel	28.2	47.1	18.9	22.1	16.5	22.7	22.1	26.4
Grasshopper Sparrow	113.0	124.4	97.9	120.6	90.4	84.8	105.5	128.2
Henslow's Sparrow	-	28.3	30.1	28.3	33.8	30.1	33.8	45.2
Red-winged Blackbird	105.5	104.7	98.4	96.3	95.8	106.8	92.6	94.2
Eastern Meadowlark	57.2	102.1	81.6	62.5	85.7	62.5	54.56	54.5
Common Grackle	2.0	-	2.0	-	-	2.0	-	3.0
Brown-headed Cowbird	12.6	9.0	5.0	7.0	9.0	14.0	10.0	3.0
Orchard Oriole	-	1.0	-	-	-	1.0	-	-
American Goldfinch	6.3	-	-	4.0	3.0	4.0	-	-
Number of birds per 40 ha	375.7	473.6	389.4	368.8	384.2	373.9	362.5	405.5
Number of species	19	25	18	16	21	22	19	22
H'	2.837	2.953	2.930	2.683	2.959	3.060	2.907	2.934

Table 5

Transect 4 Data Summary

Species	Date Censused 5/25	5/26	6/1	6/7	6/14	6/26	7/6	7/16
	Avian Density (Number of birds/40 ha)							
American Bittern	-	-	-	2.0	-	-	1.0	-
Great Blue Heron	-	1.0	1.0	-	-	1.0	1.0	-
Great Egret	-	1.0	-	1.0	2.0	-	1.0	1.0
Green-backed Heron	1.0	-	-	-	1.0	-	-	-
Canada Goose	-	17.0	10.0	7.0	-	-	4.0	-
Wood Duck	2.0	4.0	2.0	1.0	4.0	-	-	2.0
Mallard	-	3.0	2.0	3.0	2.0	2.0	2.0	2.0
Red-tailed Hawk	-	1.0	2.0	-	-	-	-	1.0
Bobwhite Quail	-	-	10.0	4.0	4.0	2.0	2.0	12.0
Ring-necked Pheasant	-	1.8	-	3.6	3.6	1.8	-	5.4
Killdeer	-	15.1	9.0	8.0	10.0	2.0	3.0	8.0
Upland Sandpiper	-	4.0	4.0	6.0	2.0	2.0	2.0	4.0
Mourning Dove	-	2.0	4.0	1.0	6.0	-	-	8.0
Northern Flicker	-	-	2.0	1.0	-	2.0	-	1.0
Eastern Kingbird	-	1.0	2.0	-	1.0	1.0	-	1.0
Horned Lark	28.8	36.2	10.8	7.2	14.4	1.8	3.6	7.2
American Robin	4.0	5.0	6.0	4.0	6.0	7.0	5.0	4.0
Gray Catbird	-	-	-	1.0	1.0	1.0	-	-
Brown Thrasher	-	-	1.0	1.0	-	4.0	-	-
Yellow Warbler	-	-	-	2.0	-	-	-	-
Dickcissel	-	-	9.0	3.0	4.5	7.5	4.5	12.0
Savannah Sparrow	3.6	-	3.6	-	-	-	3.6	-
Grasshopper Sparrow	-	361.8	422.1	423.9	482.2	220.5	331.6	482.2
Song Sparrow	-	1.0	-	-	1.0	-	-	-
Bobolink	-	1.0	-	-	1.0	-	-	-
Red-winged Blackbird	-	48.1	48.1	40.2	60.7	69.1	46.1	67.8
Eastern Meadowlark	-	68.6	70.7	63.3	81.6	81.6	65.3	68.6
Western Meadowlark	-	-	1.8	-	-	-	-	1.8
Brewer's Blackbird	-	1.0	-	2.0	-	-	-	4.0
Common Grackle	-	-	-	3.0	2.0	-	-	3.0
Brown-headed Cowbird	20.0	8.0	25.0	125.6	50.0	87.9	18.0	29.0
American Goldfinch	-	-	5.0	1.0	3.0	8.0	-	10.0
Number of birds per 40 ha	59.4	586.6	649.1	714.8	743.0	502.2	493.7	735.0
Number of species	16	20	22	24	22	18	16	22
H'	1.808	2.142	2.070	2.082	1.969	2.379	1.750	2.601

Table 6

Transect 5 Data Summary

Species	Date Censused 5/25	5/26	6/1	6/7	6/14	6/26	7/6	7/16
	Avian Density (Number of birds/40 ha)							
Mallard	-	-	-	4.0	-	2.0	-	-
Blue-winged Teal	-	-	2.0	-	4.0	-	4.0	-
Red-tailed Hawk	2.0	-	-	-	-	-	4.0	-
Bobwhite Quail	-	-	-	-	4.0	-	4.0	-
Ring-necked Pheasant	-	-	3.6	3.6	-	1.8	-	3.6
Killdeer	-	2.0	-	8.0	4.0	2.0	-	4.0
Spotted Sandpiper	-	-	-	-	-	-	-	2.0
Upland Sandpiper	-	-	-	8.0	-	4.0	-	4.0
Common Nighthawk	-	-	-	-	-	-	-	2.0
Horned Lark	3.6	-	-	3.6	-	-	-	-
Dickcissel	82.8	82.8	70.7	81.6	69.2	75.3	60.3	67.8
Savannah Sparrow	45.2	113.0	-	-	-	25.1	-	-
Grasshopper Sparrow	180.9	22.7	124.4	256.1	45.2	113.0	90.4	90.4
Song Sparrow	4.0	2.0	-	6.0	-	2.0	-	-
Bobolink	32.7	69.0	33.5	15.1	35.1	41.8	33.5	-
Red-winged Blackbird	185.3	213.6	192.6	201.0	140.7	158.1	153.7	140.6
Eastern Meadowlark	52.3	32.8	16.4	31.5	40.8	43.6	32.6	49.0
Brown-headed Cowbird	6.0	-	2.0	-	12.0	-	18.0	18.0
Number of birds per 40 ha	594.8	537.9	446.8	618.5	355.0	466.7	404.5	381.4
Number of species	10	8	8	11	9	10	10	10
H'	2.897	2.296	2.071	2.149	2.440	2.464	2.477	2.335

Table 7

Transect 6 Data Summary

Species	Date Censused 5/25	5/26	6/1	6/7	6/14	6/26	7/6	7/16
	Avian Density (Number of birds/40 ha)							
American Bittern	-	-	2.0	-	-	-	-	-
Great Blue Heron	-	-	-	2.0	2.0	-	-	2.0
Great Egret	-	-	-	-	-	2.0	-	2.0
Green-backed Heron	-	2.0	2.0	-	-	-	-	2.0
Wood Duck	-	-	-	2.0	14.0	-	-	-
Blue-winged Teal	-	4.0	2.0	16.0	-	4.0	10.0	-
Red-tailed Hawk	-	2.0	-	-	-	-	2.0	-
Bobwhite Quail	-	16.0	16.0	-	8.0	8.0	-	16.0
Ring-necked Pheasant	-	-	-	-	3.6	-	3.6	-
Killdeer	2.0	8.0	8.0	4.0	4.0	2.0	4.0	8.0
Upland Sandpiper	8.0	-	8.0	12.0	4.0	-	8.0	-
Mourning Dove	2.0	6.0	2.0	-	12.0	-	4.0	14.0
Belted Kingfisher	-	2.0	2.0	-	-	-	2.0	-
Eastern Kingbird	-	4.0	2.0	2.0	2.0	2.0	2.0	-
Horned Lark	21.6	7.8	25.2	-	-	-	-	-
American Robin	4.0	-	-	-	2.0	2.0	-	2.0
Brown Thrasher	-	-	4.0	-	2.0	-	-	2.0
Common Yellowthroat	-	-	-	-	-	-	-	2.0
Northern Cardinal	-	-	2.0	-	2.0	2.0	-	-
Dickcissel	6.0	6.0	-	-	-	3.0	6.0	-
Grasshopper Sparrow	60.3	286.2	271.4	165.8	346.3	225.9	331.4	282.4
Song Sparrow	2.0	2.0	2.0	2.0	-	-	2.0	-
Red-winged Blackbird	32.6	75.3	66.6	20.9	66.9	50.2	43.9	75.3
Eastern Meadowlark	45.8	81.6	92.6	49.0	78.3	78.3	65.3	70.7
Common Grackle	-	-	2.0	-	6.0	-	6.0	-
Brown-headed Cowbird	2.0	12.0	6.0	12.0	6.0	10.0	-	26.0
American Goldfinch	-	-	-	-	12.0	-	14.0	-
Number of birds per 40 ha	186.3	514.3	515.8	287.7	571.1	389.4	500.2	504.4
Number of species	11	15	18	11	17	12	15	13
H'	2.580	2.143	2.277	2.067	2.159	1.870	1.809	2.082

Table 8

Transect 7 Data Summary

Species	Date Censused 5/27	6/5	6/17	6/22	7/3	7/8	7/17	7/20
	Avian Density (Number of birds/40 ha)							
Great Blue Heron	-	-	-	.67	2.0	.67	-	1.2
Great Egret	-	-	.67	-	.67	-	1.2	-
Green-backed Heron	-	-	-	-	-	-	.67	-
Canada Goose	55.0	-	-	10.1	-	6.0	8.0	-
Mallard	3.3	-	1.3	2.1	-	-	2.7	1.2
Blue-winged Teal	-	-	-	1.2	-	-	-	-
Turkey Vulture	-	-	-	-	-	1.2	-	-
Red-tailed Hawk	-	-	-	.67	-	-	-	.67
Bobwhite Quail	4.0	4.2	5.2	6.8	-	-	4.0	-
Ring-necked Pheasant	-	.9	2.3	-	3.6	1.2	3.6	-
Killdeer	6.0	8.4	6.0	4.7	6.1	7.4	6.7	6.7
Greater Yellowlegs	-	-	-	-	-	-	.67	-
Spotted Sandpiper	-	-	-	-	-	.67	-	-
Pectoral Sandpiper	-	-	-	-	-	-	12.7	-
Mourning Dove	-	.5	-	1.2	1.2	-	4.7	-
Great-crested Flycatcher	-	-	-	-	-	-	.67	-
Eastern Kingbird	1.2	-	2.7	-	-	1.2	.67	2.0
American Crow	-	-	-	-	3.4	-	-	-
American Robin	1.2	.5	-	1.3	-	-	.67	-
Gray Catbird	-	.5	-	-	-	-	-	-
Dickcissel	-	8.4	6.0	3.5	-	6.0	5.1	6.0
Field Sparrow	.67	.5	-	-	-	-	1.2	-
Song Sparrow	-	4.2	1.3	-	-	2.7	.67	-
Red-winged Blackbird	80.9	48.1	60.7	60.0	50.1	67.3	56.8	64.5
Eastern Meadowlark	41.7	32.6	34.8	27.3	29.1	52.9	43.8	36.9
Western Meadowlark	-	12.1	3.6	-	-	3.6	-	2.2
Common Grackle	.67	3.3	3.3	2.1	-	4.0	-	2.0
Brown-headed Cowbird	-	2.5	2.7	-	-	8.7	-	5.4
Orchard Oriole	.67	-	-	-	1.2	-	-	-
Northern Oriole	.67	-	-	.67	-	-	-	-
American Goldfinch	1.2	-	.67	-	-	3.4	-	-
Number of birds per 40 ha	197.2	126.8	131.2	124.2	97.4	167.1	154.5	128.8
Number of species	13	14	14	14	9	15	18	11
H'	2.127	2.629	2.430	2.460	1.932	2.503	2.753	2.090

Table 9

Transect 8 Data Summary

Species	Date Censused 5/27	6/5	6/17	6/22	7/8	7/11	7/17	7/20
	Avian Density (Number of birds/40 ha)							
Great Blue Heron	-	-	-	1.1	2.3	-	1.1	2.3
Great Egret	1.1	-	-	1.1	-	1.1	-	1.1
Green-backed Heron	-	2.2	-	-	1.1	-	-	-
Canada Goose	13.0	-	6.8	-	-	-	6.8	-
Mallard	-	-	-	2.3	-	-	2.3	-
Turkey Vulture	-	-	1.1	-	-	-	-	-
Red-tailed Hawk	1.1	1.1	-	1.1	-	-	1.1	-
Bobwhite Quail	6.8	2.2	2.2	-	6.8	4.4	-	4.4
Ring-necked Pheasant	-	2.0	2.0	-	4.1	-	2.0	-
Killdeer	4.6	-	4.6	2.3	3.4	4.6	2.3	3.4
Spotted Sandpiper	-	-	-	-	-	-	2.3	-
Least Sandpiper	-	-	-	-	-	-	1.1	
Mourning Dove	3.4	2.2	4.6	-	5.7	5.7	-	2.2
Belted Kingfisher	-	-	-	-	-	-	1.1	-
Red-headed Woodpecker	-	-	-	-	-	-	1.1	
Eastern Kingbird	4.6	2.2	5.7	2.3	6.8	4.6	3.4	3.4
American Crow	2.3	1.1	-	3.4	-	3.4	-	-
Common Yellowthroat	-	-	-	-	-	-	3.4	-
Northern Cardinal	1.1	-	-	2.3	-	-	-	-
Indigo Bunting	-	1.1	-	-	-	-	1.1	-
Dickcissel	16.2	30.1	15.5	10.2	22.2	15.5	18.8	10.2
Grasshopper Sparrow	-	13.0	51.5	25.7	42.8	17.1	20.7	17.1
Song Sparrow	-	-	-	-	1.1	-	-	-
Red-winged Blackbird	112.0	49.3	59.6	57.3	83.5	64.4	52.5	100.5
Eastern Meadowlark	26.1	18.7	33.5	27.9	34.2	34.8	32.6	23.7
Brewer's Blackbird	1.1	-	-	-	2.3	-	-	3.4
Common Grackle	2.3	2.2	4.6	-	1.1	-	2.3	-
Brown-headed Cowbird	-	-	-	-	-	3.4	-	-
Northern Oriole	2.3	1.1	1.1	-	-	1.1	-	-
American Goldfinch	2.3	3.4	3.4	-	3.4	-	-	-
Number of birds per 40 ha	200.3	132.7	196.2	137.0	220.8	160.1	156.0	171.7
Number of species	16	15	14	12	15	12	18	11
H'	2.378	2.689	2.774	2.421	2.729	2.621	2.935	2.102

Table 10

Avian density (number of birds/40 ha), number of species, and H' (Shannon-Weiner Diversity Index) values per transect.

	Transect 1	2	3	4	5	6	7	8
Density								
Range	190.8 -297.1	193.5 -372.7	362.5 -473.6	59.4 -743.0	355.0 -618.5	186.3 -571.1	97.4 -197.2	132.7 -220.8
Mean	254.2	296.2	391.8	560.5	475.7	433.7	140.9	171.9
SD	34.2	73.3	35.6	225.2	98.5	134.2	30.8	31.5
Number of Species								
Range	14-25	8-13	16-25	6-24	9-11	11-18	9-18	11-18
Mean	20.4	11.6	20.3	18.8	9.5	14.0	13.5	14.1
SD	3.7	1.6	2.8	5.8	1.1	2.7	2.7	2.4
H'								
Range	2.156 -2.820	2.190 -2.964	2.683 -3.060	1.750 -2.601	2.071 -2.897	1.809 -2.580	1.932 -2.753	2.102 -2.935
Mean	2.513	2.621	2.908	2.100	2.391	2.123	2.366	2.581
SD	.2324	.2781	.1099	.2820	.2519	.2395	.2859	.2657

Table 11

Transect 1 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
American Bittern	1	.05	24	.5	.025	25
Great Blue Heron	9	.46	17	4	.20	18
Great Egret	11	.56	16	3.0	.15	20
Green-backed Heron	3	.15	22	1.5	.07	23
Canada Goose	78	3.9	6	36	1.8	6
Mallard	74	3.7	7	32	1.6	7
Blue-winged Teal	29	1.5	12	14.5	.71	13
Red-tailed Hawk	1	.05	24	.5	.025	25
Bobwhite Quail	46	2.3	8	29	1.4	8
Ring-necked Pheasant	11	.56	16	9.0	.44	17
Killdeer	209	10.6	4	85	4.2	4
Greater Yellowlegs	1	.05	24	.5	.025	25
Lesser Yellowlegs	2	.10	23	1.0	.05	24
Willet	1	.05	24	.5	.025	25
Spotted Sandpiper	5	2.5	20	2.5	.12	21
Upland Sandpiper	29	1.5	12	24	1.2	10
Mourning Dove	39	2.0	10	18.5	.91	12
Least Flycatcher	1.0	.05	24	.5	.025	25
Eastern Kingbird	6	.30	19	3.0	.15	20
Horned Lark	14	.71	15	12.6	.62	14
American Robin	42	2.1	9	20.5	1.0	11
Brown Thrasher	2	.10	23	1.0	.05	24
Starling	4	.20	21	2.0	.10	22
Dickcissel	38	1.9	11	27.8	1.4	9
Savannah Sparrow	22	1.1	14	11	.54	15
Grasshopper Sparrow	305	15.4	3	961.8	47.3	1
Song Sparrow	3	.15	22	1.5	.07	23
Bobolink	25	1.3	13	9.5	.47	16
Red-winged Blackbird	395	20.0	1	250.7	12.3	3
Eastern Meadowlark	340	17.2	2	372	18.3	2
Western Meadowlark	7	.35	18	3.2	.16	19
Brewer's Blackbird	5	.25	20	2.5	.12	21
Common Grackle	22	1.1	14	11	.54	15
Brown-headed Cowbird	192	9.7	5	82.5	4.1	5
Orchard Oriole	1.0	.05	24	.5	.025	25
Northern Oriole	1.0	.05	24	.5	.025	25
American Goldfinch	3	.15	22	1.5	.07	23
Totals	1977			2033.8		

Table 12

Transect 2 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
Great Blue Heron	3	.42	12	4.0	.17	16
Great Egret	3	.42	12	5.0	.21	15
Green-backed Heron	1	.14	13	2.0	.08	17
Red-tailed Hawk	1	.14	13	2.0	.08	17
Bobwhite Quail	8	1.1	10	22	.93	10
Ring-necked Pheasant	3	.42	12	10.8	.46	11
Killdeer	42	5.9	5	84.7	3.6	6
Upland Sandpiper	8	1.1	10	26	1.1	9
Rock Dove	5	.70	11	8	.34	12
Mourning Dove	19	2.6	6	34	1.4	8
Common Nighthawk	1	.14	13	2	.08	17
Least Flycatcher	1	.14	13	2	.08	17
American Robin	3	.42	12	6	.25	14
Dickcissel	132	18.4	3	594.6	25.1	1
Savannah Sparrow	15	2.1	7	54	2.3	7
Grasshopper Sparrow	13	1.8	9	154.6	6.5	5
Song Sparrow	3	.42	12	6	.25	14
Red-winged Blackbird	186	25.9	1	506.1	21.4	3
Eastern Meadowlark	113	15.8	4	549.6	23.2	2
Western Meadowlark	3	.42	12	7.8	.33	13
Brown-headed Cowbird	140	19.5	2	266.3	11.2	4
American Goldfinch	14	2.0	8	22	.93	10
Totals	717			2369.5		

Table 13

Transect 3 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
Great Blue Heron	8	.56	17	7.0	.22	19
Great Egret	4	.28	19	4	.13	21
Green-backed Heron	4	.28	19	4	.13	21
Black-crowned Night Heron	1	.07	22	1	.03	23
Canada Goose	27	1.9	10	22.5	.72	11
Mallard	38	2.6	7	35.5	1.1	10
Blue-winged Teal	15	1.0	14	15	.48	15
Sharp-shinned Hawk	1	.07	22	1	.03	23
Red-tailed Hawk	2	.14	21	2	.06	22
Bobwhite Quail	25	1.7	11	48	1.5	8
Ring-necked Pheasant	5	.35	18	10	.32	17
Killdeer	72	5.0	5	80	2.6	6
Spotted Sandpiper	22	1.5	12	12	.38	16
Upland Sandpiper	9	.62	16	16	.51	14
Mourning Dove	37	2.6	8	35.5	1.1	10
Common Nighthawk	1	.07	22	2	.06	22
Belted Kingfisher	5	.35	18	5	.16	20
Northern Flicker	2	.14	21	2	.06	22
Eastern Kingbird	19	1.3	13	19	.61	12
Black-capped Chickadee	1	.07	22	1	.03	23
American Robin	37	2.6	8	37	1.2	9
Brown Thrasher	4	.28	19	4	.13	21
European Starling	2	.14	21	2	.06	22
Rose-breasted Grosbeak	3	.21	20	2	.06	22
Dickcissel	80	5.6	4	204	6.5	5
Grasshopper Sparrow	116	8.0	3	864.8	27.6	1
Henslow's Sparrow	33	2.3	9	229.6	7.3	4
Red-winged Blackbird	554	38.4	1	794.3	25.3	2
Eastern Meadowlark	226	15.7	2	560.6	17.9	3
Common Grackle	9	.62	16	9	.29	18
Brown-headed Cowbird	61	4.2	6	69.6	2.2	7
Orchard Oriole	2	.14	21	2	.06	22
Northern Cardinal	2	.14	21	2	.06	22
American Goldfinch	13	.90	15	17.3	.55	13
Totals	1440			3123.7		

Table 14

Transect 4 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
American Bittern	3	.20	19	3	.07	23
Great Blue Heron	5	.33	17	4	.09	21
Great Egret	6	.39	16	6	.13	20
Green-backed Heron	3	.20	19	2	.04	24
Canada Goose	42	2.7	6	38	.85	9
Wood Duck	15	.98	12	15	.33	16
Mallard	16	1.0	11	16	.36	15
Red-tailed Hawk	4	.26	18	4	.09	21
Bobwhite Quail	17	1.1	10	34	.76	10
Ring-necked Pheasant	10	.65	13	16.2	.36	14
Killdeer	53	3.4	5	54.1	1.2	6
Upland Sandpiper	15	.98	12	24	.54	12
Mourning Dove	21	1.4	9	21	.47	13
Northern Flicker	6	.39	16	6	.13	20
Eastern Kingbird	6	.39	16	6	.13	20
Horned Lark	42	2.7	6	110	2.5	5
American Robin	41	2.7	7	41	.92	7
Gray Catbird	3	.20	19	3	.07	23
Brown Thrasher	6	.39	16	6	.13	20
Yellow Warbler	2	.13	20	2	.04	24
Dickcissel	27	1.8	8	40.5	.90	8
Savannah Sparrow	5	.33	17	10.8	.24	17
Grasshopper Sparrow	392	25.5	1	2724.3	60.8	1
Song Sparrow	2	.13	20	2	.04	24
Bobolink	2	.13	20	2	.04	24
Red-winged Blackbird	242	15.7	4	380.1	8.5	3
Eastern Meadowlark	245	15.9	3	499.7	11.2	2
Western Meadowlark	2	.13	20	3.6	.08	22
Brewer's Blackbird	7	.46	15	7	.16	19
Common Grackle	8	.52	14	8	.18	18
Brown-headed Cowbird	262	17.0	2	363.5	8.1	4
American Goldfinch	27	1.8	8	27	.60	11
Totals	1537.0			4479.8		

Table 15

Transect 5 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
Mallard	4	.42	12	6	.16	15
Blue-winged Teal	5	.52	11	10	.27	12
Red-tailed Hawk	3	.31	13	6	.16	15
Bobwhite Quail	2	.21	14	8	.22	13
Ring-necked Pheasant	4	.42	12	12.6	.34	11
Killdeer	10	1.0	8	20	.54	8
Spotted Sandpiper	1	.10	15	2	.05	16
Upland Sandpiper	6	.63	10	16	.43	9
Common Nighthawk	1	.10	15	2	.05	16
Horned Lark	2	.21	14	7.2	.19	14
Dickcissel	120	12.6	2	590.5	15.9	3
Savannah Sparrow	16	1.7	7	183.3	4.9	6
Grasshopper Sparrow	67	7.0	4	832.7	22.4	2
Song Sparrow	7	.73	9	14	.38	10
Bobolink	88	9.2	3	260.7	7.0	5
Red-winged Blackbird	525	55.1	1	1385.6	37.3	1
Eastern Meadowlark	66	6.9	5	299	8.1	4
Brown-headed Cowbird	28	2.9	6	56	1.5	7
Totals	953			3711.6		

Table 16

Transect 6 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
American Bittern	1	.16	18	2	.06	18
Great Blue Heron	4	.65	15	6	.17	16
Great Egret	2	.32	17	4	.12	17
Green-backed Heron	3	.49	16	6	.17	16
Wood Duck	8	1.3	11	16	.46	11
Blue-winged Teal	18	2.9	7	36	1.0	8
Red-tailed Hawk	2	.32	17	4	.12	17
Bobwhite Quail	16	2.6	8	64	1.8	5
Ring-necked Pheasant	2	.32	17	7.2	.21	15
Killdeer	20	3.2	6	40	1.2	7
Upland Sandpiper	11	1.8	10	40	1.2	7
Mourning Dove	22	3.6	5	40	1.2	7
Belted Kingfisher	3	.49	16	6	.17	16
Eastern Kingbird	7	1.1	12	14	.40	12
Horned Lark	13	2.1	9	54.6	1.6	6
American Robin	5	.81	14	10	.29	13
Brown Thrasher	4	.65	15	8	.23	14
Common Yellowthroat	1	.16	18	2	.06	18
Northern Cardinal	3	.49	16	6	.17	16
Dickcissel	6	.97	13	21	.60	10
Grasshopper Sparrow	150	24.3	1	1969.7	56.7	1
Song Sparrow	5	.81	14	10	.29	13
Red-winged Blackbird	134	21.7	2	431.7	12.4	3
Eastern Meadowlark	121	19.6	3	561.6	16.2	2
Common Grackle	7	1.1	12	14	.40	12
Brown-headed Cowbird	37	6.0	4	74	2.1	4
American Goldfinch	13	2.1	9	26	.75	9
Totals	617			3473.8		

Table 17

Transect 7 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Obs Number	% Obs	Rank	Number VWTM	% VWTM	Rank VWTM
Great Blue Heron	9	.75	14	4.5	.40	17
Great Egret	6	.50	17	2.4	.21	20
Green-backed Heron	2	.17	20	.67	.06	23
Canada Goose	91	7.5	3	79.1	7.0	3
Mallard	20	1.7	9	10.6	.94	12
Blue-winged Teal	2	.17	20	1.2	.11	22
Turkey Vulture	2	.17	20	1.2	.11	22
Red-tailed Hawk	2	.17	20	1.2	.11	22
Bobwhite Quail	26	2.2	7	24.2	2.2	6
Ring-necked Pheasant	13	1.1	11	11.6	1.0	11
Killdeer	80	6.7	4	52	4.6	4
Greater Yellowlegs	1	.08	21	.67	.06	23
Spotted Sandpiper	1	.08	21	.67	.06	23
Pectoral Sandpiper	19	1.5	10	12.7	1.1	10
Mourning Dove	13	1.1	11	7.6	.68	15
Great-crested Flycatcher	1	.08	21	.67	.06	23
Eastern Kingbird	10	.83	13	7.8	.69	14
American Crow	7	.58	16	3.4	.30	19
American Robin	6	.50	17	3.7	.33	18
Gray Catbird	2	17	20	.5	.04	24
Northern Cardinal	3	.25	19	1.9	.17	21
Dickcissel	33	2.7	5	35	3.1	5
Field Sparrow	4	.33	18	2.4	.21	20
Song Sparrow	10	.83	13	8.9	.79	13
Red-winged Blackbird	558	46.2	1	488.4	43.4	1
Eastern Meadowlark	229	19.0	2	299.1	26.6	2
Western Meadowlark	12	1.0	12	22	2.0	7
Common Grackle	24	2.0	8	15.4	1.4	9
Brown-headed Cowbird	30	2.5	6	19.3	1.7	8
Orchard Oriole	3	.25	19	1.9	.17	21
Northern Oriole	2	.17	20	1.2	.11	22
American Goldfinch	8	.67	15	5.3	.47	16
Totals	1208			1125.3		

Table 18

Transect 8 detections, percent of total detections, and ranking for each species (Obs=Observed, VWTM=Variable Width Transect Method)

Species	Actual Number	% Actual	Rank	Number VWTM	% VWTM	Rank VWTM
Great Blue Heron	6	.83	12	6.8	.49	13
Great Egret	4	.56	14	4.4	.32	16
Green-backed Heron	3	.41	15	3.3	.24	18
Canada Goose	25	3.4	6	26.6	1.9	7
Mallard	6	.83	12	4.6	33	15
Turkey Vulture	1	.14	17	1.1	.08	21
Red-tailed Hawk	4	.56	14	4.4	.32	16
Bobwhite Quail	17	2.3	9	26.8	2.0	6
Ring-necked Pheasant	5	.69	13	10.1	.74	12
Killdeer	22	3.0	7	25.2	1.8	8
Spotted Sandpiper	2	.28	16	2.3	.17	19
Least Sandpiper	1	.14	17	1.1	.08	21
Mourning Dove	21	2.9	8	23.8	1.7	9
Belted Kingfisher	1	.14	17	1.1	.08	21
Red-headed Woodpecker	1	.14	17	1.1	.08	21
Eastern Kingbird	31	4.3	4	33	2.4	5
American Crow	11	1.5	11	10.2	.74	11
Common Yellowthroat	3	.41	15	3.4	.25	17
Northern Cardinal	3	.41	15	3.4	.25	17
Indigo Bunting	2	.28	16	2.2	.16	20
Dickcissel	62	8.5	3	138.7	10.1	4
Grasshopper Sparrow	26	3.6	5	187.9	13.7	3
Song Sparrow	1	.14	17	1.1	.08	21
Red-winged Blackbird	314	43.3	1	579.1	42.1	1
Eastern Meadowlark	116	16.0	2	231.5	16.8	2
Rusty Blackbird	6	.83	12	6.8	.49	13
Common Grackle	14	1.9	10	12.5	.91	10
Brown-headed Cowbird	3	.41	15	3.4	.25	17
Northern Oriole	5	.69	13	5.6	.41	14
American Goldfinch	11	1.5	11	12.5	.91	10
Totals	726			1374.0		

Table 19

Summary of summer census detections, percent of total detections, and rankings by observed detections and by VWTM.

(Obs=Observed, VWTM=Variable Width Transect Method, M=Migrant, PR=Permanent Resident, SR=Summer Resident, V=Visitor, W=Winter Resident, E= Endangered, T=Threatened)

Avian Species	Obs Number	% Obs	Rank Obs	Number VWTM	% VWTM	Rank VWTM
American Bittern(SR,E)	5	.05	33	5.5	.03	37
Great Blue Heron(V)	44	.48	20	36.3	.17	24
Great Egret(V,E)	36	.39	21	28.8	.13	26
Green-backed Heron(SR)	19	.21	26	19.5	.09	28
Black-crowned Night Heron(V)	1	.01	37	1	.005	49
Canada Goose(SR)	263	2.9	7	202.2	.93	11
Wood Duck(SR)	23	.25	25	31	.14	25
Mallard(SR)	158	1.7	9	104.7	.48	17
Blue-winged Teal(SR)	69	.75	17	76.7	.35	20
Turkey Vulture(V)	3	.03	35	2.3	.01	44
Sharp-shinned Hawk(V)	1	.01	37	1	.005	49
Red-tailed Hawk(PR)	19	.21	26	24.1	.11	27
Common Bobwhite Quail(PR)	134	1.5	10	210	.96	10
Ring-necked Pheasant(PR)	53	.58	19	87.5	.40	18
Killdeer(SR)	508	5.5	5	441	2.0	6
Greater Yellowlegs(M)	2	.02	36	1.2	.006	47
Lesser Yellowlegs(M)	2	.02	36	1.0	.005	49
Willet(M)	1	.01	37	.5	.002	51
Spotted Sandpiper(SR)	31	.34	23	19.5	.09	28
Upland Sandpiper(SR)	78	.85	15	146	.67	14
Least Sandpiper(M)	1	.01	37	1.1	.005	48
Pectoral Sandpiper(M)	19	.21	26	12.7	.06	32
Short-billed Dowitcher(M)	1	.01	37	1	.005	49
Rock Dove(V)	5	.05	33	8	.04	34
Mourning Dove(PR)	172	1.9	8	180.4	.83	13
Common Nighthawk(V)	3	.03	35	6	.03	36
Belted Kingfisher(SR)	9	.10	30	12.1	.06	33
Common Flicker(PR)	8	.09	31	8	.04	34
Red-headed Woodpecker(PR)	1	.01	37	1.1	.005	48
Least Flycatcher(SR)	3	.03	35	3.6	.02	41
Great-crested Flycatcher(SR)	1	.01	37	.67	.003	50
Eastern Kingbird(SR)	79	.86	14	82.8	.38	19
Horned Lark(PR)	71	.77	16	184.4	.85	12
American Crow(PR)	18	.20	27	13.6	.06	41
Black-capped Chickadee(PR)	1	.01	37	1	.005	49

Table 19 (continued)

Avian Species	Obs Number	% Obs	Rank Obs	Number VWTM	% VWTM	Rank VWTM
American Robin(SR)	134	1.5	10	131.5	.60	15
Gray Catbird(SR)	5	.05	33	3.5	.02	42
Brown Thrasher(SR)	16	.17	28	19	.09	29
European Starling(PR)	6	.07	32	4	.02	40
Yellow Warbler(M)	2	.02	36	2	.01	46
Common Yellowthroat(SR)	4	.04	34	5.4	.02	38
Northern Cardinal(PR)	11	.12	29	13.3	.06	31
Rose-breasted Grosbeak(SR)	3	.03	35	2	.01	46
Indigo Bunting(SR)	2	.02	36	2.2	.01	45
Dickcissel(SR)	498	5.4	6	1652.1	7.6	4
Field Sparrow(PR)	4	.04	34	2.4	.01	43
Savannah Sparrow(SR)	58	.63	18	259.1	1.2	8
Grasshopper Sparrow(SR)	1069	11.6	3	7795.8	35.8	1
Henslow's Sparrow(SR)	33	.36	22	229.6	1.1	9
Song Sparrow(PR)	31	.34	23	43.5	.20	22
Bobolink(SR)	115	1.3	11	272.2	1.3	7
Red-winged Blackbird(PR)	2908	31.7	1	4816	22.1	2
Eastern Meadowlark(PR)	1456	15.9	2	3373.1	15.5	3
Western Meadowlark(PR)	24	.26	24	36.6	.17	23
Brewer's Blackbird(PR)	18	.20	27	16.6	.08	30
Common Grackle(PR)	84	.92	13	69.9	.32	21
Brown-headed Cowbird(PR)	753	8.2	4	934.6	4.3	5
Orchard Oriole(SR)	6	.07	32	4.4	.02	39
Northern Oriole(SR)	8	.09	31	7.3	.03	35
American Goldfinch(PR)	89	.97	12	111.6	.51	16
Totals	9179			21,764		

(*=Endangered or Threatened Species)

Table 20

Transect 1
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	20.0	1	12.3	3
Eastern Meadowlark	17.2	2	18.3	2
Grasshopper Sparrow	15.4	3	47.3	1
Killdeer	10.6	4	4.2	4
Brown-headed Cowbird	9.7	5		
Canada Goose	3.9	6		
Mallard	3.7	7		
Total %	80.5		82.1	

Table 21

Transect 2
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	25.9	1	21.4	3
Eastern Meadowlark	15.8	4	23.2	2
Dickcissel	18.4	3	25.1	1
Brown-headed Cowbird	19.5	2	11.2	4
Total %	79.6		80.9	

Table 22

Transect 3
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	38.4	1	25.3	2
Eastern Meadowlark	15.7	2	17.9	3
Grasshopper Sparrow	8.0	3	27.6	1
Henslow's Sparrow	2.3	9	7.3	4
Dickcissel	5.6	4	6.5	5
Killdeer	5.0	5		
Brown-headed Cowbird	4.2	6		
Total %	79.2		84.6	

Table 23

Transect 4
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	15.7	4	8.5	3
Eastern Meadowlark	15.9	3	11.2	2
Grasshopper Sparrow	25.5	1	60.8	1
Brown-headed Cowbird	17.0	2		
Killdeer	3.4	5		
Canada Goose	2.7	6		
Total %	80.2		80.5	

Table 24

Transect 5
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	55.1	1	37.3	1
Eastern Meadowlark	6.9	5	8.1	4
Grasshopper Sparrow			22.4	2
Dickcissel	12.6	2	15.9	3
Bobolink	9.2	3		
Total %	83.8		83.7	

Table 25
Transect 6
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	21.7	2	12.4	3
Eastern Meadowlark	19.6	3	16.2	2
Grasshopper Sparrow	24.3	1	56.7	1
Brown-headed Cowbird	6.0	4		
Mourning Dove	3.6	5		
Killdeer	3.2	6		
Blue-winged Teal	2.9	7		
Total %	81.3		85.3	

Table 26

Transect 7
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	46.2	1	43.4	1
Eastern Meadowlark	19.0	2	26.6	2
Canada Goose	7.5	3	7.0	3
Killdeer	6.7	4	4.6	4
Total %	79.4		81.6	

Table 27

Transect 8
Species comprising 80% of community population

Species	Observed %	Observed Rank	VWTM %	VWTM Rank
Red-winged Blackbird	43.3	1	42.1	1
Eastern Meadowlark	16.0	2	16.8	2
Grasshopper Sparrow	3.6	5	13.7	3
Dickcissel	8.5	3	10.1	4
Eastern Kingbird	4.3	4		
Canada Goose	3.4	6		
Total %	79.1		82.7	

Discussion of Results

The reclaimed surface-mined areas studied have characteristics of both grasslands and wetlands. The composition of the avian communities present on the study areas reflect this mixture of grassland and wetland.

Temperate grasslands occur in regions where the average annual temperature is 6-16 degrees Celcius, and the average annual rainfall between 40-80 centimeters (Cody, 1985). In Central Illinois, the mean annual rainfall is 93.3 centimeters (Bohlen, 1989), a value intermediate between the rainfall requirements of prairies and forests. This is one historical reason why the prairie and forest met in Illinois. Today the tallgrass prairies of pre-settlement times have been replaced by substitute grasslands in the form of hayfields, pastures, fish and wildlife areas, and recreation areas.

According to Graul (1988), the general features of grassland avian communities are 1) low species diversity, 2) numerical dominance by one or two species, and 3) the presence of a few other species with few individuals. Cody (1985) also cites low avian diversity and density in grassland birds when compared to other habitats, such as wetlands.

Dudek (1988) reviews the many definitions of wetlands, with the conclusion that a wetland is an area covered with water during at least some portion of the year, and having vegetation either around or in the water, or both. Wetlands support a diverse avifauna and are considered the

most productive wildlife habitat of all land forms, with the primary productivity of wetlands surpassing all other ecosystems (Dudek,1988). The wetlands of Illinois have been reduced to less than 0.5% of their pre-settlement acreage (Dudek,1988).

The reclaimed strip-mined areas studied are combinations of both grassland and wetland ecosytems. Karr (1968) notes that reclaimed strip-mined areas have greater avian diversity than areas with similar vegetation, and attributes this to the presence of water and to the ridge and valley topography. The combination of grassland and wetland in these areas is similar to the pre-settlement prairies in Illinois which were vast expanses of prairies with frequent low lying wetlands and marshes.

The results of the avian censuses for each transect are discussed below in terms of the most common species, avian population densities, species richness (number of species detected), and Shannon-Weiner diversity index (H').

Ten Most Common Species

Table 19 lists the ten most common species for the summer census period using both observed and VWTM detections. Tables 11-18 list these values for each transect.

The ten most common observed species in decreasing order are: 1) Red-winged Blackbird (31.7%), 2) Eastern Meadowlark (15.9%), 3) Grasshopper Sparrow (11.6%), 4) Brown-headed Cowbird (8.2%), 5) Killdeer (5.5%), 6) Dickcissel (5.4%), 7) Canada Goose (2.9%), 8) Mourning Dove (1.9%), 9) Mallard (1.7%), and 10) Robin (1.5%). Of the top ten most common species observed, four species - Red-winged Blackbird, Eastern Meadowlark, Grasshopper Sparrow, Dickcissel - are closely associated with grasslands, and three species - Killdeer, Canada Goose, Mallard - are closely associated with wetlands.

The ten most common species using the VWTM in decreasing order are: 1) Grasshopper Sparrow (35.8%), 2) Red-winged Blackbird (22.1%), 3) Eastern Meadowlark (15.5%), 4) Dickcissel (7.6%), 5) Brown-headed Cowbird (4.3%), 6) Killdeer (2.0%), 7) Bobolink (1.3%), 8) Savannah Sparrow (1.2%), 9) Henslow's Sparrow (1.1%), and 10) Bobwhite Quail (0.96%). The VWTM's ten most common species consisted of eight species - all but Brown-headed Cowbird and Killdeer - associated with grasslands, one species - Killdeer - associated with wetlands, and one cosmopolitan species - Brown-headed Cowbird. The VWTM increased the numbers of most grassland species that may have been underestimated using spot mapping techniques.

Avian Population Density

The avian population density (Observed and VWTM) per transect was measured as the number of individual birds per 40 hectares (100 acres). This method and the number of pairs of birds per 40 hectares are the most common methods for reporting density values (International Bird Census Committee, 1970). I report the number of individuals in order to include the non-mated or migratory birds at the census site since they also play important roles in the avian community.

The Canton area transects had higher density values than the Banner Marsh transects. At Banner Marsh the Red-winged Blackbird and Eastern Meadowlark comprised 58.9% and 70.0% of the avian communities (Tables 26 and 27), with neither species being extremely dense. On the Canton area transects, both species comprised from 19.7% (Transect 4) to 45.4% (Transect 5). The Grasshopper Sparrow had very high density values on the Canton transects, accounted for a significant proportion of the avian communities (6.5% on Transect 2 to 60.8% on Transect 4), and was an important reason for the higher density values on the Canton transects.

Species Richness

One measure of a community is it's species richness or the number of species it contains. Classic ecological theory predicts a heterogeneous habitat will have more species than a homogeneous habitat (Smith, 1980). My results are

consistent with this theory. Transects 2, 5, 7, and 8 were the most homogeneous in vegetation and had the lowest mean species richness values (Table 10). The more heterogeneous transects, 1 and especially 3, had the highest species richness values.

In order to increase the number of species an area will support requires increasing the heterogeneity of the vegetation on that area, which is an important consideration in managing grasslands. For grassland areas, a good approach to increase heterogeneity is to establish native prairie grasses and forbs, which is a more heterogeneous habitat than the present cool season grass dominated vegetation. For wetland areas, the establishment of native wetland vegetation species in and around the bodies of water would help increase the heterogeneity.

Shannon-Weiner Diversity Index Values

The Shannon-Weiner diversity index (H') measures species diversity by taking into account both species richness and species heterogeneity (Smith, 1980). A community with a few species having numerous individuals per species will have a lower diversity value than a community with more species and fewer individuals per species. Ecological theory predicts that a community with a heterogeneous habitat vegetation and structure will have more niches, and therefore more more species (Smith, 1980), since the species composition of a

community has been related to habitat productivity and resource density while the number of species has been related to the structure of the vegetation (Cody, 1981). In grassland communities, the tall grasslands usually have more species and are more diverse than short grasslands (Cody, 1985).

My results agree with these theories. Transect 3, which had the tallest and most heterogeneous vegetation, had the highest diversity value (2.908), and a high species richness. Transects 4 and 6 had the lowest vegetation from heavy grazing, and were more homogeneous, and had the lowest H' value (2.100 and 2.123). Transects 2, 5, and 8 had tall homogeneous vegetation, which accounted for the higher diversity than transects 4 and 6, and lower species richness than transect 3. Transect 1 and Transect 7 had tall vegetation of about the same height, but Transect 1 was more heterogeneous, and it had a higher H' and a larger species richness.

In summary, my results showed that heterogeneous tall vegetation transects supported more avian species and had greater species diversity than transects with short homogeneous vegetation.

Accounts of Each Species Detected

Only the most important and pertinant information is presented in the species' accounts. The actual quantitative data (numbers detected on each transect, etc.) are presented in the tables.

Listed here is the common name, scientific name, and any important information about the species.

The species name and the order in which they appear are from Bohlen (1989), which is the order used in the sixth edition of the American Ornithologists' Union Check-list of North American Birds (1983).

VWTM=Variable Width Transect Method

Pied-billed Grebe (Podilymbus podiceps) Migrant

Only one sighting was made of this Illinois Endangered Species. This occurred on 10/11/89 on transect 7 at Banner Marsh. The individual was detected on the large lake to the south of the transect starting point (south of the parking lot). This individual was felt to be a migrant, but could have been a resident of other areas at Banner Marsh as Birkenholz (1983) describes this species as an uncommon resident of Banner Marsh.

American Bittern (Botaurus lentiginosus) Summer Resident

This Illinois Endangered Species was detected frequently on transects 1,4, and 6. On 4/15/89 two American Bitterns were observed on transect 4 hunting frogs. When the bitterns became aware of my presence, they froze in place for several minutes and then flew off a short distance. A search of the area revealed a dead bullfrog, and a leopard frog which was still alive. Bohlen (1989) lists this species as a rare summer resident, and the transects near Canton seem to be an important area for this species, as well as Banner Marsh where the it is known to nest (Birkenholz, 1983).

Bowles et al. (1980) list management recommendations for this species as preservation of large tracts of prairie wetlands and marshes, as well as protection from human disturbance. My recommendations for this species include dedication of the Nature Conservancy lands as grasslands/ wetlands. The re-establishment of native vegetation in and around the many bodies of water would help the breeding biology of this species since it breeds in emergent vegetation, and nests in dry ground above water or mud in tall emergent vegetation (Ehrlich, et al., 1988). The emergent native vegetation would also increase the supply of aquatic invertebrates and vertebrates that the Bitterns rely on for their major food supply.

Great Blue Heron (Ardea herodias) Common Visitor

Great Blue Herons were detected on all transects but number five. The great blue herons, great egrets, and black-crowned night herons detected were all thought to have come from the Clear Lake Heronry along the Illinois River in Mason County. Bjorklund (unpublished data) observed a large increase in the number of nests at this heronry during the study period. The increase in numbers may have caused intense local competition for food near the heronry, making the wetlands at Banner Marsh and even near Canton important foraging areas for these species in times of intense population pressures, and decreased rainfall (1989 was the third in a series of three rain deficient years).

Great Egret (Casmerodius albus) Common Visitor

This Illinois endangered species was detected at all transects except number five. (See comments under the Great Blue Heron for more information.)

Green-backed Heron (Butorides striatus) Summer Resident

This heron was detected at all transects except number five. The wooded lake on the north end of transects four and six was a possible nesting area for this species.

Black-crowned Night Heron (Nycticorax nycticorax) Visitor

This species was detected only on transect 3, and was the least frequent heron or egret detected during the study. (See comments under Great Blue Heron for more information.)

White-fronted Goose (Anser albifrons) Migrant

Three White-fronted Geese were observed at Banner Marsh on 4/16/89 at the south end of transect 7 near the Illinois River.

Canada Goose (Branta canadensis) Summer Resident

The giant Canada Goose used the two study areas as both migration stops and nesting areas. Several sightings were made of adult geese with goslings at both areas. This species was the seventh most common species actually detected, but the eleventh most common species using the VWTM.

Wood Duck (Aix sponsa) Summer Resident

This species was detected at the lake on the north edge of transects 4 and 6. A brood of at least six ducklings was detected numerous times on this lake.

Green-winged Teal (Anas crecca) Migrant

Four Green-winged Teal were detected 10/11/89 on the transects near Canton.

American Black Duck (Anas rubripes) Migrant

This species was observed 10/2/89 on transect 1.

Mallard (Anas platyrhynchos) Summer Resident

The Mallard was the most common duck species detected, and was a common migrant and summer resident. Mallards were observed on all transects except 2 and 6. This species was the ninth most common species actually detected, but the seventeenth most common species using the VWTM.

Blue-winged Teal (Anas discors) Summer Resident

The Blue-winged Teal was the second most common duck species. It was frequently detected on the very common small potholes located on the transects. Several broods were noted, and one nest was located on transect 2.

Ring-necked Duck (Aythya collaris) Migrant

This species was observed 3/13/89 on transect 1.

Lesser Scaup (Aythya affinis) Migrant

Lesser scaups were observed 4/5, 4/15, and 5/15/89 on the Canton area transects.

Common Goldeneye (Bucephala clangula) Migrant

Detected 3/13 and 4/5/89 on the Canton area transects.

Bufflehead (Bucephals albeola) Migrant

Observed 4/15/89 on the Canton area transects.

Common Merganser (Mergus merganser) Migrant

Detected 4/15/89 on the Canton area transects.

Turkey Vulture (Cathartes aura) Visitor

Turkey Vultures were detected at both Banner Marsh transects during the summer, and also on 4/16/89. The vultures were all detected riding the thermals just above the western bluff of the Illinois River. The vultures were observed in all cases to ride the thermals in a North to South direction, but were not observed stopping at any of the transects. Bjorklund (unpublished data) has observed this species frequently at the Clear Lake Heron Colony.

Bald Eagle (Haliaeetus leucocephalus) Visitor

The Bald Eagle, a National and Illinois Endangered Species, was detected at Banner Marsh during the Winter months. The species was frequently observed flying over the Illinois River and in the trees bordering the river. Several times, individuals were observed flying further inland at Banner Marsh, but no hunting or feeding activity was noted on the transects.

Northern Harrier (Circus cyaneus) Winter Resident

The combination of grassland and wetland habitats on these reclaimed strip mine lands appear to be ideal winter habitat for this Illinois Endangered Species. The Marsh Hawk was detected on all transects except 2 and 8 on 3/4, 10/2, and 10/11/89. On 10/11/89 seven Harriers were observed chasing each other and hunting over transect 5 for several hours. Bohlen (1989) notes the low population levels of this species are due to the destruction of marsh and prairie habitats, and Bowles et al. (1980) state that preservation of large areas of habitat are essential for this species. Therefore, these large grassland/ wetland tracts could represent critical wintering habitat and migration stops for the Northern Harrier. In addition, these sites may be large enough to attract a small summer breeding population.

Sharp-shinned Hawk (Accipiter striatus) Visitor

One Sharp-shinned hawk flew less than 20 feet over my head on 6/2/89 at transect 3. The hawk flew from the West to the East and disappeared in the woody area just to the North of Canton.

Red-tailed Hawk (Buteo jamaicensis) Permanent Resident

The Red-tailed Hawk was the most common hawk species, being detected on all transects during all seasons. Early in the spring, two adult Red-tails were observed in a nest at the top of several pine trees located along the road to the north of transects 4 and 6. However, no immature hawks were ever observed at this location.

Rough-legged Hawk (Buteo lagopus) Winter Resident

This species was frequently detected during the winter months on transect 1, and on both Banner Marsh transects. On several occasions, the Rough-legged Hawks were observed along the Illinois River, perched in the same trees that Eagles were occupying.

American Kestral (Falco sparverius) Permanent Resident

This small falcon was detected along the highway to the west of transect 8, and several others were observed at Banner Marsh during the study period.

Northern Bobwhite Quail (Colinus virginianus) Permanent Resident

This game species was detected on all transects, during all seasons. The Bobwhite was the tenth most common species actually detected and by using the VWTM.

Ring-necked Pheasant (Phasianus colchicus) Permanent Resident

This species was common to all transects, but not as numerous as the Northern Bobwhite.

American Coot (Fulica americana) Migrant or Visitor

This species was detected once on transect 4 on 4/15/89. Birkenholz (1983) lists the Coot as an uncommon resident of Banner Marsh, therefore, this species might be found in the areas near the study sites.

Killdeer (Charadrius vociferus) Summer Resident

The Killdeer was detected on all transects, and was the fifth most common species actually detected and the sixth most common species using the VWTM. The old haul roads, the dried lake beds, and the shorelines were the habitats occupied by this species.

Greater Yellowlegs (Tringa melanoleuca) Migrant

This species was detected on transects 1, 4, and 7. The amount of exposed shorelines on the numerous lakes could be important feeding and resting habitat for migrating shorebirds.

Lesser Yellowlegs (Tringa flavipes) Migrant

This species was detected on transect 1.

Willet (Catoptrophorus semipalmatus) Migrant

This species was observed on transect 1.

Spotted Sandpiper (Actitis macularia) Summer Resident

The Spotted Sandpiper was the second most common sandpiper detected. This species preferred the smaller potholes and lakes, and was often found in conjunction with the Blue-winged Teal.

Upland Sandpiper (Bartramia longicauda) Summer Resident

The Upland Sandpiper, an Illinois Endangered Species, was detected on all transects except those at Banner Marsh, and was the number one shorebird species observed. The Upland Sandpiper probably only nested on the grazed transects 1, 4, and 6, while using the other transects (2, 3, and 5) as foraging areas. This species was easy to detect due to its loud song which could be heard in excess of a half mile on a windless day, and to it's distinctive behavior of flying over the observer and "chaterring" if approached. The species was also very visible when perched on a wooden fencepost.

While no nest searches were carried out in order not to disturb the birds, I am confident that this species was nesting on transects 1, 4, and 6, and probably on other nearby areas. Heim (1987) also detected this species during 1987 and thought it possible that the Upland Sandpiper nested on

the Canton area transects. Based on the repeated sightings of adult Upland Sandpipers in certain locations (map 11), transect 1 was felt to have three nesting pairs. There were at least two more pairs to the west of transect 2. Four pairs were on transects 4 and 6, and at least three more pairs to the south and west of transect 5. This is a minimum of 12 pairs in the immediate vicinity of the transects, and there were probably other pairs located on areas close to the study area based on conversations with residents who live near the area. Even though the nests were not confirmed, I feel this area is an important nesting area for this endangered species, and more research needs to be conducted to confirm this.

The Upland Sandpiper was also detected in 1990. On 6/28/90, 9 detections were made on the Canton area transects. Four adults (two pairs) were observed for a length of time on transect 4 near the NE corner by the fence. They repeatedly flew over and around me when I approached this area. While viewing these four, another one was heard to the south and almost simultaneously, another was heard to the west. Earlier in the day, one was heard on transect 1 near the NW corner where it was observed in 1989.

The most important factors in determining a nesting site for Upland Sandpipers appear to be the height and structure of the vegetation, and not the species composition of the vegetation (Mitchell, 1967; Buhnerkempe and Westemeier, 1988;

Dorio and Grewe, 1979; Kirsch and Higgins, 1976). Buhnerkempe and Westemeier (1988) report that nest selection is made for mixed grasses and forbs, with decreased selection for fields dominated by one plant species. They selectively nest in cover of mixed weedy forbs and grasses ranging 15-35 cm high, and do not use monotypic cover over 60 cm. Westemeier (1989) reports that freedom of vision and movement, plus insect abundance are important attributes of sandpiper nesting habitats. My observations are consistent with this information.

The Upland Sandpipers were observed in short vegetation, with small dried up potholes (with very short grasses) being close by in all instances of repeated sightings except one. The sandpipers were observed frequently flying to these dried lakes and foraging for insects. The exposed shorelines and dried lakes were due to the lowered watertable resulting from the less than normal rainfall the area has received in the past few years. Thus the drought may have positive influences on habitats for this species and other shorebird species.

The Upland Sandpipers in transects 1, 4, and 6 were also observed near a fenceline that contained wooden fenceposts the majority of the time; and in only a few instances were they detected away from a fenceline. The presence of a singing or display perch appears to be an important habitat characteristic which could be improved by the addition of additional fenceposts, trees, etc., away from the fencelines to increase the population densities.

This species appears to use the shorter vegetation for nesting areas, as it was the grazed transects that had the clusters of sightings. The non-grazed transects (2,3,5) had detections but not in clusters. The sandpipers appeared to use these areas as foraging areas. Several detections of Upland Sandpipers were also made in the soybean field to the north of transect 5. Heim (1987) also concluded that the grazed areas were the most attractive habitat for this species.

Upland Sandpiper Management Recommendations

The preservation and management of existing habitat is critical for the Upland Sandpiper (Bowles, et.al., 1980). The Canton area transects appear to represent critical habitat for this Illinois Endangered Species. The Canton area transects as well as the Banner Marsh transects could be better managed to provide more habitat for this species. Management strategies could include revegetating the reclaimed strip mine land with native warm season forbs and grasses characteristic of the prairie before settlement. Certain areas could be kept short by cutting or burning, or keeping the lake beds dry. Fenceposts or trees should be established in the areas away from the current fencelines. In areas to be grazed, the cow/acre ratio could be kept high enough to keep the vegetation short, or areas could be cut to keep the vegetation short. One danger of this is the short vegetation would not be very effective at preventing

erosion on the gently sloping hills, and this is already a big problem that needs to be addressed at the Canton area transects. Finally, pesticides should not be used on areas close to study areas to ensure an adequate and unpoisoned supply of insects.

Least Sandpiper (Calidris minutilla) Migrant

This species was detected on transects 3 and 8.

Pectoral Sandpiper (Calidris melanotos) Migrant

This species was observed on transect 7.

Short-billed Dowitcher (Limnodromus griseus) Migrant

The Short-billed Dowitcher was detected on transect 3.

Ring-billed Gull (Larus delawarensis) Visitor

This species was observed on transects 1 and 4. The gulls probably wandered over from the Illinois River where they are common.

Rock Dove (Columba livia) Visitor

These doves were detected on transects 2 and 4, coming either from the buildings to the north or from the city of Canton.

Mourning Dove (Zenaida macroura) Permanent Resident

The Mourning Dove was a common species on all transects except 5, being the eigth most common species actually detected and the thirteenth most common species using the VWTM. The doves were especially numerous on transect 2 after the grain ripened and hundreds of them were observed feeding at a time.

Short-eared Owl (Asio flammeus) Winter Resident

The Short-eared Owl, an Illinois Endangered Species, was detected on transects 1, 4, 5, and 6 on 4/15, 5/15/89, and 1/19/90. This area may represent important winter habitat for this species and the Northern Harrier, as they are known to co-exist in the same habitat at the same time (Bohlen, 1989). Several daylight detections were made of this species while it was hunting and while on the ground.

Common Nighthawk (Chordeiles minor) Visitor

The Nighthawk was an uncommon sighting on transects 2, 3, and 5, but may be more common because no late evening or night surveys were conducted.

Belted Kingfisher (Ceryle alcyon) Summer Resident

The Belted Kingfisher was detected on transects 1, 3, 6, and 8 on a lake with trees in it or near it.

Red-headed Woodpecker (Melanerpes erythrocephaplus) Permanent Resident

This species was observed on transect 8 as it flew from the heavily wooded slopes to the west of the highway.

Northern Flicker (Colaptes auratus) Permanent Resident

This species was the most common woodpecker species detected, being found on transects 3, 4, and 7. It appears to favor early successional habitats, spending a great deal of time on the ground looking for ants and other insects (Bohlen, 1989).

Least Flycatcher (Empidonax minimus) Summer Resident

This species was detected on transects 1 and 2 in small groves of willow trees surrounding the lakes.

Great-crested Flycatcher (Myiarchus crinitus) Summer Resident

This species was observed on transect 7 in a small grove of cottonwood trees.

Eastern Kingbird (Tyrannus tyrannus) Summer Resident

This species was detected on all transects but 2 and 5. The Eastern Kingbird was found in trees that were on or near water.

Horned Lark (Eremophila alpestris) Permanent Resident

This species was detected on patches of bare, rocky ground on all transects except 5 (no bare patches of ground).

Tree Swallow (Tachycineta bicolor) Summer Resident

All swallow species were only noted as being present or absent on a transect. No attempt was made to quantify their presence. All five swallow species were detected at least once over every transect, which is not unexpected given the close proximity of the transects to one another. This species was also detected nesting in bluebird nest boxes at Banner Marsh.

Northern Rough-winged Swallow (Stelgidopteryx serripennis) Summer Resident

Detected over all transects. (See Tree Swallow account)

Bank Swallow (Riparia riparia) Summer Resident

Detected over all transects. A colony of Bank Swallows was found near the top of an extremely steep highwall to the west of transect 2. (See Tree Swallow account)

Cliff Swallow (Hirundo pyrrhonota) Summer Resident

Detected over all transects. (See Tree Swallow account)

Barn Swallow (Hirundo rustica) Summer Resident

Detected over all transects. (See Tree Swallow account)

Blue Jay (Cyanocitta cristata) Permanent Resident

This was an uncommon species, being infrequently observed on transects 1, 4, and 8. The Blue Jays were probably coming to or from more advanced successional areas adjacent to the study sites.

American Crow (Corvus brachyrhynchos) Permanent Resident

This species was uncommon on the study sites, but was detected on every transect except 2 and 3.

Black-capped Chickadee (Parus atricapillus) Permanent Resident

This species was rare on the study sites, being observed on only transects 3 and 5.

White-breasted Nuthatch (Sitta carolinensis) Permanent Resident

There was only one detection of this species on 1/17/90 at transect 7.

Eastern Bluebird (Sialia sialis) Migrant

This species was detected on 4/15 and 4/16/89 at transect 8, but is known to nest at Banner Marsh (Birkenholz, 1983).

American Robin (Turdus migratorius) Summer Resident

This was a common species, being detected on all transects except 5. The robin was the tenth most common species actually detected, and the fifteenth most common using the VWTM.

Gray Catbird (Dumetella carolinensis) Summer Resident

This species was uncommon, being detected only at transects 4 and 7.

Brown Thrasher (Toxostoma rufum) Summer Resident

This species was detected on transects 1, 3, 4, and 6.

European Starling (Sturnus vulgaris) Permanent Resident

The starling was a rare detection on transects 1, 3, 4, and 7.

Yellow Warbler (Dendroica petechia) Migrant

This warbler was observed at transects 1 and 4 on 5/15/89 and once during the summer census. This is possibly a summer resident at some of these areas, since it is known to be an uncommon summer resident at Banner Marsh (Birkenholz, 1983).

Common Yellowthroat (Geothlypis trichas) Summer Resident

This species was a rare detection on transects 6 and 8. The Common Yellowthroat is a common summer resident in the brushy areas at Banner Marsh (Birkenholz, 1983), but in the less brush areas studied it was rare.

Northern Cardinal (Cardinalis cardinalis) Permanent Resident

The cardinal was an uncommon detection on transects 1, 3, 4, 6, and 8.

Rose-breasted Grosbeak (Pheucticus ludovicianus) Summer Resident

This species was a rare observation on transect 3.

Indigo Bunting (Passerina cyanea) Summer Resident

This species was detected perched upon the power lines among the cottonwood and willow trees to the west of transect 8.

Dickcissel (Spiza americana) Summer Resident

This very common species was observed on all transects, and was the sixth most common actual detection and the fourth using the VWTM. The Dickcissel was abundant on all the grasslands, anywhere a singing perch could be found such as a tall forb, a bush, a tree, wires, or fences.

American Tree Sparrow (Spizella arborea) Winter Resident

This uncommon winter resident was detected on transect 4.

Chipping Sparrow (Spizella passerina) Migrant

This species was observed at transect 4 on 3/13/89.

Field Sparrow (Spizella pusilla) Permanent Resident

The Field Sparrow was an uncommon detection at transects 7 and 8.

Savannah Sparrow (Passerculus sandwichensis) Summer Resident

This species was a fairly common detection on transects 1, 2, 4, and 5. The calculated population density of this species, as well as that of the Grasshopper Sparrow, increased markedly using the VWTM, going from the eighteenth most common species actually detected to the eigth most common species. The density using the VWTM is probably much closer to the real value, since most of the detections were made at close range and with vocal cues.

Grasshopper Sparrow (Ammodramus savannarum) Summer Resident

The Grasshopper Sparrow was very common, being detected on all transects except 7. It went from the third most common species actually detected to the number one most common species using the VWTM. The VWTM was felt to be superior to more conventional methods of estimating densities, since most detections were made at very short ranges and by vocal cues, but the very high density values obtained (up to 482.2 individuals per 40 ha) seem to be too high.

The Grasshopper Sparrow was found to be the most abundant species on reclaimed surface mines in Northern West Virginia (Whitmore and Hall, 1978), and in Eastern Kentucky this species was found on almost any reclaimed grassland larger than two hectares (Allaire, 1978). This species seems to have benefitted from the construction of these artificial grasslands.

Henslow's Sparrow (Ammodramus henslowii) Summer Resident

This Illinois Threatened Species was only detected on transect 3. I believe the VWTM overestimated the density of this species (going from twenty-second to ninth most common species). A possible explanation for this could the Henslow's Sparrow's tendency to nest in loose colonies (Bøhlen, 1989).]Colonial nesting would violate the assumption of random distribution of birds, which would make the VWTM less effective in estimating the population density.

This species appeared to prefer the undisturbed grasslands with a mixture of forbs and grasses. I expected to detect the Henslow's Sparrow at the undisturbed grasslands at Banner Marsh, but I never detected it there nor did Birkenholz (1983). The vegetation had a lower percentage of forbs, and wasn't as dense as transect 3. The re-establishment of native warm season grasses and forbs at Banner Marsh and at the Canton transects, and allowing the vegetation to reach full height and become fairly dense, might increase the populations of this rare threatened species.

The Henslow's Sparrow was not detected on transect 3 or any transect in 1990, nor was it detected in 1987 by Heim or his party when censusing this area (Heim, 1987). This suggests that the Henslow's Sparrow is a very local breeder in this area, and with the small amount of preferred habitat currently available in these areas, it will probably remain as Bohlen (1989) lists it, a rare summer resident.

Song Sparrow (Melospiza melodia) Permanent Resident

This species was common, being detected on all transects except 3.

Swamp Sparrow (Melospiza georgiana) Permanent Resident

This species was only detected on the North end of transect 4 in the brushy bottomland marsh.

Bobolink (Dolichonyx oryzivorus) Summer Resident

This species was uncommon at transects 1 and 4, but very common with a high density on transect 5. Bobolinks were abundant on transect 5 until the hayfield was mowed sometime between 7/6 and 7/16/89, after which the Bobolinks never returned. This species was the eleventh most common actual detection and the seventh using the VWTM.

The Bobolink was observed as late as 6/28/90 on transect 5, while the field had still not been cut for hay. To ensure that the breeding birds are allowed to raise the young they have hatched, this field should not be mowed for hay until the young have left the nests since they raise only one brood (Ehrlich, et al., 1988).

Red-winged Blackbird (Agelaius phoeniceus) Permanent Resident

This very common species was detected on all transects, and was the number one species actually detected, and the number two most common species using the VWTM.

Eastern Meadowlark (Sturnella magna) Permanent Resident

This species was detected on all transects, and was the number two most common species actually detected and the third using the VWTM.

Western Meadowlark (Sturnella neglecta) Permanent Resident

This species was uncommon, being detected only occasionally on transects 1, 2, 4, and 7.

Brewer's Blackbird (Euphagus cyanocephalus) Permanent Resident

This species was an uncommon detection on transects 1, 4, and 8.

Common Grackle (Quiscalus quiscula) Permanent Resident

This species was common on every transect except 2 and 5.

Brown-headed Cowbird (Molothrus ater) Permanent Resident

This common species was observed on all transects, and was the fourth most common species actually detected and the fifth using the VWTM. The birds were commonly seen in flocks, which is a characterisitic of this brood parasite (Bohlen, 1989).

Orchard Oriole (Icterus spurius) Summer Resident

This species was uncommon, being rarely detected on transects 1, 3, and 7.

Northern Oriole (Icterus galbola) Summer Resident

This oriole species was also uncommon, being observed on transects 1, 7, and 8.

American Goldfinch (Carduelis tristis) Permanent Resident

This species was common and detected on all transects. It was especially fond of the thistle patches when the seeds were ripe, and could be seen eating the seeds in large flocks.

Recommendations

My recommendations are divided into two sets; one set for the Nature Conservancy's land near Canton, and another for Banner Marsh State Fish and Wildlife Area. The main recommendations are common for both sites and are: 1) to set aside relatively large tracts of grasslands and/or wetlands; 2) to manage these tracts as grasslands and/or wetlands; and 3) to think in terms of ecosystems with multiple habitat uses and multiple requirements for the effective management of these tracts.

The basis (listed below) for these recommendations is simple, straightforward, and comes from the results of this and other research projects.

Grassland and wetland avian species are endangered, threatened, or severely reduced in numbers due to the destruction of the native prairies and the artificial grasslands that followed (Bohlen, 1989; Bowles, et.al., 1980; Graber and Graber, 1963). Few tracts of grassland large enough to support the larger territorial grassland and/or wetland avian species (American Bittern, Swainson's Hawk, Northern Harrier, Upland Sandpiper, Short-eared Owl, Barn Owl) exist anymore in it's native condition (Bowles, et.al., 1980).

Since no large areas exist in native pre-settlement condition, the only alternative is to restore suitable lands to the proper native conditions, if we expect to maintain viable breeding populations of these species. This study provides evidence that the reclaimed surface-mined lands near Canton and at Banner Marsh are important and perhaps critical habitat for grassland and/or wetland avian species. The most notable evidence of this is in the seven Illinois Endangered Species and one Illinois Threatened Species detected on the study areas. The most logical choices for the restoration of large tracts of grassland in Central Illinois would be the lands owned by the Nature Conservancy near Canton, and lands owned by the Illinois Department of Conservation at Banner Marsh and other nearby state parks and wildlife areas.

The reasons for the recommendations regarding Nature Conservancy lands and Banner Marsh State Fish and Wildlife Area are listed below.

Recommendations For Nature Conservancy Lands

1) Change the status of all or some of the lands owned by the Nature Conservancy from their present trade lands status to dedicated wildlife preserves, or some similar designation. The size of the set aside tracts should be as large and as contiguous as possible to avoid the island biogeographic and edge effects.

The options are a) include all lands currently owned by the Nature Conservancy near Canton; b) include only lands that have been surface-mined and reclaimed, while excluding current lands that have never been mined; c) trade the prime agricultural lands that have never been mined for surface-mined lands that are adjacent to Nature Conservancy owned lands.

I favor option "c" because it would increase the size of the set aside tracts of both grasslands and wetlands at the lowest cost, while gaining some important lands (such as those owned by the Freeman United Coal Mining Company) currently utilized by endangered and threatened avian species.

2) Manage the set aside lands as grassland and wetland ecosystems. The management strategies should take into account the specific requirements of the ecosystem, and not just one or two specific species. This would include the invertebrates, insects, amphibians, reptiles, mammals, as well as plant species. There are species within these groups of plants and animals that require large tracts of unbroken grasslands (For example, the Regal Fritillary and the Great Gray Copper butterflies were detected on 6/30/90 at Scrub Oak/Sand Prairie and

Metansas Wetland Nature Preserve respectively (Nature Conservancy butterfly monitoring workshop with Doug Taron). These butterfly species are either highly restricted to a certain type of habitat or require a large tract of it to survive and do well, and that is why these two butterfly species are so rare). Specific management suggestions are:

a) Establish tallgrass and shortgrass areas. In shortgrass areas grazing could still be allowed (to possibly include the re-establishment of Bison). A large section of tallgrass areas should be established for the benefit of species such as the Henslow's Sparrow, who are dependant on tallgrass habitats.

b) Restore the areas to their native condition by re-establishing native warm season prairie grasses and forbs on grasslands and wetlands. The native vegetation to be restored should also consider such native tree species such as Bur and Chinquapin Oaks, Hickory, Walnut, etc, which were commonly found alone or in small groves on the prairies. The re-establishment of prairie vegetation would be the best way to increase the heterogeneity of the vegetation, which would increase the species richness and diversity of the areas.

c) Establish seed plots of the native vegetation to be used in restoring the sites. This would decrease the cost of the restoration project, and ensure a steady supply of local phenotypes.

d) Work with local volunteer agencies, such as the Nature Conservancy's Central Illinois Volunteer Stewardship Network and the Native Plant Society, which are working to restore natural areas in Central Illinois. These volunteer agencies could provide resources and manpower for the restoration project.

e) Establish erosion control policies on the lands. Currently, the grazed transects 1, 4, and 6 have severe erosion problems. Possible solutions include fencing off the problem areas and planting native vegetation to control the erosion.

f) Develop a master management plan and use appropriate management techniques such as prescribed burning, brush cutting, nest box placement, etc. as necessary.

g) To increase the available habitat for Upland Sandpipers, the following recommendations are made:

i) Establish shortgrass areas for nesting by mowing, burning, or planting short grass species, to provide the appropriate height vegetation (see Upland Sandpiper species account).

ii) Provide display posts near the nesting areas by establishing wooden fence posts or similar objects.

iii) Do not use pesticides near any nesting areas.

h) For wetland species, the re-establishment of native prairie/wetland vegetation in and around the bodies of water will increase habitat heterogeneity, species richness, and species diversity. Several Illinois Threatened and Endangered Species (American Bittern, Northern Harrier, Yellow Rail, Black Rail, Short-eared Owls, plus duck and geese species) may benefit from the proper management of these areas.

Recommendations for Banner Marsh State Fish and Wildlife Area

(Also see Recommendations for Nature Conservancy Lands)

1) Portions of Banner Marsh should be dedicated as grasslands/wetlands. The dedicated areas should be as large and as contiguous as possible.

2) Manage the dedicated grassland areas and the wetlands areas as ecosystems.

3) Restore the grasslands/wetlands to their native conditions by re-establishing native warm season prairie grasses and forbs, especially since these areas will not be grazed. This objective is already mentioned on pages 27 and 31 of the Banner Marsh State Fish and Wildlife Area's Master Management Plan. If shortgrass areas are to be established, these will have to be managed by periodic cuttings, or by grazing. Not only will the non-game species benefit from the increased diversity and productivity of the vegetation, but so will the game species due to the increased supply of food and cover. Possibly an agreement could be reached with the Nature Conservancy for a joint venture, with the exchange of materials and labor.

4) Consider the re-establishment of tree species commonly found alone or in groves by the early settlers (Oaks, hickories, walnuts, etc.). This objective is also mentioned on page 31 of the Banner Marsh Master Management Plan.

5) Work with local volunteer agencies such as the Nature Conservancy's Central Illinois Volunteer Stewardship Network and the Native Plant Society. These agencies might be able to procure necessary resources and labor to carry out management decisions. These agencies are currently involved in restoring local native ecosystems, and have large pools of experienced volunteers.

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Appendix A

Methods

The variable width transect method was used to determine the densities of avian populations on the grasslands. Emlen (1971) describes this method in detail. A brief discussion of the method is given below.

Emlen (1977) states the objective of the variable width transect census method is to estimate the number of birds present at a particular site during a single census operation. This differs from the spot-mapping method which is used to map clusters of bird sightings to determine which birds have set up territories during the breeding season. This yields an estimate of the number of breeding birds present, but says little about the species which are present but not establishing territories. The advantages of the variable width transect method are that it is applicable during any season, and will provide a representative sampling of a region or vegetation type (Emlen,1977).

To conduct this method, a transect of known length is established on an area with homogenous vegetation of the desired type. The transect is walked and all visual and auditory contacts of avian species are noted. The exact position of the contact can either be recorded on a map of the transect area (my method), or the perpendicular distance from the transect route to the contact can be estimated and recorded.

Once the census has been completed, graphs are constructed showing the number of contacts of each species versus the lateral distance of the contact from the census route. These lateral distances are usually grouped into small parallel strips of 0-10, 10-20, 20-30 meters, etc. For each grouping, the number of contacts is plotted out to a certain specified distance.

Theoretically, the number of contacts should be maximum for locations close to the census route, and should decrease as the contacts get farther away from the route. As the distance from the transect gets larger, the chances of detecting a visual sighting or a song gets smaller.

Once the graph is complete for a particular species, the point where the number of detections starts to drop rapidly is noted. This is called the inflection point. If the birds are distributed randomly, this is the point where the observor starts to miss the visual and auditory cues. The number of detections up until this point are averaged per lateral strip width. A line from this average value is then projected out past the inflection point to a prescribed distance. The usual lateral distance it is projected to is 125.6 meters.

This value is used because a transect 1600 meters long having a 125.6 meter wide strip on both sides of the transect route will equal 40 hectares (ha) or 100 acres. Bird densities are usually reported as the number of individual birds per 40 hectares, or the number of territorial males (pairs) per 40 hectares.

One of the problems of the variable width transect method is that it doesn't take into account the birds that are present on the transect but are not providing the censuser with any cues to their presence. Examples of these types of birds are mated female birds that do not sing and stay hidden. Therefore no visual or auditory cues are received by the censuser. The males are counted because they are either displaying or are singing their courtship or territorial songs. If only the males were recorded, the density values would be one half of the true density.

The detection numbers therefore had to be corrected for the species displaying these types of behavior. For example, 84.6% of grasshopper sparrow detections were auditory in nature. For every 100 detections, 15 would be visual and either male or female, while the other 85 would be auditory, consisting mainly of only the males. If all of the males were mated, the detection count would actually be 85 birds less than the actual value. The correction factor was determined by 185/100 = 1.85. The detection counts were then multiplied by 1.85 to determine the actual density value.

The values for the differing transect lengths were corrected so that the density figures reflected the number of birds per 40 hectares. For example, if the transect was 800 meters long, this equals 20 hectares. The values for this transect were multiplied by two to obtain values for 40 hectares.

This method has advantages and disadvantages. The underlying assumptions used in this model are discussed by Emlen (1971 and 1977), and the method is compared to other methods and critiqued by Franzreb (1981).

One conclusion shared by the Franzreb (1981) and Emlen (1971,1977) was this method actually underestimates the true density values for the sites censused. This should be kept in mind while evaluating the results obtained during the course of this study.

Eight censuses of each transect were conducted during the period of the first week of may until the third week of July, when most breeding has stopped. Several different transects were censused each trip, in order to minimize the total number of trips made to the areas. The transects censused and the direction of travel on each transect were chosen at random.

The censusing started as close to one-half hour after sunrise as possible, and most were completed around 10:00 a.m.. Censuses were only conducted during favorable weather conditions (no high winds or active precipitation). The transects were censused at a slow walk with frequent stops to detect cues.

The transects were selected based on type of habitat, size, and homogeneity of desired habitat type. The habitats selected were grazed grasslands, agricultural grasslands (hay or cereal crop), and unused/undisturbed grasslands.

Qualitative characteristics of each site were recorded but more extensive quantitative evaluations were not conducted due to the limited scope of this project.

Appendix B

Descriptions of Study Areas

Each transect will be described with references to the following factors: length, vegetation type, topography, amount of water present, amount of shrubs and trees present, current management strategy, and other pertinent information.

Transect 1 (Map 4)

Length: 3200 meters

Vegetation: The vegetation consisted mostly of cool season grasses which were seeded upon reclamation. These included tall fescue, smooth bromegrass, and orchardgrass. There were forbs present but they were widely scattered and dominated by the grasses. The forbs included dandelions, bull and canada thistles, red clover, white clover, alsike clover, hoary vervain, common milkweed, bluegrass, gray goldenrod, new england aster, and false boneset. Overall, the taller vegetation was sparsely scattered, with the lower vegetation occuring in local clumps. There were still frequent patches of bare soil visible.

Topography: The topography is mostly flat, with a few gently rolling hills in the central region. The lakes have gently sloping banks with no large highwalls

Water: There are numerous small lakes interspered in the transect, with a very large lake at the northern boundry, and another one at the north end that the transect winds around. Overall, approximatly 20% of the transect area was covered by water.

Trees: The trees consisted mainly of scattered cottonwoods. These existed either alone or in small sparsely populated groves around several of the lakes. Very few willows or other trees were found.

Management Strategy: The current strategy for both the southern and northern sections of the transect was grazing stock cows. The transect had been grazed the previous year, and the cattle were placed on the transect shortly after censusing began. The grazing was not as intense on transect one as it was on transects four and six.

Transect 2 (Map 5)

Length: 800 meters

Vegetation: This transect was seeded with wheat several years ago as a cover and wildlife food crop. It has not been harvested for many years. The wheat is not densely planted but is fairly uniform throughout, with very little bare ground exposed. At the northern end of the field, the vegetation was heterogeneous, with a large number of invading forbs and cool season grasses present.

(Transect 2 continued)

The forbs were the same ones listed in transect 1. In the middle and southern ends, the vegetation was more homogeneous, with the wheat being the dominant plant, and the forbs and grasses being less numerous and dense.

Topography: The terrain is flat with almost no slope to the ground.

Water: None

Trees: There are several willow thickets in the southern end, and some scattered cottonwood trees along the eastern and western edges.

Management stratey: This field is used as a food and cover crop for wildlife, and is not currently being disturbed or harvested.

Transect 3 (Map 6)

Length: 1600 meters

Vegetation: The vegetation found on this transect is very similar in type to transect one. However, the forbs are more numerous and the vegetation overall much more dense and established. Very little ground is free of vegetation.

Topography: The northern and southern ends are basically flat, with a small draw (maximum relief of six meters) running east and west in the central region. Around several of the smaller lakes, the banks are much steeper and higher than those in transect 1. The rest of the terrain is gently rolling.

(Transect 3 continued)

Water: There is one medium sized lake at the southern end of the transect, two smaller lakes at the northern end, and four small lakes scattered throughout. However, less than 5% of the ground was covered by water.

Trees: There were numerous groves of small willow trees contained in the low and wet regions of the transect. Larger cottonwood trees were scattered throughout, but they were not very numerous.

Management strategy: This area is currently undisturbed and has not been disturbed for many years.

Transect 4 (Map 7)

Length: 1600 meters

Vegetation: The vegetation is dominated by the cool season grasses, with only occasional scattered forbs found. The common forbs found are the same as listed in transect 1, but the milkweed and thistles were the most numerous. Due to heavier grazing, this transect had shorter vegetation, was more clumpy, and had a much higher percentage of the bare ground exposed.

Topography: The topography was mostly flat with only a few gently rolling hills. The lakes had very steep banks leading down to them, and with the amount of bare ground exposed, soil erosion was occuring at a much faster rate than on the other transects. There were numerous deep gullies cut into the ground that led down to the lakes.

(Transect 4 continued)

Water: Approximately 15% of the ground surface was covered by water. The western boundry of the transect was a north-south running lake that had a long finger extending northeastward. This finger basically separated transects 4 and 6, and was the northern boundry for transect 4. Two large lakes, and numerous small lakes were found in the southern area of the transect.

Trees: The trees were mainly cottonwoods of medium height. Along a ridge in the center of the transect was a small grove of them, and only scattered ones were found outside of this grove. Willow trees were very rare here.

Management strategy: This transect is heavily grazed and has been used for many years as a grazing pasture.

Transect 5 (Map 8)

Length: 800 meters

Vegetation: This field consists mainly of alfalfa, clovers, and some cool season grasses. There were only rare milkweeds, asters, and goldenrods. The vegetation was not as dense as transect 8, but the ground was well covered and no bare patches were seen. The vegetation was allowed to grow to full height before it was cut for hay between 7/6/89 and 7/16/89.

(Transect 5 continued)

Topography: This field had a gentle slope to it that rose to the north.

Water: None

Trees: There were no trees in the transect area, but there were occasional cottonwoods and willows around the outer periphery.

Management strategy: This field has been cut for hay for many years. In 1989, it was cut for hay between 7/6 and 7/16.

Transect 6 (Map 7)

Length: 800 meters

All others: See transect 4 analysis. Transect 6 was located in the same field as transect 4. The transect was set up on the north side of a lake that bisected the field. Comments for vegetation, topography, water, trees, and management strategy are the same as transect 4.

Transect 7: (Map 9)

Length: 2400 meters

Vegetation: The vegetation of Banner Marsh is similar to the vegetation of transects 1, 3, 4, and 6. The cool season grasses dominate the vegetation with occasional forbs such as milkweed. There is a more developed vegetation around the lakes, with more extensive beds of cattails and other marshy vegetation. There were also several small food plots planted for game birds and other animals.

(Transect 7 continued)

Topography: The terrain at transect 7 is gently rolling with smooth gentle hills. The lakes have smooth banks and there are no steep or tall banks along the lakes. To the northeast was a large linear highwall which was the eastern boundry of the transect. There was also a small depression (maximum relief of six meters) by this highwall.

Water: Approximately 25% of the ground surface was covered by water. There is a large linear lake that is the northern boundry of the transect. A large lake is the eastern boundry, and a medium sized lake is located towards the eastern end. There are at least six additional medium to small sized lakes present.

Trees: There are many cottonwoods trees scattered throughout the transect, and a few willow thickets. There are also scattered multifloral rose bushes present, but they were widely dispersed in this transect.

Management strategy: This transect has not been grazed or disturbed for many years.

Transect 8: (Map 10)

Length: 1400 meters

(Transect 8 continued)

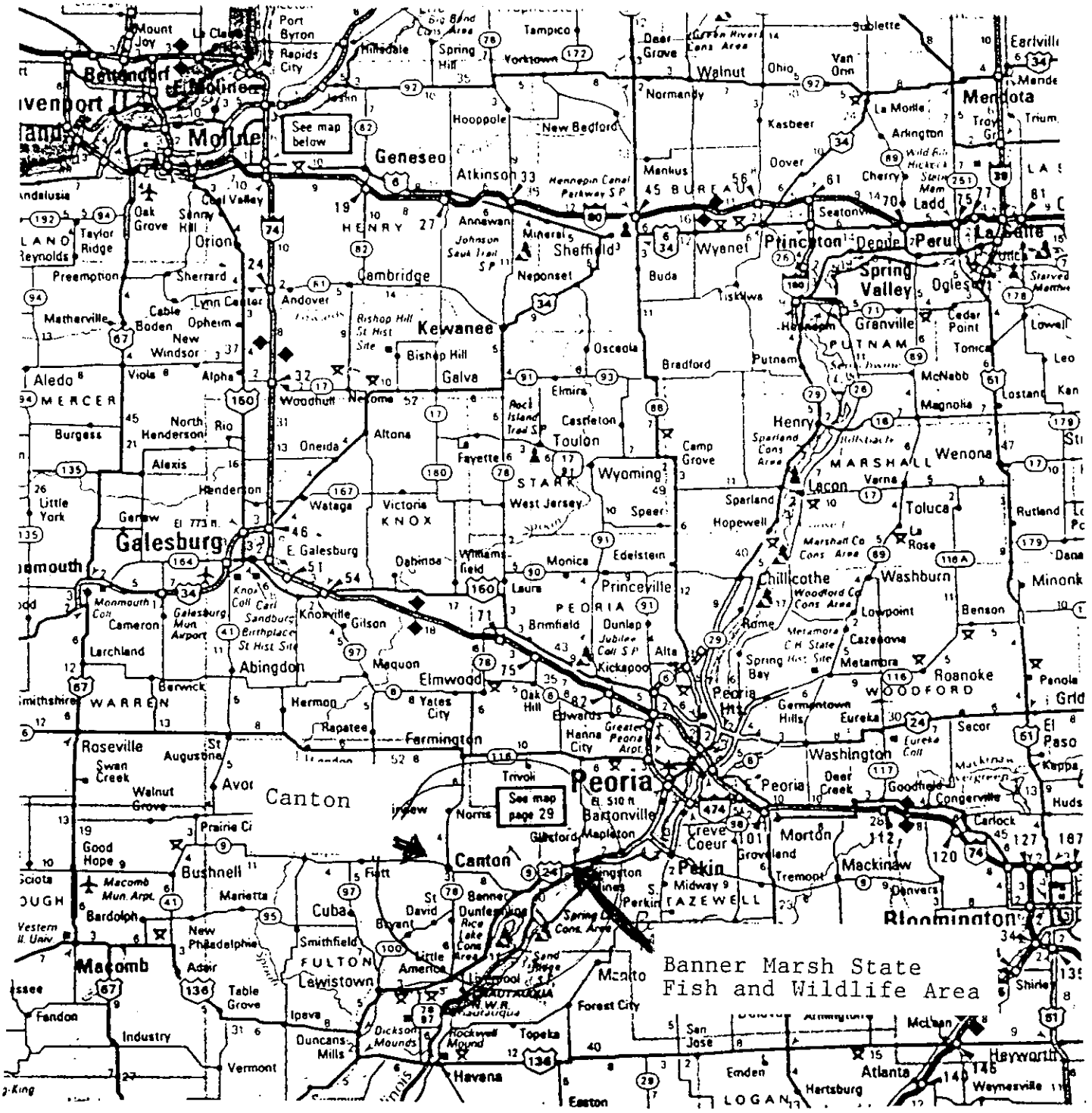
Vegetation: This transect is a hay field that is leased for hay production. The vegetation consisted mainly of alfalfa and brome grass. The vegetation was so dense and thick, that it was nearly impossible to penetrate when it got to full height. Occasional asters and goldenrods were also noted. This field was not cut for hay production until after all of the censuses were completed.

Topography: The terrain was very flat except around the periphery where there was a moderate slope down to water along the northern and eastern boundries.

Water: There is a large lake that is the northern and eastern boundry of the hayfield. A small lake is located in the middle, which had nearly dried up by July.

Trees: The small lake was almost completely surrounded by willow groves, and there were several smaller groves located in the transect. Cottonwoods were occasionally scattered throughout, being mainly along the boundries of the field.

Management strategy: This field is a hayfield, and has been harvested for many years. This summer it did not get cut until after the last census was conducted on 7/20/89.



Map 1. Map of West Central Illinois showing location of Canton and Banner Marsh

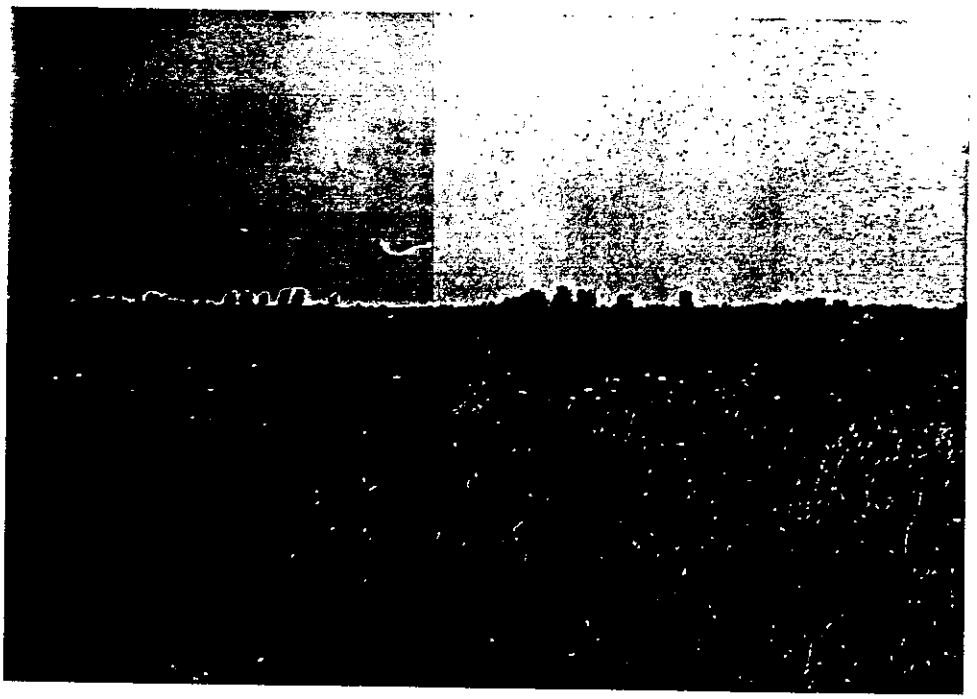
Appendix D

Photographs

Photograph 1. Transect 1. Looking SE from the NW corner.

Photograph 2. Transect 1. Looking North from NW corner. Shows dried up pothole that Upland Sandpipers frequented. (Dry in 1989)

Photograph 3. Transect 1. Looking North to fenceline in NW corner. Short grazed grass frequented by Upland Sandpipers.

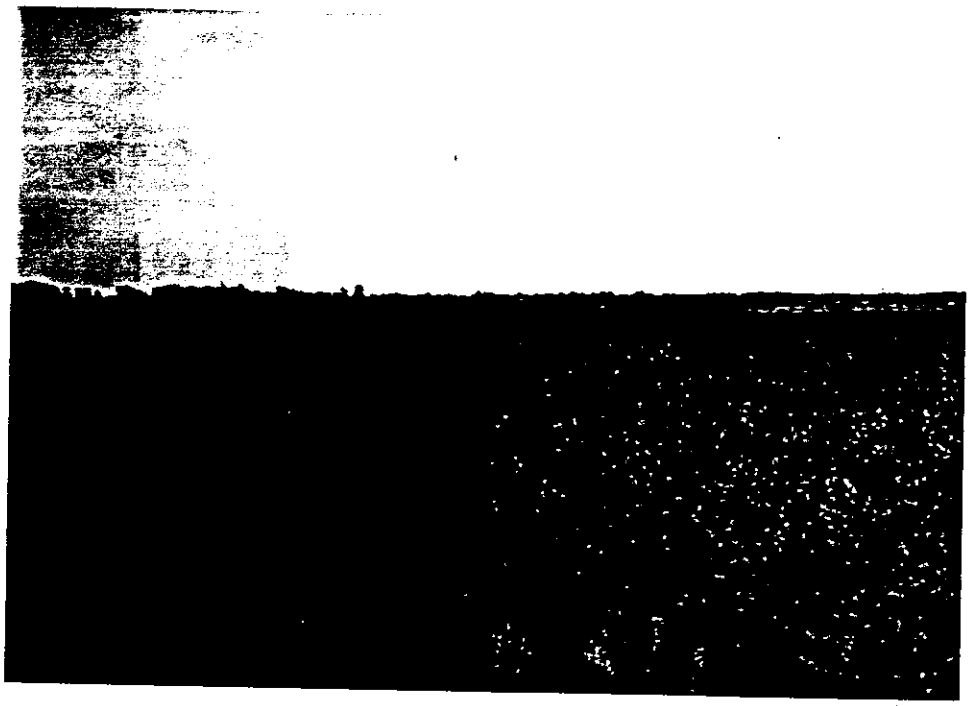


Photograph 4. Transect 2. Looking West from haul road over the unharvested wheat field.

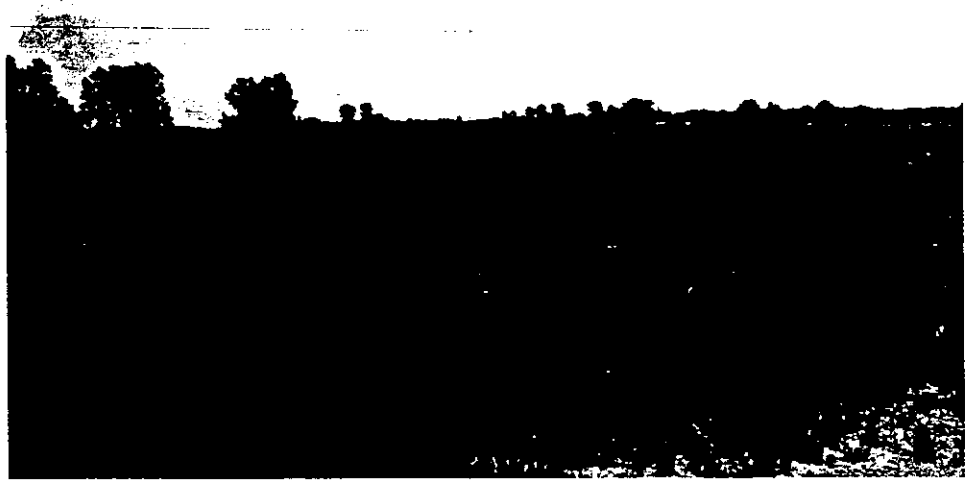
Photograph 5. Transect 3. Looking North from the county road. (SE corner)

Photograph 6. Transect 3. Looking West on southern end, to the area where Henslow's Sparrows were detected.

Photograph 7. Transects 4 and 6. Looking South from the NE corner.

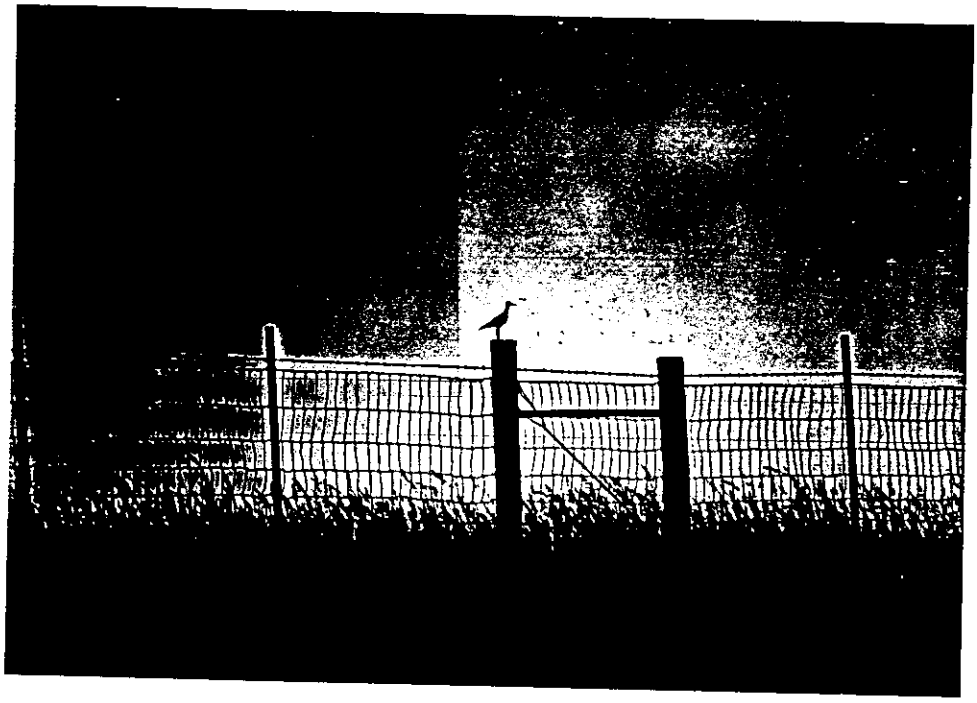


Photograph 8. Transect 5. Looking East from the NW corner over the uncut hayfield.



Photograph 9. Transect 7. Looking NE from the SW starting point.

Photograph 10. Transect 8. Looking NE from the SW corner.



Photograph 11. Upland Sandpiper taken on transect 4, near the NE corner (6/28/90).

Photograph 12. Erosion taking place on transects 4 and 6, taken from the NE corner looking south.