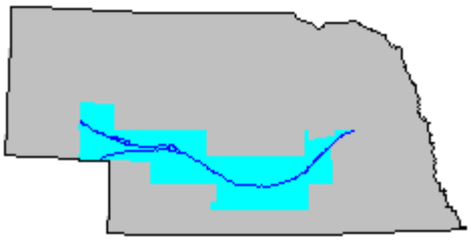
Breeding Birds of the Platte River Valley of Nebraska



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Abstract

The Platte River Valley in central Nebraska is known throughout North America for its concentrations of sandhill cranes and waterfowl during spring migration. Fully three-quarters of the world's population of lesser sandhill cranes, nearly all of the Central Flyway population of greater white-fronted goose, and over one million Canada geese spend most of the period from mid-February to early April along the Platte River. The yearly spectacle makes the Platte River a birdwatcher's paradise. The main objective of this study was to determine the numbers and kinds of bird species nesting in the area, their populations, habitat preferences, and the geographical distribution of each species across the area. Included are information about species status (including nests, fledglings, and nesting attempts), distribution, habitat use during the breeding season, the effect of habitat alteration on species distribution and abundance.

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Introduction

When the first transcontinental explorers reached the Platte River in the early 19th century, they found a relatively pristine environment occupied by Native Americans along with vast herds of ungulates and flocks of birds. Townsend (1839) and Fremont (1845), the first major explorers in the region, kept records of the natural features of the Platte River Valley in an attempt to identify the wealth of natural resources there. Breeding birds along the Platte River occurred in tremendous numbers at that time. Because forest vegetation was virtually lacking, grassland birds such as greater prairie-chicken (scientific names are given in the Species Accounts), grasshopper sparrow, western meadowlark, and long-billed curlew were among the predominant species. Wet meadows associated with the seasonally wet reaches of the river supported nesting bobolink, upland sandpiper, and dickcissel, among others.

Lured by the gold and other valuable resources farther west, explorers moved rapidly through the valley. A series of trails soon developed as additional travelers pushed westward. From the modest beginnings of wagon trains, cattle grazing, and army forts, the Platte River Valley developed rapidly into a major agricultural and livestock-producing region. Communities were established to provide support services for farming and ranching activities.

A transportation network was essential to development of the area. Until the Union Pacific Railroad was completed through central Nebraska in 1866, there was no effective way to transport agricultural goods to market. The federal government encouraged development of the Union Pacific and other railroads by granting lands along the rights-of-way to the railroad companies. The railroads then generated money by selling these lands to homesteaders. Railroads subsidized the immigration of European settlers to the region with low fares and low land prices. The effort, along with the offer of free land through various amendments of the Homestead Act, promoted settlement of central Nebraska.

Concomitant with the great influx of settlers and resultant development of the agricultural community, extensive and mostly permanent changes occurred in the character of the Platte River Valley landscape. The once-vast areas of tall grass prairie were reduced to odd corners that would not accommodate a plow. Agricultural irrigation development facilitated the drastic reduction in peak and annual flows in the Platte River, ultimately and permanently changing the habitat from sandbar and wet meadow to riparian forest. Shelterbelts, established to reduce the impact of the ever-present prairie wind on tilled lands, provided a new habitat for breeding birds to exploit. The end result of the advance of

man across the Platte River system was the unavoidable and irreparable alteration of the habitats and wildlife that once flourished here.

Because man's activities continue to influence the status of many breeding bird species, it is important to summarize the current body of knowledge about those birds. With the accumulation of more data in the future, informed decisions can be made about species populations and distribution. Our objective in this book are to provide an in-depth description of the breeding bird community that occurs in the Platte River Valley in central Nebraska. We describe the effects of prior development on the status and distribution of 141 bird species, and provide maps of their breeding distributions.

Methods and Terminology

The study area included about 26,000 km^2 in Adams, Buffalo, Dawson, Deuel, Garden (southern), Gosper, Hall, Hamilton, Kearney, Keith, Lincoln, Merrick, and Phelps counties, Nebraska (Fig. 1). Our original plan was to conduct field work in areas directly adjacent to the Platte and North Platte rivers, as outlined for studies conducted on sandhill cranes in 1978-80 (U.S. Fish and Wildlife Service 1981). However, because we desired more quantitative data on bird species distribution, we included all lands within the legal boundaries of the counties bordering the Platte and North Platte rivers. Because of the importance of the South Platte River to water flows in the Platte River, we chose to study habitats bordering the South Platte in Deuel County in order to provide a greater data base, and also to include some habitat types generally lacking from the remainder of the study area. Inclusion of all lands in the counties also allowed for less-confining search of the literature on bird use of the valley.

Field work by the authors on the study area was conducted during May 1978 through August 1988. During 1978, extensive observations were made in the area adjacent to the Platte River from Grand Island west to Lake McConaughy. During 1979-80, breeding bird species within the 13 counties were observed. From 1981 to 1987, most observations have been confined to the Grand Island - North Platte reach, although intensive observations have been made on Mormon Island Crane Meadows near Grand Island. As of 1 April 1989, 212 bird species have been recorded on that 866-ha preserve. Data on relative abundance and distribution are derived largely from our unpublished field notes.

Foremost among the published data sources on bird occurrence and distribution we have examined is the **Nebraska Bird Review**, the quarterly journal of the Nebraska Ornithologists' Union. Extensive use was made of the breeding season reports for the Southern Great Plains region contained in **American Birds** (and its predecessors), the field publication of the National Audubon Society. Johnsgard's (1979, 1980) publications dealing with Nebraska ornithology provided important information on dates of occurrence and egg dates.

Extensive use was made of the unpublished nest records obtained by Wilson Tout during 1919-1947. We also examined the bird and egg collections in the Division of Zoology at the University of Nebraska State Museum, and at The Hastings Museum. A limited amount of data was made available by the solicited responses of ornithologists and birders living in the Platte River Valley. The bulk of the data contained in this report are our own largely unpublished field notes and data gathered during the study. In total, we present data on 142 bird species that have been confirmed as nesting in our study area, or are highly suspected of so doing. Data are also presented on an additional 24 hypothetical nesting species.

We provide information throughout the species accounts on the habitats occupied by birds during the nesting season in our area. At times, to provide the reader with additional information on nesting habitat, we have included synopses of published information from other regions. Similarly, where data on nesting dates, clutch size, or other reproductive parameters are lacking, we have incorporated information from Kansas, North Dakota, or other nearby states. Our intent is to provide the reader with an indication of when the reproductive activities are likely to occur and in which habitats in the Platte River valley.

Data on breeding status and distribution was enhanced through the use of North American Breeding Bird Survey routes within the study area. These 39.2-km transect routes are selected within physiographic strata and are surveyed once each year during June. Data from these routes are presented to point out regions of peak populations of several species and, in some instances, to show geographic differences in breeding distributions. In addition, we gathered data for mapping bird distribution by conducting point survey counts (Ferry 1974, Blondel et al. 1970) within 97% of the legal townships (93 km^2) within the study area. Briefly, we recorded the presence or absence of individual species within a township by spending at least 15 minutes at representative samples of habitats. These data provided a base for the distribution maps.

Breeding Bird Populations

Censuses of breeding birds were conducted on randomly selected plots of habitat within each of several predetermined strata. The first stratification was formed by the legal boundary of each county. Within counties, the next stratification was the legal township. During selection of study sites, only one plot of a particular habitat type was censused per township. The third stratification was based on the predominant soil type of the region, as determined by Aandahl (1973).

Census plots were then selected at random within these strata. Plot size varied according to habitat complexity. Native prairie and cropland plots were all 16.2-ha, residential and riparian plots were 8.1-ha. Wooded river islands were chosen within the selected 16.2-ha plot. Shelterbelts were censused when they occurred on selected native prairie or cropland plots.

Stewart and Kantrud (1972) used 64.7-ha plots because two observers censused each plot, and because they believed complete counts of birds could be made in a 2-hour census period. Larger plot sizes have considerable merit for investigating large, wide-ranging birds such as waterfowl or raptors. We chose smaller plot sizes because they are probably better suited for censusing smaller, inconspicuous species.

Census Methods

Censusing was accomplished by one observer equipped with binoculars. Birds were counted while the observer followed a zig-zag course within each census plot. We followed the recommendation of Bond (1957), and walked slowly for 2-3 minutes, then stopped for 5 minutes to observe territorial behavior and to note if an individual bird was in or out of the plot. All territorial males were counted as they flushed before the observer, or when their singing location was encountered. The number of females was noted for brown-headed cowbirds and Wilson's phalaropes. The number of indicated pairs of sexually monomorphic species (e.g., swifts, swallows) was derived by halving the total of individuals counted on each plot. Polygamous blackbird populations are estimated based on counts of territorial males and thus represent minimums.

Breeding birds were censused only when wind speeds were **<** 15 km/h, and only on sunny or partly cloudy days. Censuses involving open habitats and wetlands were conducted during the period of 1/2 before after sunrise to 1/2 hour before sunset. Riparian woodlands were censused only until 11:00. We limited surveys in wooded habitats to early hours because of reduced song output and restricted movements later in the day (Robbins and

Van Velzen 1967, Stewart and Kantrud 1972). In wetlands, all ducks in the open were counted when the observer first arrived. Once the number of these had been determined, additional ducks and other marsh species were counted as the observer moved slowly through the vegetation.

Each plot was visited once during the 1979 season. In 1980, about 10% of those plots censused in 1979 were revisited to examine year-to-year variation. Additional plots were censused only in 1980. Single bird censuses are not recommended during intensive studies where precise estimates of populations are required (Enemar 1959) but have been used successfully to derive indices to populations during extensive surveys (Robbins and Van Velzen 1967, Stewart and Kantrud 1972, Rotenberry 1978). Speirs and Orenstein (1967) have shown that in open Ontario habitats, average efficiency of single censuses is 66-76% that of 6-10 censuses in estimating whole populations. Jarvinen and Lokki (1978) reported that nearly 90% of the species occurring on an individual census plot can be recorded in a single visit. Jarvinen and Vaisanen (1981) observed that a single census of a plot is adequate when censusing bird populations over extensive areas. Variability inherent in single visits is probably reduced by obtaining replicate censuses of each habitat.

Breeding Range Maps

The apparent range of each species during the nesting season is shown on maps of their distribution. Each symbol on the maps indicates a township in which at least one nesting season record was obtained. Closed circles refer to the presence of territorial males or pairs in the proper habitat during the nesting season. Half closed circles refer to nests, dependent young, or conclusive evidence of nesting (e.g., food carrying) within the township. Range maps for greater prairie-chicken and sharp-tailed grouse represent our best estimate of each species range based on the availability of suitable nesting habitat, and our knowledge of both species ranges in spring and fall.

Data Analysis

Population estimates for breeding birds followed the methods described by Stewart and Kantrud (1972), including the calculation of highest probability density (HPD) intervals (Johnson 1977). These intervals are Bayesian confidence intervals and were used because the number of breeding pairs is known not to be negative. Mean densities of breeding birds are expressed in pairs per km^2 for both upland and wetland habitats.

Species diversity indices (H') (Tramer 1969) and equitability (J') (Kricher 1972) were calculated for each habitat type. Species diversity is measured by the Shannon-Weaver formula:

$$H' i = E1\ Pi \log2\ Pi$$

where Pi is the proportion of individuals of species i. This index is influenced by the number of species and the number of individuals within each species. Equitability is calculated using:

$$J' = H'/H'max$$

where H' = the species diversity index, and H'max is the maximum diversity possible in the sample. Equitability is highest when all species in the sample are as nearly equal in population as possible, and it becomes smaller as single species show more influence or dominance in the population.

Terms

The terms used to describe species status in this report are adapted from Faanes (1981) including:

Regular - A species that occurs at some location in the Valley each year.

Casual - A species expected to occur at least once every 3 to 5 years, but not annually.

Accidental - A species that is not expected to occur again or that occurs very infrequently.

Hypothetical - A species that probably occurred in the Valley at least once, but the circumstances of the observation leave the record in doubt.

Introduced - A species that is naturally foreign to this region but has been released in the area as an act of man and is now established and reproducing without additional influence by man.

Extirpated - A species that once occurred naturally in the Valley, has now been eliminated, but still exists elsewhere.

Terms used in describing the occurrence of a species in the Valley include:

Permanent resident - A species that is largely nonmigratory or, if migratory, only a very small proportion of the population departs during a migration period.

Migrant - A species that normally occurs in the Valley only during the well-defined spring and fall migration period.

Breeding species - A species for which a viable clutch of eggs, dependent young in the nest, or young that have left the nest but are still dependent have been observed.

Summer resident - A species that occurs in the Valley during the normal nesting period and in all likelihood nests, but for which there areno confirmed records of eggs or dependent young.

Winter resident - A species that winters in the valley even though greater numbers may occur during migration.

Terms used in relating the relative abundance of each species during migration, winter, or the breeding season relate to its importance to the total avifauna. These terms adapted from Stewart (1975) are described as follows:

Abundant - A species that is observed in very large numbers.

Common - A species that is observed in large numbers.

Fairly common - A species that is observed in fair to moderate numbers.

Uncommon - A species that is observed in low numbers.

Rare - A species whose range includes the Valley but is observed in low numbers.

Very rare - A species that is observed in low numbers and sporadically on the study area.

Nomenclature

The taxonomic treatment of birds in this report follows the Sixth Edition of the American Ornithologists' Union **Check-list of North American Birds** (AOU 1983) and its various updates.

Description of the major plant communities of the Valley follows the classification of Bose (1977) for native prairie communities and Currier (1982) for riparian communities including wet meadows. The common and scientific names of plants mentioned in the text follow Barkley (1986). Voucher specimens of most plants mentioned in the text are housed in the Herbarium at the Northern Prairie Wildlife Research Center.

Species Accounts

Family Podicipedidae
- Pied-billed Grebe *(Podilymbus podiceps)*
- Eared Grebe *(Podiceps nigricollis)*

Family Phalacrocoracidae
- Double-crested Cormorant *(Phalacrocorax auritus)*

Family Ardeidae
- American Bittern *(Botaurus Lengtiginosus)*
- Great Blue Heron *(Ardea herodias)*
- Green-backed Heron *(Butorides striatus)*
- Black-crowned Night-Heron *(Nycticorax nycticorax)*

Family Anatidae
- Canada Goose *(Branta canadensis)*
- Wood Duck *(Aix sponsa)*
- Green-winged Teal *(Anas crecca)*
- Mallard *(Anas platyrhynchos)*
- Northern Pintail *(Anas acuta)*
- Blue-winged Teal *(Anas discors)*
- Northern Shoveler *(Anas clypeata)*
- Gadwall *(Anas strepera)*
- American Wigeon *(Anas americana)*
- Redhead *(Aythya americana)*

Family Cathartidae
- Turkey Vulture *(Cathartes aura)*

Family Accititridae
- Bald Eagle *(Haliaeetus leucocephalus)*
- Northern Harrier *(Circus cyaneus)*
- Swainson's Hawk *(Buteo swainsoni)*
- Red-tailed Hawk *(Buteo jamaicensis)*
- Ferruginous Hawk *(Buteo regalis)*
- Golden Eagle *(Aquila chrysaetos)*
- American Kestrel *(Falco sparverius)*
- Prairie Falcon *(Falco mexicanus)*

Family Phasianidae
- Ring-necked Pheasant *(Phasianus colchicus)*
- Greater Prairie-Chicken *(Tympanuchus cupido)*
- Sharp-tailed Grouse *(Tympanuchus phasianellus)*
- Wild Turkey *(Meleagris gallopavo)*
- Northern Bobwhite *(Colinus virginianus)*

Family Rallidae
- Virginia Rail *(Rallus limicola)*
- Sora *(Porzana carolina)*
- Common Moorhen *(Gallinula chloropus)*
- American Coot *(Fulica americana)*

Family Charadriidae
- Piping Plover *(Charadrius melodus)*
- Killdeer *(Charadrius vociferus)*

Family Recurvirostridae
- American Avocet *(Recurvirostra americana)*

Family Scolopacidae
- Spotted Sandpiper *(Actitis macularia)*
- Upland Sandpiper *(Bartramia longicauda)*
- Long-billed Curlew *(Numenius americanus)*
- Common Snipe *(Gallinago gallinago)*
- American Woodcock *(Scolopax minor)*
- Wilson's Phalarope *(Phalaropus tricolor)*
- Least Tern *(Sterna antillarum)*
- Black Tern *(Chlidonias niger)*

Family Columbidae
- Rock Dove *(Columba livia)*
- Mourning Dove *(Zenaida macroura)*

Family Cuculidae
- Black-billed Cuckoo *(Coccyzus erythropthalmus)*
- Yellow-billed Cuckoo *(Coccyzus americanus)*

Family Tytonidae
- Common Barn-Owl *(Tyto alba)*

Family Strigidae
- Eastern Screech-Owl *(Otus asio)*
- Great Horned Owl *(Bubo virginianus)*
- Burrowing Owl *(Athene cunicularia)*
- Short-eared Owl *(Asio flammeus)*

Family Caprimulgidae
- Common Nighthawk *(Chordeiles minor)*

Family Apodidae
- Chimney Swift *(Chaetura pelagica)*

Family Alcedinidae
- Belted Kingfisher *(Ceryle alcyon)*

Family Picidae
- Red-headed Woodpecker *(Melanerpes erythrocephalus)*
- Red-bellied Woodpecker *(Melanerpes carolinus)*
- Downy Woodpecker *(Picoides pubescens)*
- Hairy Woodpecker *(Picoides villosus)*
- Northern Flicker *(Colaptes auratus)*

Family Tyrannidae
- Western Wood-Pewee *(Contopus sordidulus)*
- Eastern Wood-Pewee *(Contopus virens)*
- Willow Flycatcher *(Epidonax traillii)*
- Eastern Phoebe *(Sayornis phoebe)*
- Say's Phoebe *(Sayornis saya)*
- Great Crested Flycatcher *(Myiarchus crinitus)*

- Cassin's Kingbird *(Tyrannus vociferans)*
- Western Kingbird *(Tyrannus verticalis)*
- Eastern Kingbird *(Tyrannus tyrannus)*
- Scissor-tailed Flycatcher *(Tyrannus forficatus)*

Family Alaudidae
- Horned Lark *(Eremophila alpestris)*

Family Hirundinidae
- Purple Martin *(Progne subis)*
- Tree Swallow *(Tachycineta bicolor)*
- Northern Rough-winged Swallow *(Stelgidopteryx serripennis)*
- Bank Swallow *(Riparia riparia)*
- Cliff Swallow *(Hirundo pyrrhonota)*
- Barn Swallow *(Hirundo rustica)*

Family Corvidae
- Blue Jay *(Cyanocitta cristata)*
- Black-billed Magpie *(Pica pica)*
- American Crow *(Corvus brachyrhynchos)*
- Chihuahuan Raven *(Corvus cryptoleucus)*

Family Paridae
- Black-capped Chickadee *(Parus atricapillus)*

Family Sittidae
- White-breasted Nuthatch *(Sitta carolinensis)*

Family Troglodytidae
- Rock Wren *(Salpinctes obsoletus)*
- Bewick's Wren *(Thryomanes bewickii)*
- House Wren *(Troglodytes aedon)*
- Sedge Wren *(Cistothorus platensis)*
- Marsh Wren *(Cistothorus palustris)*

Family Muscicapidae
- Eastern Bluebird *(Sialia sialis)*
- Wood Thrush *(Hylocichla mustelina)*
- American Robin *(Turdus migratorius)*

Family Mimidae
- Gray Catbird *(Dumetella carolinensis)*
- Northern Mockingbird *(Mimus polyglottis)*
- Brown Thrasher *(Toxostoma rufum)*

Family Bombycillidae
- Cedar Waxwing *(Bombycilla cedrorum)*

Family Laniidae
- Loggerhead Shrike *(Lanius ludovicianus)*

Family Sturnidae
- European Starling *(Sturnus vulgaris)*

Family Vireonidae
- Bell's Vireo *(Vireo bellii)*
- Warbling Vireo *(Vireo gilvus)*
- Red-eyed Vireo *(Vireo olivaceus)*

Family Emberizidae

- Yellow Warbler *(Dendoica petechia)*
- American Redstart *(Setophaga ruticilla)*
- Common Yellowthroat *(Geothlypis trichas)*
- Yellow-breasted Chat *(Icteria virens)*
- Scarlet Tanager *(Piranga olivacea)*
- Northern Cardinal *(Cardinalis cardinalis)*
- Rose-breasted Grosbeak *(Pheucticus ludovicianus)*
- Black-headed Grosbeak *(Pheucticus melanocephalus)*
- Blue Grosbeak *(Guiraca caerulea)*
- Lazuli Bunting *(Passerina amoena)*
- Indigo Bunting *(Passerina cyanea)*
- Dickcissel *(Spiza americana)*
- Rufous-sided Towhee *(Pipilo erythrophthalmus)*
- Cassin's Sparrow *(Aimophila cassinii)*
- Chipping Sparrow *(Spizella passerina)*
- Brewer's Sparrow *(Spizella breweri)*
- Field Sparrow *(Spizella pusilla)*
- Vesper Sparrow *(Pooecetes gramineus)*
- Lark Sparrow *(Chondestes grammacus)*
- Lark Bunting *(Calamospiza melanocorys)*
- Savannah Sparrow *(Passerculus sandwichensis)*
- Grasshopper Sparrow *(Ammodramus savannarum)*
- Song Sparrow *(Melospiza melodia)*
- Swamp Sparrow *(Melospiza georgiana)*
- Bobolink *(Dolichonyx oryzivorous)*
- Red-winged Blackbird *(Agelaius phoeniceus)*
- Eastern Meadowlark *(Sturnella magna)*
- Western Meadowlark *(Sturnella neglecta)*
- Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*
- Brewer's Blackbird *(Euphagus cyanocephalus)*
- Great-tailed Grackle *(Quiscalus mexicanus)*
- Common Grackle *(Quiscalus quiscula)*
- Brown-headed Cowbird *(Molothrus ater)*
- Orchard Oriole *(Icterus spurius)*
- Northern Oriole *(Icterus galbula)*

Family Fringillidae

- House Finch *(Carpodacus mexicanus)*
- Pine Siskin *(Carduelis pinus)*
- American Goldfinch *(Carduelis tristis)*

Family Passeridae

- House Sparrow *(Passer domesticus)*

Hypothetical Breeding Species

During our extensive surveys of breeding bird populations and distribution in the study area, we encountered several bird species that were outside their normal breeding range. Examination of the literature revealed that additional records existed for some of the species we encountered, plus other species have been found here that we did not observe. In all likelihood, many of the bird species mentioned have nested at one time or another in our area. However, the lack of convincing documentation renders their occurrence as a nesting species hypothetical. Other species have occurred occasionally in the study area during the nesting season (e.g. snowy plover, common poorwill), and may subsequently become established as nesting species in the future.

Contents

Western Grebe --*(Aechmophorus occidentalis)*

A regular nesting species at Crescent Lake National Wildlife Refuge in central Garden County (Sharpe and Payne 1966). Rosche (1979) reported western grebe summering in the lower North Platte River Valley, but obtained no evidence of nesting there. Swenk (1933) reported numerous nests from wetland areas slightly north of our study area in northern Garden County. Our records consist primarily of adults found at several locations on Lake McConaughy during June, but observed no evidence of nesting; we have no doubt this species nests at least occasionally in our area.

Clark's Grebe --*(Aechmophorus clarkii)*

T.M. Bergin found a dead male (testes 13 x 5 and 10 x 4 mm) at the Cedar Point Biological Station, Keith County, on 11 June 1986. This represented the first confirmed record of the species in Nebraska. Little known at the eastern limit of the species range, Clark's grebe may nest at least occasionally in the Platte River valley.

Least Bittern --*(Ixobrychus exilis)*

Johnsgard (1980) speculated that least bittern nests in Nebraska as far west as Garden County where it has been observed in summer at Crescent Lake National Wildlife Refuge. Lingle found a single least bittern near Doniphan, Hall County on 14 August 1985, and at Mormon Island Crane Meadows on 24 May 1986.

Cinnamon Teal --*(Anas cyanoptera)*

Rosche (1979) reported male cinnamon teal in the lower North Platte River valley as late as 4 June. Johnsgard (1980) mentioned probable nesting at Crescent Lake National Wildlife Refuge. Lingle observed two males at the Taylor Ranch, Hall County, on 12 May 1985. Faanes found a male at Mormon Island Crane Meadows on 20 May 1986. Rising (1974) considered cinnamon teal "probably a low density summer resident" in western Kansas.

Canvasback --*(Aythya valisineria)*

U.S. Fish and Wildlife Service files contain records of canvasback on Rainwater Basin wetlands during the late 1960's. Johnsgards (1980) described canvasback as a local

breeding species in the Sandhills physiographic region. Sharpe and Payne (1966) found a canvasback nest on an island in a wetland at the Crescent Lake National Wildlife Refuge, Garden County, during early June 1965.

Lesser Scaup --*(Aythya afinis)*

Johnsgard (1980) reported occasional nesting by lesser scaup at Crescent Lake National Wildlife Refuge, Garden County. We believe that lesser scaup nest at least occasionally in our area.

Hooded Merganser --*(Lophodytes cucullatus)*

Bruner et al. (1904) reported several records of hooded merganser nests from Cuming, Gage and Lancaster Counties, Nebraska during the 1800's. The nearest location of regular nesting to the Platte River valley is North Dakota (Johnsgard 1979). Sharpe and Payne (1966) flushed a female from Blue Creek about 14.5 km southeast of the Crescent Lake National Wildlife Refuge headquarters during June 1965.

Ruddy Duck --*(Oxyura jamaicensis)*

Johnsgard (1980) reported ruddy duck as a local summer resident on permanent wetlands in the Sandhills and the Rainwater Basin area. Sharpe and Payne (1966) reported that ruddy ducks were present in relatively large numbers on most water bodies at the Crescent Lake National Wildlife Refuge, Garden County, during 7-11 June 1965. Our records include one pair at the North Platte sewage lagoon, Lincoln County, on 29 May 1979. We have no doubt that this duck nests at least occasionally in our study area.

Gray Partridge --*(Perdix perdix)*

Johnsgard (1980) reported that Adams County is one of the areas in Nebraska where gray partridge has been observed most regularly in the State. Viehmeyer (1942) described early stocking activities in Nebraska including 54 birds released in Buffalo, and 25 birds in Merrick Counties during 1929-1931. The stocking efforts were considered only fairly successful, and apparently later failed. We have never observed this species in the study area, although the

Nebraska Game and Parks Commission has maintained a hunting season on gray partridge here since 1983.

Chukar --*(Alectoris chukar)*

Johnsgard (1980) mentioned the release of 700 chukar in Scottsbluff County in 1969. Subsequent observations, as late as 1976, were made as far east as Lincoln County. There is a possibility that a limited population may still exist in the study area, especially in the canyon region between the North and South Platte rivers in Garden, Keith, and Lincoln counties.

Rallus elegans --*(Rallus elegans)*

There are several records from the Clear Creek marshes at the upper end of Lake McConaughy, in Keith and Garden counties. Rosche (1979) found one there on 23 April 1977. Faanes saw an adult at Clear Creek on 5 June 1979. Johnsgard (1980) reported that king rail occurs in Nebraska during 2 April and 11 September, and stated that nesting is possible at Clear Creek.

Snowy Plover --*(Charadrius alexandrinus)*

Johnsgard (1980) reported this species as an extremely rare migrant in Nebraska, stating that there was no evidence of nesting in the State. Bliese (1975) found single snowy plovers on 20 June and 29 June 1974 along the shore of a wetland 5.5 km northeast of Funk, Phelps County; two snowy plovers were present there 25 June 1974. Lingle has seen this species twice on unvegetated river channel islands in the Platte River, Buffalo County on 24 May 1978 and 25 July 1984. On 24 May 1978, he watched a pair preparing a nest scrape on an island. A subsequent rise in the water level washed out the nesting attempt. The University of Nebraska-Lincoln ornithology class observed a pair of snowy plover on the South Platte River near Ogallala, Keith County in June 1976 that was engaged in a distraction display.

Mountain Plover --*(Charadrius montanus)*

Johnsgard (1980) reported the observation of young mountain plover in Kimball County in 1974 as the only evidence of nesting in Nebraska. Cooke (1910) mentioned a clutch of eggs collected "at North Platte" on 8 July 1859. Because of the vague nest location described by Cooke, we are not certain that the nest was actually in our study area. Undoubtedly extensive areas of habitat suitable for supporting nesting mountain plovers existed throughout the western edge of the study area in 1859. However, the settlement of North Platte did not exist in 1859. Cooke may have been using the river as a reference location, thus making any point along the entire course of the river in Nebraska or Wyoming the potential nest site.

Willet --*(Catoptrophorus semipalmatus)*

Johnsgard (1980) described the willet as a locally common summer resident in the Sandhills physiographic region. Sharpe and Payne (1966) reported that willets were present and apparently on established breeding territories at Crescent Lake National Wildlife Refuge, Garden County, during 7-11 June 1965. We have no doubt that the willet nests, at least occasionally, within the boundaries of our study area.

Franklin's Gull --*(Larus pipixcan)*

Johnsgard (1980) described Franklin's gull as a very rare or accidental nesting species in Nebraska, with breeding season records only from northern Garden County. Sharpe and Payne (1966) found 2 nests, each with 2 eggs on Smith Lake, Crescent Lake National Wildlife Refuge during 7-11 June 1965. Rosche (1979) recorded this species as a summer visitor in the lower North Platte River valley. We found Franklin's gull fairly regularly on Lake McConaughy during late May to July 1978-1980. The birds present many have been non-breeding sub-adults, or breeding birds from colonies in the Sandhills that were foraging there.

Forster's Tern --*(Sterna forsteri)*

Johnsgard (1980) reported that Forster's tern was a highly localized summer resident in the Sandhills, especially in Garden County. Sharpe and Payne (1966) found one nest at Crescent Lake National Wildlife Refuge during 7-11 June 1965; several hundred adults were

present on Smith Lake with many exhibiting territorial behavior. Hudson (1938b) found Forster's tern commonly at Hastings, Adams County, during 6-9 June 1937.

Long-eared Owl --*(Asio otus)*

Johnsgard (1979) considered long-eared owl a rare to uncommon nesting species in Nebraska. Johnsgard's figure depicting the nesting distribution of this species across the Great Plains shows long-eared owl widely distributed throughout our study area. We have never observed long-eared owl in the Platte River Valley, or are we aware of any specific records of nests from the literature.

Common Poorwill --*(Phalaenoptilus nuttallii)*

Johnsgard (1979) described the nesting distribution of common poorwill in the Great Plains to include the portion of our study area westward from the Dawson - Lincoln County border. Tout (1947) described the observation of a common poorwill west of North Platte, Lincoln County on 6 June 1913. Rosche (1979) recorded common poorwill at Ash Hollow, Garden County, 23 April 1977. Faanes found a singing male at Ash Hollow on 8 June 1979. We believe that common poorwill nests, at least occasionally, in the extensive, highly eroded canyon lands along the North Platte River, upstream from Lake McConaughy in Garden County.

Whip-poorwill --*(Caprimulgus vociferus)*

Johnsgard (1980) described this species as a summer resident in Nebraska along the Missouri River. The only suggestion we have of whip-poor-will occurrence in our area is the anecdotal account by Swanson (1954) of this species being present throughout the summer in southeastern Merrick County.

Ruby-throated Hummingbird --*(Achilochus colubris)*

There is considerable evidence suggesting that ruby-throated hummingbird nests in our area. Johnsgard (1980) stated that nesting occurs "an uncertain distance" west along the Platte River in Nebraska. Tout (1947) recorded this hummingbird at North Platte during 3

June to 9 October, and observed that the species was seen virtually everyday during the summer, although a nest was never located. Ludden (1956) included (without details) ruby-throated hummingbird among the species he found nesting on the campus of Kearney State College, Buffalo County. Johnsgard (1985) reported, without details, that ruby-throated hummingbird nests in Nebraska as far west as North Platte. Our records of this species in the study area are restricted to spring and fall migration.

Golden-crowned Kinglet --*(Regulus satrapa)*

Weakley (1938) reported that a pair of golden-crowned kinglets spent June and early July 1938 at the Agricultural Experiment Station grounds in North Platte. The birds frequented a group of spruce trees and there was evidence of nesting including several observations of the birds carrying what appeared to be nest material. However, Weakley found neither a nest or young. The nearest known nesting area of this species is the Black Hills region of South Dakota (Johnsgard 1979), where it is an uncommon permanent resident at higher elevations (Pettingill and Whitney 1965).

Sage Thrasher --*(Oreoscoptes montanus)*

Tout (1942) observed a sage thrasher along a road southwest of North Platte, Lincoln County, on 4 July 1942. After a brief observation, the bird flew into thick vegetation and was not seen again. The nearest area of regular nesting is the Buffalo Gap National Grassland in South Dakota (Johnsgard 1979). Sage thrasher is probably a rare summer resident in Sioux County, Nebraska (Johnsgard 1980).

Yellow-throated Vireo --*(Vireo flavifrons)*

Johnsgard (1980) reported yellow-throated vireo as an uncommon summer resident along the Platte River west to Hall County. We have never observed this species in the study area except as a spring and fall migrant.

Clay-colored Sparrow --*(Spizella pallida)*

Bennett (1974) provided a record of a young clay-colored sparrow in Hall County which is considered the only confirmed nest record for Nebraska (Johnsgard 1980). We question the

validity of this record based on the lack of suitable nesting habitat for this species in the area, and the distance from the normal breeding range.

The Physical Setting

Climate

The climate of central Nebraska is continental, characterized by hot summers, cold winters, and irregular precipitation. Precipitation is seasonal, occurring mainly between May and September. At North Platte, the climate is semiarid, with annual precipitation averaging 450 mm (Stevens 1978). Near Grand Island, the climate is semihumid, with average precipitation of 570 mm (Stevens 1978).

Geology

The Platte River Valley is underlain with Quaternary alluvium made up of clay, gravel, sand, and silt (Bose 1977, Huss 1981). Interfingering beds of clay, gravel, sand, sandstone, and silt lie beneath the alluvium. The Ogallala Formation, highly porous and permeable Tertiary sediments, acts as a water reservoir known as the Ogallala Aquifer beneath a large portion of the Great Plains.

Near Grand Island, alluvial sediments of the Platte River are deposited in a series of troughs cut into the underlying Ogallala, Niobrara, and Pierre Formations (Hurr 1978). The Niobrara and Pierre Formations consist of chalk, limestone, and marine shales. Above this layer lies a shallow alluvial aquifer that occurs beneath the Platte River throughout central Nebraska (Hurr 1978).

Topography

Alluvial bottomlands, river terraces, and gently rolling bluffs along the river escarpment are the dominant physiographic features of the Platte River Valley (Fig. 2). The bottomlands are flat and extend for 24 km in some places. The rich prairie soils of the valley are the basis for the productive row-crop agriculture that dominates the landscape today. Bluffs along the river escarpment are overlain with loess deposits and dissected by natural ravines that drain uplands. There is a gradual rise in elevation to the west throughout the valley, from 540 m near Chapman to 1070 m near Lewellen. The mean rise in the river bed from east to west is about 1.2 m per kilometer.

Hydrology

The North Platte and South Platte rivers originate as snowmelt runoff streams in the Rocky Mountains of Colorado. The North Platte River flows northward from Colorado into east-central Wyoming and then flows southeast to its confluence with the South Platte River. The South Platte River flows northward through Denver to Greeley, Colorado, and then northeastward to its confluence with the North Platte River near North Platte Nebraska. From this junction, the Platte River flows east across Nebraska to the Missouri River at Plattsmouth, Nebraska. Precipitation in the Platte River basin contributes to the flow in the river, but most of the flow is derived from spring snowmelt in the Rocky Mountains (Eschner et al. 1981).

The pattern of streamflow in the Platte River has been substantially altered by the diversion and storage of water, primarily for use in irrigation and power generation (Fig. 3). Before settlement, the river was characterized by high spring flows and relatively low mid-summer flows (Eschner et al. 1981). Reservoirs in Wyoming, Colorado, and Nebraska have resulted in a reduction in peak flows and mean annual discharge in the North Platte and Platte rivers (Currier et al. 1985). Since 1915, peak flows have declined from a mean of 550 cubic meters per second to 150 cubic meters per second at Overton (Williams 1978). Corresponding to this decline in mean annual discharge has been a reduction in the width of the Platte River channel. Today, the river channel is 10 to 70 percent of its width at the time of settlement in the 1860's (Williams 1978). Lake McConaughy and Tri-county supply canal are the principal impoundment and diversion structures affecting instream flows in the Platte River.

Habitats for Breeding Birds

Grasslands

Sandhill Prairie

The sandhills region developed from wind-deposited sand after the close of the last glacial epoch. Topography consists of rolling steep-sided slopes with level to slightly sloping valleys between the sand dunes. Soils are very sandy, well-drained, and vary in texture from loamy fine sand to fine sand. Within our study area, the sandhill prairie occurs generally north of the Platte and North Platte rivers in Lincoln, Keith, and Garden counties (Fig. 2). Small outliers of this community exist as scattered remnants in Kearney, Phelps, Buffalo, Hall, and Dawson counties.

Principal grasses of the sandhills prairie include sand bluestem (scientific names of plants are given in the Appendix), little bluestem prairie sandreed, switchgrass, sand lovegrass, blue grama, and needle-and-thread. Typical forbs are silky prairie clover, hoary puccoon, annual eriogonum, prairie coneflower, stiff sunflower, prairie sandwort, and little pricklypear. Leadplant, New Jersey tea, wild rose, western snowberry, and soapweed yucca are the principal shrubs of this community. Sandhill prairie was the most extensive habitat in the study area primarily because of the largely unaltered Sandhills.

Fifty-one bird species were recorded in this habitat, and 31 were considered to be breeding. Mean density of breeding birds was 110.7 pairs per km^2. Grasshopper sparrow, western meadowlark, and lark bunting were the most numerous species, making up 45.8% of the breeding population. Sixteen species reached their highest density in sandhill prairie: Swainson's hawk, greater prairie-chicken, sharp-tailed grouse, long-billed curlew, great horned owl, burrowing owl, common nighthawk, horned lark, black-billed magpie, rock wren, and savannah, grasshopper, vesper, lark, Brewer's, and Cassin's sparrow. Six species were restricted in this habitat (Table 1).

Mixed Prairie

The mixed prairie community exists on nearly level terrain both north and south of the Platte River in Hall, Buffalo, Dawson, Lincoln, Gosper, Phelps, Kearney and Adams counties (Fig. 2). Because of its topography, most of the mixed prairie has been converted to agricultural production. Soils are deep silty loams derived from loess deposits.

Principal grasses of this prairie community include big bluestem, little bluestem, sideoats grama, switchgrass, Indian grass, blue grama, western wheatgrass, junegrass, and needle-and-thread. Common forbs include scurfpea silverleaf scurfpea, dotted gayfeather, false boneset, Missouri goldenrod, purple prairie-clover, panicled aster, scarlet globemallow and eastern pricklypear. Typical shrubs include lead plant, western snowberry, white coralberry, smooth sumac, and soapweed yucca.

Characteristic breeding birds of the mixed prairie community include red-tailed hawk, Swainson's hawk, killdeer, upland sandpiper, burrowing owl, common nighthawk, horned lark, American crow, grasshopper sparrow, and western meadowlark.

Shortgrass Prairie

The shortgrass prairie community exists in the western region of the study area where average precipitation varies from 33 to 43 cm per year. Topography consists of a nearly level to gently sloping plain, dissected in numerous areas by the intermittent streams. Soils are well drained

and are mainly loams or silt loams. Because of the flat topography and productive soil, much of the shortgrass prairie has been converted to agricultural production. About 73% of Deuel County, which lies entirely within this community, has been developed for cropland. The shortgrass prairie occurs generally south of the North Platte River in Keith, Garden and Deuel counties (Fig. 2).

Common grasses of this community include prairie sandreed, western wheatgrass, blue grama, threadleaf sedge, buffalograss, little bluestem, sand dropseed, green needlegrass, and Indian ricegrass. Forbs include scurfpea, silverleaf scurfpea, dotted gayfeather, Platte lupine, and broom snakeweed. The shrub layer is generally characterized by rabbitbrush, silver sage, and soapweed yucca.

Characteristic breeding birds of the shortgrass prairie community include Swainson's hawk, long-billed curlew, burrowing owl, common nighthawk, loggerhead shrike, horned lark, black-billed magpie, rock wren, western meadowlark, grasshopper sparrow, lark sparrow, lark bunting, Brewer's sparrow, and Cassin's sparrow. The latter two sparrows occur almost exclusively on shortgrass prairie dominated by rabbitbrush.

Sandsage Prairie

The sandsage prairie consists primarily of rolling hilly sand dunes stabilized by grass-like vegetation generally south of the South Platte River in Lincoln County (Fig. 2). The soils are well-drained sands derived from wind-deposited sand sediments.

Principal grasses of this community include sand bluestem, little bluestem, prairie sandreed, needle-and-thread, blue grama, switchgrass, hairy grama, and purple three-awn. Characteristic forbs include stiff sunflower, prairie spiderwort, annual eriogonum, hairy goldaster, dotted gayfeather, scurfpea and eastern pricklypear. Sand sagebrush is the primary shrub species associated with the sandsage prairie.

Characteristic breeding birds include Swainson's hawk, greater prairie-chicken, killdeer, upland sandpiper, long-billed curlew, mourning dove, common nighthawk, horned lark, loggerhead shrike, lark sparrow, lark bunting, grasshopper sparrow, western meadowlark, and brown-headed cowbird.

Forest

Riparian Forest

Development of riparian forest vegetation in the study area closely parallels the reduction of river flow levels brought on by the construction of water diversion projects in the upstream reaches of the valley (Frith 1974). Currier (1982) reported that most stands of riparian forest in the Platte and North Platte rivers appeared to be of uniform age, suggesting that widespread forest development occurred after changes in hydrological conditions. Reductions in river levels have impeded the scouring action of ice and the shifting of stream sediments.

These actions have greatly enhanced the development of forest vegetation. Currier (1982) presented an excellent description of the developmental history and dynamics of Platte River riparian vegetation.

Currier (1982) identified nine distinct forest vegetation types in the area from Lake McConaughy to Merrick County. These types vary in tree species, composition, soils, biogeographic distribution, and the mixture of shrub species. The cottonwood/cedar vegetation type is quite prevalent throughout the valley. Cottonwood is the predominant overstory plant species, with red cedar and rough-leaved dogwood important in the shrub layer. Other important tree species in Platte River riparian forests include green ash, American elm, and diamond willow. Russian olive, river-bank grape, wild rose, false indigo, and coyote willow are important shrub species. Kentucky bluegrass, poison ivy, common ragweed, black medic, white sweetclover, false soloman's seal, water sedge, and Canada goldenrod are important ground layer species.

Breeding bird populations in riparian forest ranked second in abundance among habitats studied, although considerable variability was evident on several plots censused both years. Twenty-seven species reached their maximum density in this habitat type (Table 1). The most abundant species were house wren, mourning dove, American robin, and warbling vireo. Eight species occurred only in this habitat type: yellow-billed cuckoo, eastern wood-pewee, northern rough-winged swallow, white-breasted nuthatch, Bewick's wren, cedar waxwing, red-eyed vireo, lazuli bunting, and rufous-sided towhee.

Riparian habitats are important to many wildlife species, especially in regions with intensive agriculture where streamside habitats are being depleted rapidly (Stauffer and Best 1980). Breeding bird densities in Platte River riparian forest were quite similar to the 678 pairs per km^2 reported by Zimmerman and Tatschl (1975) in mature lowland forest along the Missouri River in eastern Kansas. Fawver (1947) reported a breeding density of 356 per km^2 from mature floodplain forest in Illinois. Karr (1968) however, reported 1,208 pairs of 32 species per km^2 in

mature lowland forest in Illinois. Stamp (1978) reported 1,690 pairs per km^2 from riparian cottonwoods in Arizona, and Stauffer and Best (1980) found 1,265 pairs per km^2 in Iowa.

Wooded River Channel Island

Islands that are raised above the river channel and on which the vegetation has stabilized by woody growth are typically dominated by shrub vegetation. The islands dominated by dense shrub growth have an open, sandy understory with scattered grasses and forbs. Although widespread throughout the study area, this community is most prevalent in Dawson, Gosper, Phelps, Buffalo, Kearney, Adams, Hall, Merrick, and Hamilton counties (Currier 1982).

Considerable variation exists in river channel island vegetation, primarily because of varying degrees of soil wetness. In general, this community is dominated by coyote willow, false indigo, eastern cottonwood, and diamond willow. Red-osier dogwood is locally abundant. Important understory species include common ragweed, fog fruit, prairie cordgrass, narrowleaf aster, Canada goldenrod, cocklebur, and Japanese brome. Downy brome, white sweet clover, and poison ivy are important understory species on islands where red-osier dogwood and false indigo are prevalent overstory plants.

Wooded river channel islands represent a small proportion of available habitats, but their significance was demonstrated by the high degree of use made by breeding birds. Forty-one species were recorded on river channel islands, and 39 were considered breeders. Mean density of breeding birds was 523 pairs per km^2. Cliff swallow and common yellowthroat were the most numerous species, making up 28.2% of the population. Fourteen species reach their highest density on river channel islands: killdeer, piping plover, spotted sandpiper, willow flycatcher, western wood-pewee, bank swallow, barn swallow, cliff swallow, Bell's vireo, yellow warbler, common yellowthroat, Indigo bunting, American goldfinch, and field sparrow.

Rocky Mountain Forest

Small outliers of coniferous vegetation resembling that associated with the Pine Ridge region of Nebraska occur along the North Platte River in Keith and Garden counties. This habitat type occurs on moderately steep north-facing slopes and in adjacent canyons. Soils are generally shallow loams or silts formed from the underlying sandstones.

Principal plant species associated with the ground layer of this community include little bluestem, prairie sandreed, blue grama, plains muhly, needle-and-thread, sand bluestem, western wheatgrass, Canada wildrye, green needlegrass, and Kentucky bluegrass. Forbs include shell-leaf penstemon, broom snakeweed, prairie goldenpea, false boneset, scarlet globemallow, Missouri goldenrod, and fringed sage. Typical shrubs include silver sage, chokecherry, prickly rose, poison

ivy, and soapweed yucca. Rocky Mountain juniper is the predominant tree species, but green ash and box elder occur occasionally.

Characteristic breeding birds include mourning dove, northern flicker, western kingbird, black-billed magpie, house wren, American robin, loggerhead shrike, yellow-breasted chat, chipping sparrow, field sparrow, lark sparrow, brown-headed cowbird, and American goldfinch.

Aquatic Habitats

Prairie Wetlands

Wetlands on the Sandhills developed as groundwater seepage areas in the valleys of wind-deposited sand dunes. Soils of the region are principally fine sands of various taxonomic series. sandhills wetlands within our study areas are slightly to moderately alkaline (McCarraher 1977). Agricultural development is less intense in this region; the principal land use is livestock grazing of the surrounding native grasslands.

Prairie wetlands occur within the rainwater basin region of Adams, Kearney,Phelps, and Gosper counties, and in the sandhills region of northern Lincoln and southern Garden counties. Wetlands of the Rainwater Basin occur as closed systems resulting in basins ranging from <1 to 390 ha. The wetlands formed on irregular loess deposits modified by wind action (Evans and Wolfe 1967). The Rainwater Basin is characterized by flat to gently rolling topography. Soils are quite fertile, but contain a high percentage of clay which makes them susceptible to both drought and flooding. Nearly 95% of the wetlands in the rainwater basin have been drained and converted to cropland. Emergent vegetation of Rainwater Basin wetlands is characterized by hybrid cattail, hardstem bulrush, American bulrush, and various smartweeds (Evans and Wolfe 1967). Vegetation of Sandhills wetlands is dominated by hardstem bulrush, American bulrush, and common reed. The principal submerged aquatic species include sago pondweed, muskgrass,coontail, and water milfoil.

Breeding bird populations in natural basin wetlands are characterized by waterfowl, rails and coots, and blackbirds. Twenty-one species were recorded in natural basin wetlands, and 18 species were considered breeders. Mean density of breeding pairs was 533 pairs per km^2. Red-winged blackbirds, yellow-headed blackbirds, mallards and American coots were the most numerous breeding species, making up 54.1 percent of the population. Fifteen species reached their highest breeding density in natural basin wetlands: pied-billed grebe, green-backed heron, mallard, northern pintail, green-winged teal, blue-winged teal, northern shoveler, sora, American

coot, Wilson's phalarope, marsh wren, yellow-headed blackbird, red-winged blackbird, swamp sparrow and song sparrow. Eleven of these species were restricted to natural basin wetlands.

Wet Meadow

The wet meadow community occurs along river channels and other low areas in open grasslands and forests (Currier 1982). Because of its origin within the river floodplain, topography is essentially flat. Soils are typically poorly drained silty clay to loamy fine sands derived from accumulation of organic matter on alluvial sediments. Wet meadows are distributed throughout the study area, but are more common in the east where they are associated with grasslands on Fort Farm Island, Shoemaker Island, and Mormon Island. The grasslands generally consist of grazed pastures with ribbons of wet meadow vegetation in depressions that follow the natural drainage patterns (Currier 1982).

Vegetation is dominated primarily by sedges including American bulrush, spikerush, fescue sedge, wooly sedge, woodland sedge, Mead's sedge, saw-beak sedge, and fox sedge. Reed canary grass is most important among the grasses. Principal forbs include fog fruit, fringed loosestrife, and lady's thumb. Wet soils and grazing by livestock generally reduce the shrub layer in this community; coyote willow and false indigo are the two most prevalent (Currier 1982).

Thirty-one species were recorded in wet meadows, and 27 of these were considered breeders. The mean density of breeding birds was 110 pairs per km^2. Western meadowlark, grasshopper sparrow, and brown-headed cowbird were the most numerous species, making up 40.8 percent of the population. Five species reached their highest densities in wet meadows: ring-necked pheasant, upland sandpiper, bobolink, eastern meadowlark, and western meadowlark. The eastern meadowlark was the only species restricted to wet meadows.

Riverine Wetland

Riverine wetland vegetation occurs primarily in areas of standing water behind dams and in isolated pools of water adjacent to the river channel (Currier 1982). Areas of riverine wetland vegetation occur most frequently along the North Platte River and in widely scattered reaches of the Platte River between Lexington and Grand Island. Hardstem bulrush, American bulrush, cattail, spikerush, water sedge, fog fruit, and coyote willow make up the predominant emergent vegetation of this community.

Characteristic breeding birds of riverine wetlands include pied-billed grebe, great blue heron, green-backed heron, wood duck, mallard, virginia rail, sora, killdeer, belted kingfisher, eastern phoebe, tree swallow, northern rough-winged swallow, bank swallow, cliff swallow, barn swallow,

marsh wren, yellow warbler, common yellowthroat, red-winged blackbird, yellow-headed blackbird, and brown-headed cowbird.

Open River Channel Island

This community is made up of exposed sandy deposits within the river channels. Open River Channel Islands are usually exposed during the summer as river levels decline from increased evapotranspiration, low precipitation, and increased water demands for agricultural production. Higher river levels during spring result in scouring the islands and the removal of short-lived plant species (Currier 1982). Although well distributed throughout the Platte River Valley, the bulk of this community occurs in Hall County between Alda and Grand Island, and in Lincoln County between Hershey and North Platte.

Vegetation characteristic of open river channel islands is typically annuals and biennials that can become established quickly during dry periods. Dominant plant species of this community include lovegrass, various nutsedges, cocklebur, barnyard grass, and sand dropseed.

Breeding birds of this open community include piping plover, killdeer, spotted sandpiper, and least tern. The plover and tern are especially characteristic of open sandbars, and their range and breeding populations have apparently declined dramatically in response to increasing woody vegetation encroachment of the sandbars.

Man-made Habitats

Shelterbelts

Long, narrow, belts of trees and shrubs occur at the periphery of agricultural fields and near farmsteads. Shelterbelt establishment was encouraged by the Timber Culture Act of 1873. The Act provided for the acquisition of an additional free section (252 ha) of land for each 4 or more ha of shelterbelt trees planted (Albertson and Weaver 1945). In 1979, shelterbelts occupied about 8,300 ha (0.3%) of the study area.

Cottonwood and red cedar are the predominant tree species planted in shelterbelts. Other frequently encountered tree species include Russian olive, green ash, American elm, slippery elm, red mulberry, box elder, silver maple, hackberry, Chinese elm, and Siberian elm. The ground layer is usually poorly developed, consisting of various grasses including Kentucky bluegrass and timothy.

Characteristic breeding birds of shelterbelts include mourning dove, red-headed woodpecker, northern flicker, western kingbird, eastern kingbird, blue jay, house wren, American robin, brown

thrasher, European starling, yellow warbler, northern cardinal, common grackle, brown-headed cowbird, orchard oriole, and house sparrow.

Data on the estimated number of pairs per km^2 for each habitat type indicate that largest breeding densities occurred in shelterbelts (Table 1). Populations were similar between years thus suggesting little year-to-year variation. Shelterbelts were used by 26 species, of which 22 were considered nesting species. Eleven species reached their highest density in shelterbelts: red-headed woodpecker, eastern kingbird, and northern oriole were most abundant.

Yahner (1980) reported considerably higher breeding densities in four mature Minnesota shelterbelts. His densities ranged from 3,440 to 9,800 pairs per km^2. Common grackles and mourning doves were the most abundant breeding birds; greatest densities for those bird species were 8,419 and 709 pairs per km^2, respectively (Yahner 1980). Ressell (1973 a,b,c,d) reported densities ranging from 699 to 2,137 pairs per km^2 in mature shelterbelts in eastern North Dakota. Mourning dove, yellow warbler, and American robin were the three most abundant species. Species diversity in Ressell's area ranged from 4 to 14 species. H. A. Kantrud (pers. comm.) found that breeding bird densities in central North Dakota shelterbelts averaged 803 pairs per km^2 and consisted of 33 species.

The total number of species occupying shelterbelt habitat during the nesting season was among the lowest of all habitats (Table 1). Species diversity and equitability in shelterbelts were among the highest of all habitat in the Platte River Valley. Species diversity of a habitat is determined by the number of species in the habitat and the number of individuals of each species that are present. Equitability is highest when all species in the sample are as nearly equal in population as is possible (Kricher 1972). Although the number of species of breeding birds occupying shelterbelts is relatively low, their densities indicate that minimum habitat requirements are being met for a number of species.

Cropland

About 55% of the land area within our study area was devoted to some form of crops in 1969 (Bose 1977). The intensity of agricultural land use ranged from 14% in Garden County to 84% in Hamilton County (Table 2). Because much of the study area was originally native grassland. The changes wrought by agriculture have made dramatic inroads into avian populations and species diversity. Current agricultural practices of fencerow to fencerow farming, summer fallowing, fencerow removal and shelterbelt removal to facilitate expanded use of center-pivot irrigation systems have placed additional stresses on native bird communities.

Corn production is the predominant use of much of the land in the eastern half of the study area. Large areas of land in Buffalo and Dawson counties are devoted to alfalfa production. Winter

wheat is grown extensively in the western counties of Lincoln, Keith, Garden and Deuel. The breeding avifauna of cropland is decidedly barren in comparison to natural or other man-made habitats. Among land uses, the fewest breeding bird species occupy cornfields. The horned lark is most characteristic of cornfields. This holds only until after emergence of the corn which greatly diminishes the suitability of cornfields to that bird species. Of the 17 major habitat types studied by Graber and Graber (1963) in Illinois, row crops (corn and soybeans) consistently supported the lowest mean nesting densities.

Breeding bird populations in corn fields were the third lowest among all habitats in the study area. Eighteen bird species were recorded in corn fields, of which only three (horned lark, killdeer, and western meadowlark) were considered breeders. The mean density of breeding birds was 63 pairs per km^2. Of the three breeding species, the western meadowlark made up 47.8 percent of the population. No species reached its highest density in cornfields. Graber and Graber (1963) reported that the nesting avifauna of Illinois cornfields was dominated by killdeer, horned lark, and vesper sparrow. Mean breeding density in cornfields across Illinois ranged from 74 to 222 pairs/km^2.

Twenty-eight species of birds occupied alfalfa fields in our study area, of which 13 species were considered nesting. The mean density was 101 pairs per km^2. Dickcissel, red-winged blackbird, western meadowlark and brown-headed cowbird occurred in highest densities. No species reached its maximum breeding density in alfalfa fields. Graber and Graber (1963) found nine species nesting in Illinois alfalfa fields; red-winged blackbird and dickcissel were the two most numerous nesting species.

Eight species were recorded in domestic pastures. The mean density of breeding birds was 58 pairs per km^2. Red-winged blackbird and western meadowlark occurred in greatest densities, making up 52.6 percent of the population. No species reached its maximum breeding density in domestic pastures.

The mean breeding density of 48 pairs per km^2 in winter wheat fields was the lowest recorded in the study area. Thirteen of the fifteen species recorded in wheat fields were considered to be nesting. Lark bunting, western meadowlark and grasshopper sparrow were most abundant, making up 60 percent of the population. Only one species, the lark bunting (at 12 pairs/km^2) reached its greatest population density in wheat fields. Nesting densities in southern Illinois wheat fields ranged from 25 to 74 pairs per km^2 (Graber and Graber 1963). Dickcissel, meadowlark sp., and grasshopper sparrow were the three most numerous nesting birds in central Illinois wheat fields (Graber and Graber 1963).

Residential Habitats

Numerous small towns and cities within the study area provide a wide range of habitats available for breeding birds. Prominent among these are deciduous and coniferous ornamental plantings around residences, parks and cemeteries, industrial areas, grain elevators, building ledges, and landfills. Diverse food sources are provided in these settings, which accommodate the existence of numerous bird species. Graber and Graber (1963) stated that residential habitats in Illinois supported higher densities of breeding birds than any other habitat except ecotones.

Characteristic breeding birds of residential habitats include rock dove, mourning dove, common nighthawk, chimney swift, downy woodpecker, western kingbird, purple martin, barn swallow, blue jay, black-capped chickadee, white-breasted nuthatch, house wren, American robin, northern mockingbird, European starling, northern cardinal, rose-breasted grosbeak, chipping sparrow, common grackle, northern oriole, house finch, and house sparrow.

The estimated density of breeding pairs in residential habitats was 624 pairs per km^2 (Table 1). Populations between years were quite variable, related primarily to wide fluctuations in the number of house sparrows in each plot. Residential habitats were used by 23 species, and eight species reached their maximum density here. The breeding birds of residential areas were dominated by four species, which accounted for 61.8% of the population: house sparrow, common grackle, chimney swift, European starling. Chimney swifts had the most stable population of the common breeding birds in residential areas. Several species of irregular occurrence in south-central Nebraska were found in residential habitats including pine siskin and house finch.

Dutch elm disease has spread throughout the Platte River Valley, and there was an abundance of dead branches and natural cavities, which provided numerous places for hole-nesting European starlings and house sparrows. The general lack of other hole-nesters including northern flicker, black-capped chickadee and white-breasted nuthatch in residential habitats was probably due to competitive exclusion by the more aggressive house sparrows and European starlings.

Our population estimate of 624 pairs per km^2 is quite similar to estimates of 588 and 600 in Ohio (Claugus 1977, 1978), 610 in Manitoba (Erskine 1972) and 645 in New Jersey (Waal Melefyt 1977).

Changes in Habitat Quality

Before settlement, most of the Platte River Valley was poorly drained sedge meadows and marshes. The lowland prairies, which were characterized by big bluestem, dominated the valley. Short- and mid-grass prairies of little bluestem and buffalo grass were the dominant feature on the bluffs and tablelands surrounding the valley. The sod of both the lowland and upland prairies remained intact for thousands of years before the arrival of the settlers. Except for the nomadic grazing of bison (*Bison bison*) and other native species, and the cultivation of small patches for corn and squash by the Native Americans, there was relatively little disturbance of the prairie. Prairie fires, either intentionally set by Native Americans, or naturally ignited by lightning, periodically swept the prairies, stimulating the growth of native grasses and forbs. For thousands of years the natural process of plant production, litter decomposition and decay, and regrowth of underground and aboveground shoots resulted in the gradual accumulation of a rich topsoil 0.15 m to 0.30 m deep.

Early observers failed to recognize the richness and productivity of these soils. The plains were known as the "Great American Desert" because the soils were thought to be so poor that they could not support forests. In fact, the prevailing theory today is that forests were not prevalent on the plains because of the semi-arid climate and the frequent prairie fires. The numerous woodlots and shelterbelts present today are evidence that the soils in the Platte River Valley are indeed sufficient to support trees.

Once the richness of the valley soils was recognized, cultivation soon began. The development of agricultural lands was promoted by the federal government through the Homestead Act of 1862 and the Timber Claim Act of 1873. The Homestead Act allowed settlers to claim 65 ha if they were willing to cultivate or reside on the land for 5 years. Lands given to the railroads by the federal or State governments were also available for purchase. In Nebraska, the Union Pacific, Burlington, and Chicago and Northwestern railroads sold land to settlers through their land companies. In some circumstances the land companies sponsored agricultural fairs in cities such as Chicago, in which they touted the fertility of the prairie and tried to lure prospective land-buyers into starting a new life on the plains.

Homesteaders in the Platte River Valley faced major obstacles in converting the lowland prairies and wet meadows into productive agricultural lands. The first task was simply to break the sod. The dense grass sod that had developed over thousands of years was not easy to turn with horses and a manual plow. Once the sod was turned, the next step was

drainage. Although the soils in the valley are sandy and generally well drained, overflow from the river, high ground water levels when the river level is high, and heavy spring rains contributed to standing water areas each spring over much of the bottomlands adjacent to the Platte. It was often too late to plant crops by the time the bottomlands dried out. For this reason, farmers began draining their land by digging open ditches to carry water to the river channel. The wettest areas and those with rolling topography were difficult to farm, and were generally reserved for pasture or hayland. Most of these reserved lands were located on the bluffs surrounding the river or adjacent to the river channel.

Drainage of river lands has apparently been a slow process, beginning in the 1870's and continuing to the present. Most of the large-scale drainage systems were completed by the 1940's. Since that time, declining river levels in the Platte have allowed some of the formerly very wet prairie lowlands near the river channel to be converted to croplands. Many of these lands, however, were flooded during the 1983 growing season when river flows were at a 40-year sustained peak of over 20,000 cubic feet/sec (CFS) (566 cubic meters/sec.).

Unpredictable rainfall and other natural catastrophic events were also major obstacles to early homesteaders. Many settlers were unable to make a living. Nearly 50% of the original homestead entries, for instance, were never carried through to a final claim (Olson 1966). Until the 1940's and 1950's when widespread use of pesticides began, a farmer could protect his crops from the vagaries of nature only by employing a crop rotation program and selecting hardy varieties. As a protection against drought, irritation was introduced as early as the 1860's. The early irrigation systems used direct diversion of water from the Platte and were limited to areas adjacent to the river channel.

Gravity irrigation began to be widely used in the 1940's, 1950's, and 1960's to irrigate relatively level croplands. In such a system either groundwater is pumped or water is delivered through a canal system to the upper end of a field and allowed to flow with gravity through a furrow to the lower end of the field. Land leveling has been used extensively to allow gravity irritation of fields that formerly were not level. The subsequent development of center-pivot irrigation has eliminated the need for land leveling in many situations, and has allowed conversion of lands near the river channel with fragile soils that would not ordinarily withstand land leveling.

On the tablelands surrounding the Platte River Valley, the soils are better drained than those on the bottomlands, and they are also not affected by changes in river level. For this reason, wetland drainage has not been as extensive for development of cropland on the

tablelands. Because land on the tablelands is relatively level, nearly all of the native short-grass prairie has been converted to cropland. Wetland basins or "prairie potholes" on the tablelands are generally the only areas that have escaped conversion to cropland. These basins, which primarily collect spring runoff and precipitation, are particularly prevalent to the south of the Platte and are collectively known as the Rainwater Basins. Although the wetland basins have been difficult to drain, fewer than 10% of the basins present at the time of settlement remain today (Schildman 1981).

Along the North Platte River in western Nebraska, relatively rough topography and the arid climate have prevented conversion of much of the native sandhills prairie to cropland. Most of the cropland in the region is in the relatively flat bottomlands near the channel of the North Platte River. In recent years, center-pivot irrigation technology has sparked the conversion of some upland sandhill prairies to cropland, by providing irrigation lands that formerly received too little rainfall to support most crops. However, the uplands surrounding the North Platte Valley remain much the same as in presettlement times. Intensive grazing in some areas has altered the composition and character of grasslands in the sandhills, but most grasslands along the river are in relatively good range condition.

Cropland and Rangeland Changes

The conversion of prairie to cropland along the Big Bend stretch of the Platte River and along the North Platte River was essentially completed by 1911 (Currier et al. 1985). The amount of rangeland (principally native grassland)in the Big Bend region has fluctuated very little since 1911. Only 38% of the native big bluestem lowland prairie and short-grass upland prairie remained in 1911. Following a slight decline (3%) in rangeland between 1911 and 1939, the amount of rangeland increased to 42% by 1950. This increase is probably in response to the drought years in the 1930's, and most likely represents croplands which were either seeded or allowed to revert to grassland. By 1980, the percentage of rangeland had declined again to 39% of the total land area.

Along the North Platte River, much more of the native grassland was still present in 1911. At that time 83% of the rangeland remained. There was a decline of about 10% in rangeland from 1911 to 1939 and this decline continued through 1950. Between 1950 and 1980, however, the amount of rangeland increased to 79% of the land area along the North Platte River.

Changes in cropland between 1911 and 1980 have been more dramatic than those in rangeland. Although some native grasslands are included in the hayland category, most of the area represents alfalfa production. In the Big Bend region there have been 2 major

changes in cropland acreage. First, the amount of hayland has steadily declined from 16% in 1911 to 6% in 1980. This change reflects the shift from raising a mixture of crops and livestock toward raising row crops only. Secondly, the area of land in corn gradually increased from (22%) 1911 to (25%) 1950 and then dramatically increased between 1950 and 1980 to 44% of the land area. This jump in the production of corn has largely been at the expense of a reduction in other crops which declined by 15% between 1950 to 1980. The slight decline (3%) in rangeland in the 1950 to 1980 period may also account for some of the increase in corn acreage. The shift towards corn has resulted in cropland monoculture in many areas adjacent to the Big Bend stretch of the Platte River. In 1980, corn accounted for over 73% of all crop production (including alfalfa). Excluding haylands, 81% of all cropland was planted to corn in 1980. The remaining 19% included wheat, sorghum, soybeans, oats, and barley.

Summary of Habitat Changes

Settlement and agricultural development in the Platte River Valley over the past 120 years have impacted the natural communities of plants and animals. The major habitat changes, are as follows (Currier et al. 1985):

(1) 66% reduction in average mean discharge of the Platte River (gauged at Overton) as a result of diversion and storage of water for irrigation, power generation and other uses.

(2) 68% reduction in average peak discharge of the Platte River (gauged at Overton) as a result of diversion and storage of water for irrigation, power generation and other uses.

(3) 65% to 79% reduction in channel width on the Platte River and a corresponding increase in encroachment of the channel by trees and shrubs following regulation of water in the river (Table 3).

(4) 58% to 87% reduction in area in the Platte River channel as a result of encroachment of wooded vegetation.

(5) As much as 97% loss of optimal sandhill crane roosting habitat in some segments of the Platte River as a result of wooded vegetation encroachment.

(6) 73% loss of native grasslands and wetland meadows within 5.6 km of the Platte River.

(7) Extensive drainage of the wetlands adjacent to the Platte River channel following declines in river flows and the construction of open ditch drainage systems.

(8) A reduction in production and cover of native grasslands and a shift in composition to early-maturing (cool-season) grasses, as a result of intensive grazing and the suppression of natural fires.

Changes in the Platte River habitat since the time of settlement are quantified in (Table 3). These data were generated from the geographical information system of the Platte River Whooping Crane Trust, Grand Island, Nebraska and compared with the status of native habitat before settlement (1840's). Since settlement, 2 major habitat components have greatly diminished; (1) open, unvegetated river channel, and (2) native lowland grasslands and tallgrass prairie.

Within the Big Bend stretch of the Platte 10,500 ha of river channel have been altered or lost; on the North Platte River an additional 3,239 ha of river channel has been lost. This amounts to a loss of 230 to 260 ha of river channel. These estimates are conservative, because lands in agricultural production (e.g., cropland, alfalfa) that lie within the historic 1840's floodplain boundary have been excluded from the analysis of channel losses.

Losses of native lowland grasslands and sandhills prairie on the lands adjacent to the river channel have also been substantial. Within the database area, native prairie grassland losses have averaged 52%. In the Big Bend reach of the Platte, grassland losses have ranged from 56% near Odessa to about 80% near Grand Island and near Shelton. The average loss of grassland in the Big Bend reach has been 72%. This loss is greater than the 61% overall loss of grasslands in the counties adjacent to the Big Bend, and indicates that conversion of grassland to cropland in the Platte Valley has occurred at an accelerated rate in comparison with adjacent lands.

Losses of native grassland along the North Platte River have been considerably less than on the Platte, ranging from 25% near Lewellen to 37% near North Platte. On average, grassland loss along the North Platte River has been 31%. As along the Platte River, the conversion of grassland to cropland in the North Platte River valley has been greater than in the surrounding counties where the loss has been 21%.

Current management practices have also seriously degraded the quality of much of the remainingnative grassland. On the dissected uplands surrounding the Platte River Valley the native range is in relatively good condition, but the rangeland on the river bottom is generally in poor condition. Years of season-long grazing, high stocking rates, and suppression of natural fires have permanently altered the character of many native

grasslands. Species composition has gradually shifted from native late-maturing (warm-season) prairie grasses to a dominance by early-maturing (cool-season) grasses. This change has resulted in lower forage production and a reduction in cover for nesting birds and other species (e.g., small mammals that provide food for some migratory birds).

Human disturbances and development account for a relatively small proportion of the total land area (7.4%) in the Platte River Valley. The location of these disturbances, however, is critical when assessing their impact on migratory birds. For instance, one of the most serious disturbances in the Platte River Valley is Interstate Highway 80, which parallels the Platte River for over 161 km in central Nebraska. The roadway was completed in the mid-1960's in the floodplain of the river, less than 0.1 km was from the channel in many areas. Along the north side of the Platte River the habitat for migratory birds has nearly been eliminated by the presence of I-80. The wet meadows and sloughs that existed where I-80 lies today provided some of the best nesting and feeding habitat for migratory birds along the Platte River.

Summary of Impacts

The changes in riverine and grassland habitat along the Platte and North Platte rivers have had a major impact on migratory birds. Several species present at the time of settlement are now extinct. Populations of several other species have been reduced to endangered (e.g., least tern) status. The loss of nesting, feeding, and migration habitat and uncontrolled hunting have been the dominant factors leading to reduced populations among many migratory birds. Intensive hunting directly reduced some species over a short period of time, with little chance that these species could repopulate. The permanent and irreversible destruction of habitat, however, has had a long-term detrimental effect on many migratory species. The thousands of years of co-existence of prairie grasslands in the Great Plains and the birds that inhabited them was cut short by an intensive period of human and agricultural development between 1840 and 1900. This 60-year development period is incredibly short for native species to adapt to the changing environment in the Great Plains.

Human and agricultural development in the Great Plains has affected migratory birds in two general phases. The first phase occurred before the turn of the century when market hunting was in its heyday and cropland was being molded out of the prairie. During this

time much of the feeding and nesting habitat for migratory birds was lost. Some populations of migratory birds were reduced directly as a result of uncontrolled hunting. In the second phase of development, Platte River flows were regulated for irrigation and power generation.

Although water development began as early as the 1860's (direct diversion for irrigation), the primary impact on Platte River flows was not felt until the development of large storage reservoirs on the river between 1909 and 1940. Water diversion and storage has altered the historic streamflow of the Platte and resulted in the development of forest and shrub communities where once there had been an unvegetated, wide river channel of shifting alluvial sand. The development of forest vegetation in the Big Bend reach of the Platte (especially between Brady and Overton) has accelerated since the late 1930's. Kingsley Dam and Lake McConaughy in Nebraska, and other reservoirs on the North Platte River upstream from Lake McConaughy, have been the major factor responsible for alteration of the flow regime in the Platte since the 1930's and consequently for the development of the wooded vegetation on the floodplain. Following regulation of the Platte, the breeding birds that were adapted to unvegetated sandy river channel, standing water sloughs, marshes, and wet meadows were forced into the few remaining areas of prairie-riverine habitat.

Changes in the distribution of sandhill crane populations on the Platte River since the 1930's are an excellent example of how a species has been forced to use alternative riverine habitat. The reach of the Platte between Cozad and Lexington served as one of the largest roost site complexes for sandhill cranes in the 1930's and 1940's. As a result of forest encroachment, sandhill cranes have now completely abandoned this stretch of the Platte River. The cranes have gradually shifted their distribution to more open areas of the channel farther east. The river channel near Grand Island is now one of the most important roost sites for sandhill cranes on the Platte River. This area was sparsely used 20 years ago when the channel farther west provided suitable roosting habitat. Currently there is no habitat suitable for sandhill crane roosting east of Grand Island.

Because most bird species require a complex of habitat types for feeding, nesting, and roosting, their responses reflect the net effect of habitat changes on particular species. Changes in the availability of habitat, and the effects of these changes on survivorship were considered in determining the response for each population. Of the 233 species of migratory birds currently recorded in the Platte River Valley, 45% (104 species) have benefited by habitat changes, while 42% (98 species) have declined, and 13% (31 species) have not changed noticeably (Table 4). The impacts of habitat alteration on the migratory species

that currently nest in the Platte River Valley have generally been less severe than the impacts on migrant bird populations.

The most vulnerable species in the valley (i.e., endangered or threatened) have generally been negatively affected by habitat changes. In an evaluation of the 28 most vulnerable species, 18 species (64%) have declined as a result of habitat changes, while only 10 species (36%) have benefited. Of the 4 endangered and threatened species present along the Platte River, all but the bald eagle have been negatively affected by habitat changes.

Species adapted to woodland and shrub communities have been the primary beneficiaries of the change in habitat. Most of these species have expanded their populations in response to the increasing woody vegetation on the Platte River floodplain and around farmsteads. At the time of settlement there were few woodlands along the Platte River or on the adjacent prairies. Species adapted to woodland communities were not common or abundant before settlement. Woodland species have gradually invaded the Platte River Valley from forests to the east and from the Rocky Mountains to the west. Although woodland species have been increasing in response to the changing environment, native grassland species have been declining. As a group, species associated with native lowland grasslands have undergone the most substantial population declines (U.S. Fish and Wildlife Service 1981). Species adapted to unvegetated alluvial sandbars have also suffered. The encroachment of woody vegetation on Platte River sandbars has reduced roosting and nesting habitat for sandhill cranes, whooping cranes, least terns, ducks and geese.

Ring-necked pheasants and some waterfowl have benefited by adapting their diets to feeding on waste grain, generally corn. Because of the abundance of waste corn in the valley, some flocks of waterfowl now winter along the Platte River instead of migrating farther south as they traditionally have done.

Many of the increasing woodland- and shrub-adapted migratory birds are common or abundant, and have ubiquitous distributions. Most of the species on the decline, however, are uncommon, species with localized distributions. For example, the great horned owl, northern flicker, and Bell's vireo are woodland species which are widely distributed throughout the midwest, as well as along the Platte River. Grasshopper sparrows, upland sandpipers, and dickcissels, however, are grassland species with relatively limited distributions in the Great Plains. Woodland and shrub communities are widespread throughout the midwest, while grassland communities are almost universally being destroyed.

Grassland habitat losses have been considerable throughout the Great Plains. These losses have been most significant in the area bounded by Texas, Illinois, Saskatchewan, and Colorado. To the east of central Nebraska, grassland losses have been considerably greater than those along the Platte River. In the more arid region to the west, grassland losses have been less severe. Because grasslands are being lost at an accelerated rate on the Great Plains, bird species adapted to this habitat type are in greater peril than those adapted to woodlands. The unique character of the prairie habitat surrounding the Platte River before settlement makes the loss of grasslands in the valley particularly devastating to breeding birds. The lush wetland bottomlands and prairies surrounding the broad, shallow channel of the historic Platte, provided an ideal, centrally located oasis for migratory birds on their route to northern breeding grounds. No other place in the flyway provided such a complex of grassland, wetland, and sandy riverbed habitat.

Much of the riverine habitat for migratory birds along the Platte River today is in a transitional stage of development from an open, unvegetated, sandy river channel, to a forest community. The gradual development of wooded vegetation on the Platte River floodplain has resulted in a mixture of tree and shrub communities at various intermediate stages of growth and species compositions. The structural diversity provided by these successional stages has resulted in a greater habitat diversity for migratory birds. We found 50 species of breeding birds using these early-growth lowland forests. Seven of the species recorded were not found outside of these woodlands. Bell's vireo, for example, is a species primarily confined to young willows on the river floodplain. The willow community provides less diverse habitat for migratory birds than mature cottonwood forests. Many of the species taking advantage of the transitional shrub and woodland habitats available today will eventually be displaced as the forest communities mature into a uniform habitat type.

The benefits of transitional and agricultural habitats are temporary. Bald eagles, for instance, have benefited from an increase in forest vegetation along the Platte River, particularly in areas where the forest borders open river channel. Bald eagles are primarily dependent on fish and waterfowl as a food source while they are in the Platte River Valley. Without protection of instream flows to maintain a fishery, and open river channel to provide roost sites for waterfowl, the food source for bald eagles would be severely limited and there would be little available habitat for this species. A transitional habitat of 50% trees and 50% open river channel, for instance, would be much more valuable to bald eagles than a channel almost entirely covered by mature forest trees. Waterfowl and ring-necked pheasants, as mentioned previously, have benefited from agricultural production of corn. There are no guarantees, however, that corn will remain the principal crop in the

Platte River Valley. A change in the economics of growing corn could immediately eliminate this food source for these species. Furthermore, cornfields provide only one component of the habitat complex required by waterfowl and species such as the ring-necked pheasant. Corn is a food source for a relatively small portion of the year (winter months). Without nesting habitat, roosting habitat, and food sources other than corn, these species cannot reproduce and sustain their population. Cornfields alone cannot provide for all the habitat needs of species such as waterfowl and pheasants.

The widespread use of pesticides in croplands is also detrimental to waterfowl and other migratory birds that feed on waste grain. Pesticide residues in grain and the soils are ingested by birds feeding in croplands. Many of these pesticides are absorbed and accumulated in the fat tissues of the birds, and are eventually transferred and concentrated in species such as hawks and bald eagles, which are at a higher level in the food chain.

Biogeographic Distribution of Breeding Birds

The central Great Plains of North America are at a biological crossroads for many breeding bird species. Because of its east-west orientation, the Platte River Valley has accommodated the movement of several closely related forms that typically have an "eastern" or "western" distribution. The area of range overlap, and the resultant integration of closely allied species has been the subject of several studies hybridization. Groups receiving the greatest amount of attention thus far include black-headed and rose-breasted grosbeaks (Kroodsma 1970, Kroodsma 1974), indigo and lazuli buntings (Kroodsma 1970), eastern and western meadowlark (Lanyon 1957), and Baltimore and Bullock's orioles (Sibley and Short 1964, Rising 1983).

Cook (1969) found a decrease in the number of breeding bird species progressing southward from central Canada. One explanation for decreasing numbers of species is found in examination of glacial history. During the pre-Pleistocene, much of the central United States was covered with tropical or sub-tropical forests. Advancing ice sheets caused species to retreat to the south and west, away from the central regions. At the close of the last glacial epoch, breeding bird distributions were influenced not only by the lack of species in response to glacial-period movements, but also by the increasing area of grasslands forming in the rain shadow of the Rocky Mountains.

The grassland biome is relatively depauperate of breeding bird species compared with more structurally complex habitats such as forests (Kantrud and Kologiski 1982). Thus, the early developmental history of the central United States avifauna was influenced by the preponderance of species adapted to the grassland biome. Peterson (1975) analyzed data from the North American Breeding Bird Survey (BBS) and ranked the biogeographic zones used to stratify the continent for the BBS by the average number of species observed per route. The High Plains Border (eastern half of our study area) ranked 33rd out of 56 strata, and the High Plains (western half of our study area) ranked 46.

Examination of species diversity among the 56 North American strata revealed that the High Plains Border ranked 37, and the High Plains ranked 47. Generally, the species diversity indices for these two strata suggest that although there was a moderate number of species available, their population levels were influenced by the preponderance of a few species in the sample. Among the species recorded on most BBS routes in the study area, red-winged blackbird, common grackle, European starling, and house sparrow were typically the four most numerous species.

Peterson (1975) went on to examine latitudinal stratification on the continent. A positive relationship was found between the average number of species recorded and the degrees of latitude north from southern Texas. Peterson concluded that the latitudinal stratification he found was influenced by the more heterogeneous landscape in the north, which attracts and supports more species than in areas farther south.

We find Peterson's (1975) conclusion to be in general agreement with our analysis. Because of its location at the center of the Great Plains, the Platte River Valley is far removed from the principal nesting areas for many bird species. For instance, the study area is about 650 km east of the coniferous forests of the Rocky Mountains. Although the Missouri River riparian forests are about 200 km from the eastern edge of our study area, the large contiguous eastern deciduous forest with its myriad of warblers, thrushes, and flycatchers are 800 km farther removed. The Platte River Valley is about 350 km south of the northern Great Plains prairie and wetland habitats, and about 1500 km north of the south Texas brushlands, and the species with typically Mexican or southwestern distribution that exist there. Although small outliers of most of these biomes exist in various regions of the Platte River Valley, and thus contribute to the overall uniqueness of the area, in general the lack of extensive areas of these habitats undoubtedly contributes to the overall lack of diversity of breeding bird species throughout the study area.

Examination of the zoogeographic distribution and faunal affinities of the breeding avifauna of the Platte River Valley, reveals that the majority of species are associated with woodlands (47.6%) and are of Pandemic origin (44.1%) (Table 5). Terms used in this analysis are from Johnsgard (1979) including:

Pandemic: a species having a large, continuous or disruptive distribution pattern not clearly associated with major vegetation types.

Endemic: a species largely limited to the grasslands and wetlands of the Great Plains.

Eastern: a species with a breeding distribution generally associated with areas or habitats east or southeast of the study area.

Northern: a species having a breeding distribution associated with areas or habitats north or northeast of the study area.

Western: a species having a breeding distribution associated with major areas or habitats west or northwest of the study area.

Southern: a species having a breeding distribution associated with major habitats south or southwest of the study area.

Introduced: a species added to the local avifauna as a result of humans.

The habitat affinities of individual species are described as:

Forested: a species having a distribution associated with native deciduous woodlands or earlier wooded successional stages.

Grassland and Xeric Shrub: a species having a distribution generally associated with native grasslands or introduced grass species; xeric shrub species are associated with arid or shrub-dominated vegetation types.

Aquatic: a species having a distribution associated with natural basin wetlands, rivers, or reservoirs and lakes.

Miscellaneous: a species having a breeding distribution not specifically associated with any of the above-mentioned vegetation types.

Most Pandemic species have forest affinities. The preponderance of eastern species in the breeding population suggests that the Rocky Mountain montane habitats, coupled with the wide expanse of arid grasslands are an effective barrier for the eastward expansion of western species. The virtual lack of northern and southern species with woodland affinities

relates principally to the lack of northern coniferous communities and arid brushland communities in south-central Nebraska.

The influence of typical western species in the avifauna is especially pronounced among grassland birds, which make up about 44% of the western avifauna. The large number of grassland species reflects the importance of the prairie in contributing to the Platte River avifauna. Among aquatic species, about 59% are of Pandemic origin, whereas only about 6% are of northern origin. The aquatic species nesting in the study area are principally waterfowl and rails. Most waterfowl species considered here are dabbling ducks with wide-ranging distributions. The lack of a northern component among aquatic species reflects the lack of boreal-nesting waterfowl and also many of the common shorebirds including marbled godwit (*Limosa fedoa*)and the *Calidris* sandpipers.

Although located at about 40 degrees north latitude, the Platte River Valley avifauna is relatively depauperate of typical southern species (2.1%). Among the species in our study area, only the scissor-tailed flycather, Chihuahuan raven, great-tailed grackle, and blue grosbeak are of southern origin. There are scattered, sporadic nest records of the flycatcher and raven. The great-tailed grackle is a relatively recent addition to the nesting avifauna (Faanes and Norling 1979). Only the blue grosbeak is of regular occurrence as a nesting species throughout the study area.

The virtual lack of southern nesting species at this latitude appears to relate to past glacial activity which forced many species into southern refugia. Apparently the time span since the close of the last glacial epoch has not been sufficient to allow the colonization of the region by additional southern species. The absence of xeric shrub and brushland habitats throughout the study area appears to also have a pronounced influence on southern species colonization of the Platte River Valley. Perhaps the nearest large area supporting species typical of southern xeric habitats is along the Cimmaron National Grasslands in Morton County, Kansas, about 400 km south of North Platte, Nebraska.

The recent nesting-season sightings of species typical of southern habitats such as Mississippi kite, snowy plover, and white-faced ibis coupled with the rapid colonization of the study area by the great-tailed grackle, may be a signal of future movement of additional southern species into the study area.

Data gathered from the North American Breeding Bird Survey (BBS) (Bystrak 1981) provide an effective index to bird population levels, both temporal and spatial. Therefore, we analyzed data from 7 BBS routes in our study area (Fig. 4) to seek differences in relative

abundance among species. These data suggest striking differences in relative abundance of some sources across an apparent east-west environmental gradient (Table 6).

Data for ring-necked pheasant suggest their relative abundance is patchy throughout the study area, although occurring in greatest numbers in northern Lincoln County. The distribution of northern bobwhite is equally patchy, although largest numbers are in the east and in areas supporting a heterogeneous mixture of native grasslands, woodlands, and cropland.

Among shorebirds, the killdeer occurs in greatest relative abundance in the western counties that support extensive areas of native grassland and fallow fields. Upland sandpiper occurs in greatest abundance along the route of the Kearney BBS, which traverses extensive areas of wet meadow habitats adjacent to the Platte River. The long-billed curlew is absent east of 100 degrees W. longitude.

Numbers of chimney swift are more heavily weighted toward the eastern half of the study area, generally east of 100 degrees W. longitude. The eastern half also contains more urban-residential areas which support chimneys providing suitable nest sites. The distribution of red-headed woodpecker abundance grades slowly from east to west. Much of the abundance of the species appears to be related not only to geographic location, but also to the presence of dead trees resulting from flooding and dutch elm disease. Northern flickers, on the other hand, appear to be most abundant in the central third of the Platte River Valley. Previous investigations (Short 1961), have shown the Platte River Valley to be an important hybridization zone for the yellow-shafted and red-shafted subspecies of northern flicker.

Relative abundance of the western kingbird and eastern kingbird appears to be similar except that the eastern kingbird occurs in slightly larger numbers west of 100 degrees W. longitude. Horned lark is also more abundant west of 100 degrees W. longitude. This pattern may be a reflection of actual biogeographic preference for western climate and physiography. However, habitat may be an important influence as well. Much of the uplands east of 100 degrees W. longitude has been converted to corn production. Our breeding bird population data reveal that corn provides unsuitable habitat for many bird species because of its rapid upward growth after emergence from the ground. Lower numbers of horned larks may be a reflection of habitat in addition to biogeographic affinities.

Among the Corvidae, blue jay numbers are largest in the east, which coincides with the eastern woodland affinity of this species. Black-billed magpies occur in largest numbers in the west. The American crow population is largest in the eastern half of the study area.

American crow numbers probably reflect the larger number of farmsteads, shelterbelts, and feedlots here which crows use extensively for feeding, nesting and roosting.

Black-capped chickadee abundance is greatest in the eastern half of the study area, reflecting the general eastern affinity of this woodland species. House wrens are also most abundant in the east. Eastern bluebirds become virtually nonexistent west of 100 degrees W. longitude, and American robin numbers also decline west of that longitude. Gray catbird distribution appears to be related to the location of Riparian Forests along the Platte River, but northern mockingbirds are most prevalent in the west. The latter may reflect colonization of the Platte River by southwestern populations of this ubiquitous species of the southern United States.

The center of abundance of the brown thrasher was in the western half of the study area. The occurrence of large numbers of brown thrashers in the west may be a reflection of habitat stability because this species is typically associated with eastern or southeastern scrub habitats. The intensive land use in the eastern half of the study area may be affecting brown thrasher distribution and abundance. Loggerhead shrike numbers are also greater in the west. This species, too, may be responding to variations in land use intensity further east, although sizeable numbers of loggerhead shrikes occur in the xeric habitats southwest of the study area.

The abundance of European starling in the eastern half of the study area reflects habitat preferences and availability. Not only are dead trees supporting suitable nest sites more numerous in the east, but cattle feedlots and other preferred starling feeding sites are more prevalent in the east. The first European starling in Nebraska was recorded at Hastings, Adams County, in 1937 (Hudson 1938), thus the eastern population has also been established longer.

Common yellowthroat abundance reflects the eastern affinity of this species. Northern cardinal numbers are also related to the eastern origin of this species, and may reflect the slow colonization of western habitats along the Platte River. Blue grosbeak numbers reflect the southern xericorigin of this species which becomes sporadic east of 100 degrees W. longitude. Indigo bunting, an eastern deciduous species, occurs in sporadic numbers adjacent to the Platte River. Surprisingly, relative abundance appears to increase as the species approaches the zone of overlap with the congeneric lazuli bunting. Dickcissel abundance follows the southeastern and southern origin of this grassland species.

Among the Emberizid sparrows, relative abundance of field sparrows appears to be greatest west of 100 degrees W. longitude. Areas supporting largest numbers of field sparrows are

associated with the mixed forests occurring in the highly dissected mixed prairie region of southern Lincoln County. Lark sparrow abundance reflects the western origin of this population and also the species apparent preference for shrub-dominated native grasslands supporting soapweed yucca. Lark bunting abundance increases rapidly as the 100 degrees W. longitude line is approached. Largest numbers are associated with the extensive native grasslands and winter wheat fields of the western counties. Grasshopper sparrow abundance coincides both with the western biogeographic origin of the bird, and also with the presence of contiguous areas of native grasslands in the western counties.

Relative abundance of the bobolink is influenced by the wet meadow habitats occurring along the route of the Kearney BBS. Johnsgard (1979) showed the southern limit of the bobolink breeding range in North America to closely parallel the Platte River Valley in Nebraska. Western meadowlark abundance nearly doubles upon approaching the 100 degrees W. longitude line. Distribution and abundance of this meadowlark reflects biogeographic origin more so than habitat availability, although lower numbers occurred in the heavily farmed regions of the eastern counties.

Red-winged blackbird abundance appeared to be relatively stable throughout, reflecting the ubiquitous habitat use of this species. Common grackle abundance, on the other hand, was a reflection of the eastern origin of this species, and the slow colonization of western habitats which this species is exhibiting. Preferred nesting habitat and feeding sites for common grackles are more prevalent in the eastern counties. Orchard oriole numbers appear to be greater in the western counties which may reflect a southwestern rather than southeastern origin of the Platte River population. Northern oriole numbers are greatest approaching the zone of overlap between the Baltimore and Bullock's subspecies. Relative abundance of the two subspecies appears to be similar within their usual ranges.

No discernible abundance patterns can be determined for the American goldfinch, although numbers are largest adjacent to the Platte River. The preponderance of house sparrows in the east is a reflection of greater human populations there, which contribute to the availability of nest sites and food sources.

Populations of Breeding Birds

During extensive observations of bird populations conducted in the study area during 1979-80, we obtained data on 125 breeding bird species. Johnsgard (1979) listed 201 bird species that currently breed or have bred in Nebraska, thus our total represents 62% of the breeding avifauna of Nebraska. Of the 125 breeding bird species we observed, 101 species (82%) were found on the random sample plots. Confirmed records of nests or dependent young were obtained for 51 bird species during those two years. An additional 23 bird species were recorded during these surveys that were not found on the random census plots. Among these species were several (greater prairie chicken, least tern) with restricted breeding ranges. However, three species that are fairly common in the study area (red-tailed hawk, black-billed cuckoo, Say's phoebe) were not found on sample plots.

Among habitat types, the greatest diversity occurred in lowland forest (55 species), and native prairie (51 species). Wheat and corn had the lowest species diversity, 18 and 3 species respectively. Those habitat types made up over 36% of the total habitat availability in the study area.

The mean density of all breeding birds within the study area was 110 per km^2. The projected breeding bird population in the valley was about 3,100,000 breeding pairs. Investigations of total breeding bird populations over large areas have usually considered the population of a state (Stewart and Kantrud 1975; Graber and Graber 1963) or a country (Fisher 1940). Only Merikallio (1958) in Finland reported a lower mean breeding density (96 pairs/km^2) than ours determined for the Platte River Valley. Mean breeding bird densities in Great Britain were estimated at 261 per km^2 (Fisher 1940). Graber and Graber (1963) reported statewide densities in Illinois ranged from 200 to 227 pairs per km^2 over several years. Stewart and Kantrud (1972) reported a statewide density of 143 pairs per km^2 in North Dakota.

Distribution and extent of habitats, and probably climatic variability, influenced the population densities we observed. Particularly important was the amount of cropland available. Stewart and Kantrud (1972) censused 130 randomly selected 65-ha census plots in North Dakota. Of these, about 48% consisted mostly or entirely of summer fallow or cereal grain fields. Stewart and Kantrud considered the difference in breeding densities between their study and Illinois was related to the greater degree of habitat variability, particularly woodlands, that existed in Illinois. Our lower densities were also related to differences in habitat variability. Among the important aspects were the large extent of

cropland, and the existence of the native grasslands in the Sandhills physiographic region. Native grasslands accounted for nearly 50% of the area, but breeding bird densities were relatively low.

Four orders accounted for 95% of the population. The Passeriformes were by far the most important group, contributing nearly 83% of the total, followed by Apodiformes, Piciformes, and Charadriiformes. In North Dakota, Stewart and Kantrud (1972) also reported that passerines were the dominant order, but that waterfowl and rails were among the two most common groups. In our area, waterfowl and rails combined accounted for 0.6% of the total population. These striking differences are related primarily to differences in habitat availability between the two areas. In North Dakota, wetlands made up 9.5% of the area censused, whereas in the Platte River Valley, wetlands contributed less than 0.3% of the area. Percentages of Charadriiformes in both areas were similar. The Platte River population of Charadriiformes was made up of five species; killdeer and upland sandpiper made up the bulk of the total.

Fifteen families made up 95% of the population (Table 7). The blackbirds and emberizine finches made up over 51% of the total. Five additional families (Passeridae, Tyrannidae, Apodidae, Picidae, and Sturnidae) made up an additional 26% of the population.

Thirty-five species made up about 95% of the total breeding bird population (Table 8). Among these, grasshopper sparrow, western meadowlark, and house sparrow made up over 26% of the total birds, each represented by over 240,000 breeding pairs. The common grackle and red-winged blackbird made up over 13% of the total population, each contributing over 190,000 breeding pairs. The remaining 30 species were represented by breeding populations of less than 150,000 pairs.

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Table 1. Population densities (pairs/km^2) and diversity of breeding species among major habitat types in the Platte River Valley.

	Density	Number of Species	Diversity (H')	Equitability (J')
Shelterbelt	698.8	24	4.263	1.341
Residential	631.2	23	3.499	1.116
Lowland forest	561.6	50	4.506	1.152
Wetlands	532.6	18	3.494	1.209
River channel Island	522.8	39	4.052	1.106
Upland native Prairie	110.6	30	3.609	1.061
Wet meadow	110.3	20	3.508	1.171
Alfalfa	101.2	14	3.004	1.138
Corn	63.0	3	1.509	1.374
Domestic hayland	58.6	7	2.542	1.306
Wheat	47.6	12	2.876	1.157

Table 2. Areal extent (in ha) of various land uses by county in the Platte River Valley.

County	Row crop	Wheat	Alfalfa	Upland prairie	Wet meadow	Lowland forest	Shelter belt	River channel island	Resi dential	Wet lands	Total
Adams	74,089	27,247	3,806	26,316	0	40	405	40	10,263	154	142,360
Buffalo	91,417	15,385	20,202	80,566	1,518	850	2,025	990	15,425	0	228,378
Dawson	72,550	3,725	41,984	101,052	3,036	1,822	587	4,635	11,893	0	241,284
Deuel	10,607	67,712	3,259	25,790	405	345	0	195	3,866	0	112,179
South half Garden	4,048	20,081	5,364	141,700	2,025	405	284	890	32,450	810	208,057
Gosper	38,502	14,170	4,858	56,275	40	202	405	60	4,797	405	119,714
Hall	74,575	5,223	7,450	26,518	3,623	708	425	445	10,587	200	129,754
Hamilton	103,765	6,761	3,806	9,515	1,125	324	202	445	8,500	325	134,768
Kearney	75,708	15,587	5,324	27,814	145	0	120	0	6,600	567	131,865
Keith	20,611	36,113	6,275	175,304	1,984	1,073	405	566	23,320	608	266,259
Lincoln	75,212	34,615	29,089	76,923	3,644	1,984	810	485	21,780	850	245,392
Merrick	70,850	4,656	5,304	26,315	2,025	324	243	445	10,280	0	120,442
Phelps	81,376	8,178	5,627	23,805	2,590	648	223	668	8,988	810	132,913
Total	783,313	259,453	142,348	797,893	22,160	8,725	6,134	9,864	168,749	4,729	2,203,368
% of total area	35.5	11.8	6.5	36.2	1.0	0.4	0.3	0.4	7.6	0.2	

Table 3. Changes in area (in ha) of channel and vegetation between 1938 and 1982 at 3 locations of the Big Bend reach of the Platte River compared with 1860. Data from Currier et al. (1985)

Location	Channel Area	Channel %change since 1860	Vegetation Area	Vegetation %change since 1860
Odessa				
1938	291.5	-39	188.7	+39
1969	69.6	-85	394.7	+82
1982	62.3	-87	403.4	+84
% change 1938-1982		-48		+45
Denman				
1938	199.0	-21	51.8	+21
1969	83.6	-67	165.8	+66
1982	68.4	-73	181.6	+72
% change 1938-1982		-52		+51
Shoemaker Island (Main Channel)				
1938	71.2	-62	116.2	+62
1969	97.2	-48	68.4	+36
1982	47.4	-75	76.9	+41
% change 1938-1982		-13		+21

Table 4. Effects of wooded vegetation encroachment on abundance and distribution of various species ofbirds breeding in the Platte River Valley. Symbols denote increase (+), decrease (-) or no change (0).

Species	Impact of encroachment on Abundance	Distribution
Northern bobwhite	+	+
Piping plover	-	-
Killdeer	0	0
Upland sandpiper	-	0
Spotted sandpiper	-	0
Wilson's phalarope	-	-
Least tern	-	-
Yellow-billed cuckoo	+	+
Great horned owl	+	0
Northern flicker	+	0
Red-bellied woodpecker	+	+
Red-headed woodpecker	+	0
Hairy woodpecker	+	+
Downy woodpecker	+	+
Eastern kingbird	+	+
Western kingbird	+	+
Great crested flycatcher	+	+
Willow flycatcher	+	+
Eastern wood-pewee	+	+
Western wood-pewee	+	+
Blue jay	+	+
Black-capped chickadee	+	+
House wren	+	0
Gray catbird	+	+
Brown thrasher	+	0
American robin	+	0
Eurasian starling	+	+
Bell's vireo	+	+
Red-eyed vireo	+	+
Warbling vireo	+	+
Yellow warbler	+	+
Common yellowthroat	+	0
Bobolink	-	-
Eastern meadowlark	-	-
Western meadowlark	-	0
Orchard oriole	+	+
Northern oriole	+	+
Northern cardinal	+	+
Rose-breasted grosbeak	+	+
Black-headed grosbeak	+	+
Indigo bunting	+	+
American goldfinch	+	0
Dickcissel	-	-
Rufous-sided towhee	+	0
Grasshopper sparrow	-	0
Field sparrow	+	+
Song sparrow	0	0

Table 5. Zoogeographic distribution of breeding birds in the Platte River Valley. Data adapted from Johnsgard (1979).

Woodland/Forest Species				
Eastern	Northern	Pandemic	Western	Southern
American kestrel	Golden-crowned kinglet	Red-tailed hawk	Western kingbird	Scissor-tailed flycatcher
Northern bobwhite	Pine siskin	Wild turkey	Say's phoebe	Great-tailed grackle
Black-billed cuckoo		Mourning dove	Western wood-pewee	Blue grosbeak
Chimney swift		Yellow-billed cuckoo	Black-billed magpie	
Red-bellied woodpecker		Eastern screech-owl	Black-headed gosbeak	
Red-headed woodpecker		Great horned owl	House finch	
Eastern kingbird		Northern flicker	Lazuli bunting	
Great crested flycatcher		Hairy woodpecker		
Eastern phoebe		Downy woodpecker		
Eastern wood-pewee		Willow flycatcher		
Blue jay		Common crow		
Northern mockingbird		Black-capped Chickadee		
Gray catbird		White-breasted nuthatch		
Brown thrasher		House wren		
Wood thrush		American robin		
Eastern bluebird		Loggerhead shrike		
Bell's vireo		Warbling vireo		
Red-eyed vireo		Yellow warbler		

American redstart	Brown-headed cowbird
Common grackle	Northern oriole
Orchard oriole	American goldfinch
Northern cardinal	Rufous-sided towhee
Rose-breasted grosbeak	Chipping sparrow
Indigo bunting	Song sparrow

Wetland Species

Eastern	Northern	Pandemic	Western	Southern
Wood duck	Common snipe	Pied-billed grebe	American wigeon	Wilson's phalarope
Green-backed heron	Swamp sparrow	Double-crested cormorant	Gadwall	
American bittern		Canada goose	Canvasback	
King rail		Green-winged teal	Redhead	
Sedge wren		Mallard	Ruddy duck	
		Northern pintail	Yellow-headed blackbird	
		Blue-winged teal		
		Northern shoveler		
		Great blue heron		
		Black-crowned night-heron		
		Virginia rail		
		Sora		

American coot

Piping plover

Killdeer

Spotted sandpiper

Black tern

Least tern

Marsh wren

Common yellowthroat

Red-winged blackbird

Grassland Species				
Eastern	Northern	Pandemic	Western	Southern
Eastern meadowlark	Sharp-tailed grouse	Northern harrier	Ferruginous hawk	Greater prairie-chicken
Field sparrow		Short-eared owl	Swainson's hawk	Long-billed curlew
		Horned lark	Burrowing owl	Upland sandpiper
		Boblink	Western meadowlark	Chihuahuan raven
		Savannah sparrow	Brewer's blackbird	Dickcissel
		Grasshopper sparrow	Lark sparrow	Lark bunting
		Vesper sparrow	Brewer's sparrow	Cassin's sparrow

Table 6. Differences in relative abundances among selected breeding birds in the Platte River Valley recorded on Breeding Bird Survey routes. Refer to Figure 4 for route locations.

Species	X number of birds (recorded/route) 1a	2	3	4	5	6	7
Ring-necked pheasant	35.3	18.0	11.2	65.3	35.0	137.0	17.7
Northern bobwhite	2.8	27.0	9.6	45.3	25.0	5.0	12.7
Killdeer	6.6	7.2	5.2	3.8	13.0	13.0	7.3
Upland sandpiper	0	8.7	4.0	0	0	3.0	5.4
Mourning dove	85.4	67.7	62.4	116.0	138.0	149.0	45.4
Black-billed cuckoo	0.4	0.8	0	0	2.0	2.0	0
Yellow-billed cuckoo	0	0.3	0.2	0.6	11.0	5.0	0.2
Chimney swift	2.2	3.2	0.4	1.0	1.0	0	0
Red-headed woodpecker	4.4	10.7	6.4	1.9	8.0	3.0	5.9
Northern flicker	2.2	7.7	5.0	5.5	4.0	3.0	3.0
Great crested flycatcher	0.1	0.1	0	0	0	0	0
Western kingbird	12.9	11.0	13.6	22.7	33.0	36.0	6.0
Eastern kingbird	11.4	12.0	17.6	14.1	51.0	49.0	2.1
Eastern bluebird	0.2	0.4	0.2	0	0	0	0
American robin	30.4	49.3	13.8	9.1	24.0	15.0	5.8
Gray catbird	0.3	0.7	0.6	0	2.0	0	0
Northern mockingbird	0	0	0	2.3	3.0	3.0	1.0
Brown trasher	11.6	9.3	7.4	21.7	15.0	22.0	2.9
Loggerhead shrike	0.6	0.4	0.4	2.4	6.0	4.0	1.4
Warbling vireo	1.7	3.2	0.6	0.1	2.0	2.0	0.2
Yellow warbler	0	1.2	0	0.7	2.0	1.0	0.9
Common yellowthroat	5.3	9.1	1.2	2.1	1.0	3.0	3.7
Northern cardinal	0.5	3.2	1.6	0.3	0	0	0
Blue grosbeak	0	0.8	0.2	1.6	8.0	0	2.4
Indigo bunting	0.1	0	0	0.1	0	0	0.2

Dickcissel	51.2	28.0	17.8	14.4	0	7.0	29.1
Lark bunting	0.3	10.7	32.4	4.6	0	39.0	6.8
Field sparrow	0	0.7	0	1.9	24.0	4.0	0.4
Lark sparrow	0	0.1	0	0.4	13.0	3.0	1.1
Grasshopper sparrow	0.1	0.3	0.4	2.7	13.0	55.0	6.8
Bobolink	0.3	4.8	1.2	0	0	0	0.1
Eastern meadowlark	0.1	1.4	0	0	0	0	0.1
Western meadowlark	28.4	71.9	132.6	183.0	147.0	181.0	145.7
Red-winged blackbird	82.7	71.8	122.2	123.0	42.0	159.0	81.4
Common grackle	147.1	93.2	31.8	50.7	24.0	83.0	24.7
Brown-headed cowbird	20.4	58.9	53.0	32.1	42.0	95.0	6.1
Orchard oriole	1.4	5.9	0.2	1.3	11.0	14.0	1.3
Northern oriole	7.1	12.7	3.6	4.9	32.0	14.0	1.1

Survey route names: 1- Kenesaw, 2- Kearney, 3- Sumner, 4- Holbrook, 5- Brady, 6- Table, 7- Paxton.

Table 7. Mean breeding populations of major bird families or subfamily, 1979-80.

Family	Number of species	X population	% total
Icteridae	10	1,007,000	34.1
Fringillinae	19	549,000	18.6
Passeridae	1	214,500	7.3
Columbidae	2	181,000	6.1
Tyrannidae	6	166,000	5.6
Turdinae	2	120,000	4.1
Apodidae	1	95,000	3.2
Alaudidae	1	87,000	2.9
Hirundinidae	6	86,000	2.9
Sturnidae	1	85,000	2.9
Picidae	5	77,000	2.6
Troglodytidae	4	60,000	2.0
Scolopacidae	4	36,000	1.2
Parulinae	2	36,000	1.2
Mimidae	3	27,000	0.9

Table 8. Population estimates among the most numerous breeding bird species in the Platte River valley.

Species	Density (pairs/km^2) Highest	mean	Major Habitats	Estimated population (prs. and HPD interval)	% of total population
Grasshopper sparrow	22.0	10.7	1	301,000 (239,800-362,200)	9.65
Western meadowlark	18.5	10.2	1,2	287,000 (251,300-323,300)	9.20
House sparrow	140.5	8.7	8	244,000 (58,400-430,200)	7.82
Common grackle	100.0	7.8	8	221,000 (157,100-285,300)	7.08
Red-winged blackbird	243.2	6.7	9	191,000 (79,100-302,100)	6.12
Lark bunting	12.0	5.3	7	149,000 (64,400-234,400)	4.77
Brown-headed cowbird	57.0	5.1	4	145,000 (70,000-219,400)	4.65
Chimney swift	84.2	4.9	8	138,000 (107,800-167,700)	4.42
Eurasian starling	65.5	4.4	8	125,000 (33,300-216,900)	4.00
Horned lark	7.2	4.3	1	123,000 (68,500-177,700)	3.94
Western kingbird	69.5	3.9	4	111,000 (59,600-161,500)	3.56
Dickcissel	19.2	3.8	6	109,000 (57,300-160,100)	3.49
Mourning dove	44.5	3.2	3	92,000 (59,600-125,100)	2.95
Barn swallow	9.2	2.5	5	72,000 (42,600-102,100)	2.31
Northern flicker	39.0	2.5	4	71,000 (0-160,300)	2.27
American robin	33.2	2.4	3	70,000 (0-159,700)	2.24
Eastern kingbird	96.7	2.3	4	67,000 (36,800-97,600)	2.15
Upland sandpiper	8.2	2.0	2	59,000 (28,700-88,700)	1.89

Red-headed woodpecker	111.0	1.9	4	53,000 (9,900-96,800)	1.70
Bobolink	7.7	1.8	2	53,000 (24,400-81,800)	1.70
Northern oriole	74.5	1.2	4	34,000 (23,800-45,000)	1.09
House wren	70.7	1.2	3	34,000 (26,900-41,800)	1.09
Brown thrasher	9.5	1.1	3	32,000 (15,100-49,000)	1.02
Killdeer	21.2	0.9	5	28,000 (13,700-41,700)	0.88
Orchard oriole	32.0	0.7	4	21,000 (0-47,600)	0.67
Common yellowthroat	71.2	0.6	5	18,000 (10,300-24,700)	0.56
Lark sparrow	1.2	0.6	1	17,000 (1,900-31,200)	0.53
Cliff swallow	81.2	0.5	5	15,000 (2,600-26,800)	0.47
American goldfinch	12.7	0.5	5	15,000 (0-32,000)	0.47
Ring-necked pheasant	2.0	0.5	2	14,000 (4,100-24,500)	0.46
Yellow warbler	32.2	0.5	5	14,000 (5,100-23,200)	0.46
Blue jay	9.2	0.4	3	11,000 (0-23,300)	0.36
Common nighthawk	0.7	0.4	1	11,000 (0-26,200)	0.36
Northern bobwhite	14.2	0.3	3	10,000 (0-19,500)	0.30
Common crow	6.2	0.3	4	9,000 (0-21,800)	0.27

Major habitats include: 1) upland native prairie, 2) wet meadow, 3)lowland forest, 4) shelterbelt, 5) river channel islands, 6) alfalfa, 7) wheat, 8) residential, 9) natural basin wetlands.