Partners in Flight
Bird Conservation Plan
for
The Northern Tallgrass Prairie
(Physiographic Area 40)

American Bird Conservancy

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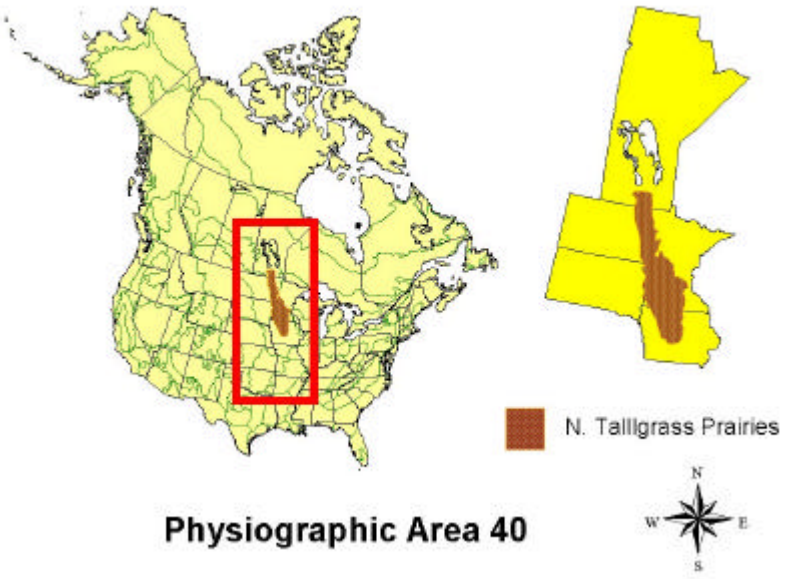

by

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Partners In Flight
Northern Tallgrass Prairie Bird Conservation Plan
(Physiographic Area 40)

Executive Summary:

The Northern Tallgrass Prairie physiographic area occupies the eastern portion of the Prairie Pothole Region, the most important waterfowl production area of North America. While very little of the area's native vegetation is left, active habitat restoration and enhancement for waterfowl conservation has been ongoing since the Prairie Pothole Joint Venture (PPJV) of the North American Waterfowl Management Plan was established in the mid-1980s. Within the past few years, Partners in Flight (PIF) has been working with the waterfowl conservation community in the PPJV to integrate game and non-game bird conservation, so that the entire avifauna is secure. This plan offers managers and decision makers in the PPJV information on how better to make that goal a reality.

Grassland birds are a very high priority in the region, as many species are characterized by consistent and dramatic population declines throughout much of their ranges. Grassland Bird Conservation Areas, consisting of 800 ha (2,000 acre) grassland cores within a 4,000 ha (10,000 acre) matrix also containing at least 2,000 acres of suitable grassland habitat are being promoted as a model for landscape scale grassland bird conservation. The concept is currently being tested by scientists at the Northern Prairie Wildlife Research Center at Jamestown, ND.

Non-game wetland bird species generally are under-sampled in the region, and their long- term population trends not well known. However, many of the PIF priority species need large wetland complexes, and relatively large acreages of grass cover in the matrix surrounding the wetlands. While some of the species' requirements are more stringent than those of waterfowl, waterfowl should benefit from efforts to meet the additional needs of the non-game wetland bird community.

Riparian forest ecosystems in the Northern Tallgrass Prairie have received relatively little treatment from ecologists to date, yet they are an important habitat type for a suite of PIF priority species. Private landowners in many of the river valleys in the Northern Tallgrass Prairie are taking advantage of Federal incentive programs such as the Wetland Reserve Program and the Conservation Reserve Program. A larger, more focused floodplain recovery effort will be funded by the Conservation Reserve Enhancement Program (CREP) in the Minnesota River Valley. The U.S. Fish and Wildlife Service's Minnesota Valley National Wildlife Refuge also is situated within the designated CREP area, and provides an important core of habitat. The Partners in Flight community is encouraged to bring non-game bird conservation into the central arena of these efforts.

PREFACE:

Partners in Flight (PIF) is a voluntary, international coalition of government agencies, conservation groups, academic institutions, private businesses, and everyday citizens dedicated to "keeping common birds common". PIF's goal is to direct resources toward the conservation of birds and their habitats through cooperative efforts in North America and the Neotropics. While PIF's focus generally is limited to the conservation of landbirds, it is intended to complement similar efforts for waterfowl, shorebirds and other taxa. PIF now joins the North American Waterfowl Management Plan, National Shorebird Conservation Plan, and North American Colonial Waterbird Conservation Plan in undertaking the kind of long-range planning necessary to help insure that viable populations of all native bird species continue to exist and that all our native ecosystems have full and functional avifaunal communities.

The foundation of PIF's bird conservation strategy, known as "The Flight Plan", is a series of Bird Conservation Plans, of which this document is one. These plans identify species and habitats most in need of conservation, and establish objectives for bird populations and habitats in physiographic areas (ecoregions) and states. The plans not only identify the microhabitat requirements of priority species, but also focus on the types and quality of habitats required by birds at the landscape scale. Needed conservation actions are recommended and partnerships are formed to accomplish them. Information and recommendations in the plans are based upon sound science and consensus among interested groups and knowledgeable individuals.

Many of the species that are part of the avifauna of the United States migrate through or winter in other countries in the Western Hemisphere where they also face habitat loss, exposure to toxicants and persecution (Basili and Temple 1995, Bird Conservation, Fall 1996). While it is beyond the scope or desire of Bird Conservation Plans to recommend conservation objectives for other countries, PIF is working in concert with like-minded counterparts throughout the hemisphere to deliver integrated bird conservation at the necessary geographic scale. For more information about Partners in Flight, see the following web site: <http://www.PartnersInFlight.org>.

Section 1: The planning unit

Background:

Partners in Flight Physiographic Area 40, The Northern Tallgrass Prairie, occupies north-central Iowa, south-central and western Minnesota, a small portion of adjacent N. Dakota and extends into south-central Manitoba (see map inside front cover). It is approximately 155,000 square kilometers in size and occupies the eastern part of the Prairie Pothole Region. It is roughly coincident with sections 251A and 251B of the U. S. Forest Services' Ecoregional classification system for the United States (McNab and Avers 1994; also known as the "Bailey" system).

The northwestern portion of the physiographic area, drained by the Red River, is characterized by prominent alluvial fans bordered by beach and morainal ridges on the east. Level to rolling till plain predominates in the southern and eastern portion of the region and is drained by the Minnesota and Des Moines Rivers. Relatively small temporary, semi-permanent and permanent wetlands (prairie potholes) are scattered throughout the physiographic area, although the majority of these have been drained and converted to agricultural land. Relief ranges from 1- 30 m (3-100 ft.), at elevations of 225-600 m (750-2,000 ft) above sea level (McNab and Avers 1994). Potential natural vegetation (Kuchler, from McNab and Avers 1994) is bluestem prairie, with corridors of forest in the river floodplains.

Conservation issues:

Little of the original native grasslands and associated potholes of the Northern Tallgrass Prairie remains today. Grasslands were plowed or degraded by fire suppression or inappropriate grazing and wetlands were drained and converted to agricultural land earlier in this century (McNab and Avers 1994). Although crop fields and non-native grasslands are used by some species of birds, nest loss to predation and crop harvest during the breeding season can result in low reproductive output (Frawley 1989, Bollinger et al. 1990, Bryan and Best 1994, Patterson and Best 1996). The declines of many grassland- and wetland-dependent bird species in the region are most likely attributable to loss and degradation of suitable habitat and related problems of predation and cowbird parasitism.

General conservation opportunities:

The Northern Tallgrass Prairie comprises the eastern portion of the Prairie Pothole Joint Venture (PPJV). The PPJV is identified as the number one priority waterfowl habitat area in the country by the North American Waterfowl Management Plan (NAWMP). The prairies of the PPJV and adjacent Prairie Habitat Joint Venture in Canada (in total, the Prairie Pothole Region) comprise the principal duck production area of North America.

Over the last century, waterfowl nesting habitat and nest success in the PPJV declined dramatically as wetlands were drained and grasslands plowed and put into agricultural production. While the overall goal of the PPJV is "to increase waterfowl populations through habitat conservation projects that improve natural diversity across the U.S. Prairie Pothole landscape", there are two objectives: to conserve breeding duck habitat to maximize recruitment, and a second objective "to stabilize or increase populations of declining wetland/grassland-associated wildlife species in the Prairie Pothole Region, with special emphasis on non-waterfowl migratory birds." (Prairie Pothole Management Board 1995).

Partners in Flight species of concern in the Northern Tallgrass Prairie were identified by PIF and a Nongame Technical Committee established by the PPJV Management Board. Bird species were ranked primarily by the PIF Species Prioritization Scheme (Hunter et al. 1993, Carter et al. in prep) and a list of priority species was identified for the region based upon a standardized set of criteria developed by PIF (see Appendix 1). Birds on the list primarily are those breeding species

showing global or regional population declines and whose center of abundance lies within the region. It is hoped that integrated management for waterfowl and landbirds will insure the viability of these species in the PPJV well into the future.

In addition to the conservation efforts of the PPJV, there is a prairie conservation initiative being led by the U.S. Fish and Wildlife Service (USFWS or the Service) called the Northern Tallgrass Prairie Habitat Preservation Area (HPA). The Service wishes to work with all interested individuals, groups, and governmental entities on a voluntary basis to protect approximately 30,800 hectares (77,000 acres) of native prairie and buffer lands through acquisition from willing sellers via fee title, easement, lease or other management rights transfer arrangements (USFWS Northern Tallgrass Prairie HPA Final Environmental Impact Statement, 1998).

The Nature Conservancy (TNC) is developing Ecosystem Planning for the Northern Tallgrass Prairie, with the goal of protecting viable examples of all natural communities found within the region. TNC recognizes that these communities must be imbedded within "functioning landscapes" that are "large enough that area-sensitive species have enough resources to maintain minimum viable populations, and that ecological processes such as fire, grazing and nutrient flows can occur or be introduced to act in a way that they did in a natural context" (Ecoregional Planning in the Midwest: The Northern Tallgrass Prairie Ecoregion, The Nature Conservancy, unpublished).

As described in part above, many opportunities for cooperation exist among habitat conservation groups that can benefit PIF species of conservation concern. Resource managers should consult with these groups, and keep current on new initiatives (such as the National Shorebird Conservation Plan and the North American Colonial Waterbird planning effort) which may overlap PIF efforts. Working in partnership with these and other groups will allow economies of scale in habitat consolidation and management.

Section 2: Avifaunal analysis

General characteristics:

At least 185 species of birds have been recorded in the Northern Tallgrass Prairie physiographic area during the 32 years of the North American Breeding Bird Survey. Over half of those species

use the wetland-grassland habitats that characterize the Prairie Pothole Region. An additional 10% are dependent upon bottomland and riparian forest, and about 7% use shrubby habitats. While roughly 20% of the species breed in upland forests, all occur at relatively low densities compared to other parts of their ranges, perhaps reflecting the peripheral nature of this habitat type in the planning unit.

Population declines are most evident among the grassland birds, with approximately 25% of the breeding species exhibiting downward trends as documented by the Breeding Bird Survey. Only 10% of wetland species have shown declines, yet the vast majority of these are not adequately sampled and their true status is unknown. Approximately 11% of bottomland and upland forest bird species also have declined.

Because it is unrealistic to write conservation plans for all species of birds in the planning unit, or even one for each species that has shown long-term declines, Partners in Flight developed a system that identifies species of conservation priority in each of its planning units. It is believed that if conservation measures are focused upon these species and their habitats, the needs of other species breeding in the physiographic area will be met as well.

Priority Species:

Species are considered of conservation priority for PIF physiographic area Bird Conservation Plans if they meet one of seven criteria (see Appendix 1). These criteria variously emphasize the species' vulnerability to extinction range-wide, the species population trend in the physiographic area and the degree to which the planning unit in question is a center of abundance for that species. Species that have a large proportion of their population breeding in the planning unit but that are not declining do not warrant immediate conservation action, but should be considered of high conservation responsibility and their needs considered in long-range planning. Species for which the planning unit is a center of abundance and that also show significant declining population trends need more immediate conservation attention.

The priority species for the Northern Tallgrass Prairie Physiographic Area are given in Table 1 (overleaf).

Table 1. Partners in Flight Priority Species for Physiographic Area 40: The Northern Tallgrass Prairie.

Species	Criteria	Total Score	AI	PT	BBS Trend	% Pop.
Greater Prairie-Chicken	I	28	3	3	na	<1
Nelson's Sharp-tailed Sparrow	I	27	3	3	-10.9	na
Trumpeter Swan	I	25	2	3	na	na
Yellow Rail	I	25	3	3	na	na
Sedge Wren	I	24	5	3	-1.6	19.7
Hooded Merganser	I	23	5	3	29.0	22.6
Black-billed Cuckoo	I	23	5	5	-3.4**	5.4
Bobolink	I	23	4	5	-2.5**	9.0
Red-headed Woodpecker	II	22	4	5	-3.6**	7.4
Marsh Wren	II	22	4	5	-4.4**	6.2
Wood Duck	II	20	5	3	7.3	17.0
Grasshopper Sparrow	II	19	3	5	-4.5**	2.4
Marbled Godwit	III	22	3	3	-14.7**	1.4
Franklin's Gull	III	22	3	3	2.2	1.8
Dickcissel	III	22	3	4	-2.6	3.5
Northern Flicker	IV	17	5	5	-3.7**	2.2
Vesper Sparrow	V	18	5	4	-1.1	8.9
House Wren	V	13	5	2	0.2	5.6
Pied-billed Grebe	V	15	4	3	-1.2	5.1

Species	Criteria	Total Score	AI	PT	BBS Trend	% Pop.
Bald Eagle	VI	17	2	3	na	
American Bittern	VII	19	3	4	-14.2**	1.2
Virginia Rail	VII	16	3	3	8.3	2.4
Sora	VII	14	3	3	-1.3	2.0
Wilson's Phalarope	VII	20	3	3	-24.7**	1.0
Black Tern	VII	17	3	2	-0.6	3.1
Loggerhead Shrike	VII	17	2	3	4.4	<1
Clay-colored Sparrow	VII	19	3	3	-1.0	3.6

Criteria: see Appendix 1.

Total score: see Appendix 1.

AI = area importance score; see appendix 1.

PT = population trend score; see Appendix 1.

BBS = Breeding Bird Survey trend, measured as mean 5 change per year for the years 1966-1996, for this physiographic area.

* = significant at 0.10; ** = significant at 0.05; na = not available.

% pop = percentage of the species population residing in the planning unit.

Section 3: Habitats and objectives

Habitat-species suites:

Priority species are grouped by suites into habitat types as shown in Table 2 (overleaf).

Table 2: Priority species by habitat type in Physiographic Area 40: The Northern Tallgrass Prairie.

Species	Habitat	Total Score	AI	PT	TB
Greater Prairie-Chicken	GR	28	3	3	4
Nelson's Sharp-tailed Sparrow	GR	27	3	3	4
Sedge Wren	GR	24	5	3	4
Bobolink	GR	23	4	5	4
Dickcissel	GR	22	3	4	4
Grasshopper Sparrow	GR	19	3	5	3
Clay-colored Sparrow	GR	19	3	3	3
Vesper Sparrow	GR	18	5	4	3
Loggerhead Shrike	GR	17	2	3	4
Nelson's Sharp-tailed Sparrow	WE	27	3	3	4
Trumpeter Swan	WE	25	2	3	4
Yellow Rail	WE	25	3	3	3
Sedge Wren	WE	24	5	3	4
Marbled Godwit	WE	22	3	3	4
Franklin's Gull	WE	22	3	3	4
Marsh Wren	WE	22	4	5	4
Wilson's Phalarope	WE	20	3	3	3
American Bittern	WE	19	3	4	3
Black Tern	WE	17	3	2	4
Virginia Rail	WE	16	3	3	3
Pied-billed Grebe	WE	15	4	3	2
Sora	WE	14	3	3	2

Species	Habitat	Total Score	AI	PT	TB
Hooded Merganser	RF	23	5	3	3
Black-billed Cuckoo	RF-OW	23	5	5	3
Red-headed Woodpecker	RF-OW	22	4	5	3
Wood Duck	RF-WE	20	5	3	3
Northern Flicker	RF-OW	17	5	5	2
House Wren	RF-FS	13	5	2	1
Bald Eagle	RF	17	2	3	3

Habitat codes: GR = grassland; WE = wetlands; OW = open woodlands; RF = riparian forest; FS = farmland/suburban.
Total score: see Appendix 1.
AI = area importance score; see appendix 1.
PT = population trend score; see Appendix 1.
TB = threats breeding score; see Appendix 1.

Priority species group into three main habitat types: grasslands, wetlands, and riparian forest-savanna. The groups with the highest Area Importance scores and highest proportions of declining species are grassland and riparian forest birds, although population trends of wetland birds are largely unknown. Grasslands and wetlands are the habitats with the species that score highest in the PIF system and therefore are host to the most vulnerable species. Thus it appears that no clear priority among habitat types emerges and that the priority species of grasslands, wetlands and riparian forests all have conservation needs of some sort that must be met. The nature of those needs will differ, however, so specifics will be addressed in the habitat sections that follow.

Grasslands:

Ecology and conservation status:

Prior to increased human settlement in the late 1800's, tallgrass prairies were frequently disturbed by fire and the grazing of elk and bison. Estimates of pre-settlement fire frequency are every 5-10 years (Wright and Bailey 1982), every 6 years (Rowe 1969) and two to five times every 10 years (Hulbert 1973). Fires probably were both lightning-caused (Komarek 1968, Higgins 1984) and set by native Americans (Gleason 1913, Sauer 1950, Pyne 1983). Fire, acting in conjunction with topography and climatic variation, influences plant species richness and composition on the prairie, with the number of forb, grass and woody species increasing during post-fire succession (Gibson 1988, Collins and Gibson 1990). Forbs are more common in areas burned in winter or early spring (Hulbert and Wilson 1983, Hulbert 1986). Tallgrass prairie unburned for 10 or more years begins to convert to woodlands (Abrams and Gibson 1991).

Grazing by bison also affected plant community composition and structure on tallgrass prairies. Recent studies found that bison herbivory reduced the dominance of matrix species such as warm-season grasses and increased space for interstitial species such as forbs and annuals, thus increasing species richness (Collins 1987, Collins and Gibson 1990). Bison were attracted to recently burned areas and preferentially grazed them over unburned prairie, but grazing in prairie that had not been recently burned did occur. In unburned prairie, particular patches were found to be grazed repeatedly from year to year, resulting in a patchy grassland mosaic at the landscape scale (Vinton et al. 1993).

As a result of interactions among climate, topography, fire and bison herbivory, the vegetative structure and composition of the prairie varied both temporally and spatially across the landscape. Thus, grassland birds evolved in an ever-changing mosaic of habitats, and as a result, bird communities also were likely to have varied both temporally and spatially across the landscape.

Now that over 99% of the tallgrass prairie has been converted to agricultural or other uses, grassland bird communities persist mostly in habitats such as hayfields, pastures, small grain fields and land enrolled in Federal incentive programs such as the Conservation Reserve Program (CRP). Unfortunately, birds attracted to hayfields suffer such high nest failure rates when fields

are mown during the breeding season that nesting in such habitat can actually be a detriment to the population (Bollinger et al. 1990, Frawley and Best 1991). Further, the fragmented nature of these habitats and the relatively high densities of nest predators and parasites associated with these landscapes add to the factors thought responsible for the declines of many species of grassland birds (Herkert 1994, Greenwood et al. 1995). While the CRP provides breeding habitat for many grassland bird species in the northern Great Plains (Johnson and Igl 1995) and was determined to support source populations of some species in northern Missouri (McCoy 1996), the amount of land that will continue to be enrolled in CRP, and indeed the long term future of the program is uncertain. It is imperative that grassland habitat adequate to support source populations of grassland birds be identified and protected in some way that the long-term security of birds dependent upon grassland habitats is assured.

Bird habitat requirements:

Open grasslands: Greater Prairie-Chicken

Greater Prairie-Chickens utilize a variety of grassland habitat types within their annual cycle. Leks, or "booming grounds", where males dance and vocalize to attract females, are located on areas with short vegetation and on ground higher than the surrounding landscape. Females typically nest within 0.3 -1.1 km (0.2 - 0.7 mi.) of the leks, selecting grassland from 25-70 cm (10 - 21 in.) in height (Schroeder and Robb 1993). Although females prefer large tracts of grassland to nest in, the nest itself is usually placed near the edge of the tract. Broods need cover they can walk through and see over, so brood habitat should be somewhat shorter than nesting habitat. In Kansas, broods were often seen within 55 m (60 yds) of an edge. Number of broods seen was significantly higher in areas with cool season grasses and where some cultivation occurred. Winter roosts were located in small pockets of short vegetation within tall, denser grass cover. Sites where extensive roost habitat was located near grain fields were preferred. Home ranges of flocks during fall and winter were approximately 1.6 sq. km. (1 sq. mi.) in Kansas with flights of up to 3 km (2 mi.) to feeding sites (Horak 1985).

In a review of habitat management considerations for prairie-chickens, Kirsch (1974) suggested that lack of nesting and brood rearing cover was a universal limiting factor for prairie-chickens throughout their range. He indicated that annually grazed, hayed or long-idled lands did not provide desirable habitat, and that the most successful method for maintaining high quality

grassland habitat for prairie-chickens was prescribed burning at 3-5 year intervals. He recommended that management units should contain at least 3 sq km (2 sq. miles) of high-quality habitat within an area not to exceed 12 sq. km (8 sq. mi.). Sixty-five hectares (160 acres) was the suggested minimum field size needed for habitat blocks. Ryan et al. (in press), found that prairie-chickens populations in a Missouri landscape that had scattered tracts of prairie declined over a 27 year period, while populations in a landscape with large acreages of contiguous prairie were stable. A minimum field size of 65 ha (160 acres) also was recommended by the authors to improve conservation of prairie-chickens in fragmented landscapes. Horak (1985) suggested that an interspersion of 75% grassland and 25% cropland within the range of a flock was optimum, and that grassland should be 80% grass and 20% forbs. It is thought that providing habitat adequate to maintain viable populations of Greater Prairie-Chickens in the Northern Tallgrass Prairie would also sustain populations of the other PIF priority grassland bird species, as outlined below.

Open grasslands, continued: Bobolink/Sedge Wren/Grasshopper Sparrow/Dickcissel/Nelson's Sharp-tailed Sparrow/Vesper Sparrow

Although all the species in this suite are grassland species, not all are expected to co-occur at the same site at the same time. For example, Dickcissels have a more southernly distribution than Nelson's Sharp-tailed Sparrow, and Grasshopper Sparrows and Vesper Sparrows prefer shorter and somewhat more open grasslands than do Bobolinks or Sedge Wrens. Nelson's Sharp-tailed Sparrows and Sedge Wrens are typically found in wetter sites, Vesper Sparrows in drier, and Bobolinks in areas that are transitional between wet and dry. However, some of these species will occupy the same sites over time, with relative densities dependent upon rainfall patterns, time since disturbance, type of disturbance, etc..

The amount of information on the microhabitats associated with species in this suite varies, as does the manner in which data were collected. Therefore, it is difficult to make direct comparisons of microhabitat needs among species, especially when research was done in areas other than the Northern Tallgrass Prairie. However, Renkin (1983) and Renkin and Dinsmore (1987) quantified the microhabitat associated with four of the six species in the suite in North Dakota using the same methodology. The results of their work are presented in Table 3 (overleaf).

Table 3. Microhabitat associations of Dickcissels, Grasshopper Sparrows, Bobolinks and Sedge Wrens.

Species	Litter depth (cm.)	% forb cover	% grass cover	% litter cover	% shrub	% bare ground	General preferences (from Renkin, 1983 and Renkin and Dinsmore , 1987)
Dickcissel	4.7	27	76	100	<1	0	dense vegetation with a high forb component
Grasshopper Sparrow	2.8	26	62	99	6.9	<1	avoids tall, dense grasslands
Bobolink	3.2	34	75	99	2.3	<1	typically uses areas with a higher ratio of grass to forb cover than the others
Sedge Wren	3.6	35	77	99	<1	<1	typically uses wetter sites

Although there is variability in the microhabitats preferred, all of the species in Table 3 share a need for a forb/grassland mix. The matrix does not necessarily have to be native grasses, however, as long as the species of plants at a given site provide the structural characteristics the birds require. For example, Dickcissels in Kansas reach higher densities in old fields than in native prairies (Zimmerman 1983), and Bobolinks are associated with stands of exotic grasses and legumes such as bluegrass (*Poa pratensis*) and alfalfa (*Medicago sativa*) throughout their range (Birkenholz 1973, Bollinger et al. 1990, Herkert 1991, Madden 1996). None of the species favors grasslands that have been grazed at moderate to high intensities, although lightly grazed sites can be attractive to Grasshopper Sparrows, Bobolinks and Sedge Wrens. All will breed on sites that are burned on 4-6 year rotations, but densities will vary among species depending upon the amount of time that has elapsed since treatment. Grasshopper Sparrows favor sites mowed prior

to their arrival on the breeding grounds, and Bobolinks and Dickcissels will use mowed sites one or more years after treatment. Management practices such as mowing and burning should not be applied during the breeding season at any site.

Grasslands with a shrubby component: Loggerhead Shrike/Clay-colored Sparrow

These species require relatively open grassland habitats, with sparsely scattered trees or shrubs present (Brooks and Temple 1990, Knapton 1994, Yosef 1996, Johnson et al. 1998). Shrikes typically nest in trees, placing the nest approximately 3 m (9.5 ft.) above the ground (Tyler 1992). Prey is located visually from natural or man-made perches elevated above the grassland canopy (Yosef and Grubb 1994, Chavez-Ramirez et al. 1994), with the area effectively searched from the perch a function of perch height, vegetation height and vegetation density (Mills 1979, Rice 1983, Sonerud 1992, Yosef and Grubb 1993). The number and availability of hunting perches can determine the amount of the territory actually utilized for foraging. Significantly more fledglings per territory resulted after wooden fence posts were added to Loggerhead Shrike territories in a Florida study, presumably as a result of an increase in foraging opportunities for adults (Yosef and Grubb 1994). While short grassland vegetation is often promoted as more favorable for shrikes than taller vegetation, mowed areas of a native grassland in Texas were not used significantly more than unmowed areas (Chavez-Ramirez et al. 1994). Neither territory size, territory configuration, hunting success nor composition of prey taken was significantly different in mowed versus unmowed territories in Florida, although individuals spent more time in hovers and other more energetically expensive hunting activities at unmowed sites (Yosef and Grubb 1993). Concern over pesticide contamination in shrikes (Anderson and Duzan 1978) suggests that factors in addition to lack of suitable habitat may be limiting this species. More research is warranted to determine whether and how pesticide use should be reduced or discouraged in habitats where shrikes are likely to occur.

Clay-colored Sparrows typically build nests in shrubby vegetation, less than 30 cm (1 ft.) above the ground (Knapton 1994). The primary cause for loss of eggs and young is predation. In Saskatchewan, breeding numbers declined after prescribed burning, with the population reaching only 66% of non-burned sites three years after the burn (Pylypec 1991). Therefore, even though burning, grazing and late-season mowing are management tools that can be used to maintain the grassland component needed by this suite, burns should only be frequent enough to prevent woody vegetation from dominating a site.

Population objectives and habitat strategies:

Of the species of birds in the grassland suite, Grasshopper Sparrows and Bobolinks have shown significant 30-year declines (BBS data). Both Nelson's Sharp-tailed Sparrows and Dickcissels have shown non-significant declines of greater than 2% per year, and warrant continued monitoring. Greater Prairie-Chicken populations in Minnesota, Iowa, North Dakota and South Dakota have declined dramatically since 1968; only South Dakota is estimated to presently have more than 2,000 birds (Westemeier and Gough, unpublished data). The objective for priority grassland species exhibiting declines is to increase their populations across the physiographic area at the rate of 3 percent per year or greater until 30-year trends are reversed. Trends of other priority species should remain stable or increase as well. Suitable sampling techniques may vary among species and places, but units of measure such as number of birds per point, per route, per hectare, etc. should be able to be converted and compared as population trend information. Monitoring efforts may need to be increased or new techniques developed for some species.

In order to increase populations, two requirements must be met. First, adequate habitat must be provided to breeding individuals in the population base as well as the increasing number of individuals produced by population growth. Second, birds in those habitats must produce enough offspring to maintain the targeted growth rate.

Habitat of adequate quality to support breeding individuals must meet both the microhabitat needs (See "bird habitat requirements" section) and minimum area requirements of each species. Minimum area requirements can vary across a species' range, however, and may be dependent to some degree upon the characteristics of the landscape in which the habitat patches are embedded (Horn and Koford, unpublished data). Yet in the highly fragmented, agricultural landscapes of Illinois, Bobolink and Grasshopper Sparrow area requirements were estimated to be 30 and 50 ha (75 and 125 acres), respectively (Herkert 1994). Nest success of grassland birds also was shown to be greater in patches above rather than below this size, with significant increases in patches 130 ha (325 acres) or greater. Nest success also increased as distance from a woody edge increased, with highest rates of success at distances greater than 100 m (103 yards) from the edge (Johnson and Temple 1990).

Little is known about how habitat patch size and landscape patterns interact to affect grassland bird demographics. Research in forested regions of the Midwest indicates that the percentage of

forest cover across a landscape can affect cowbird densities and therefore reproductive success of forest songbirds (Donovan et al 1995, Robinson et al 1995). It is unknown whether a similar relationship holds true between grass cover and nest parasitism of grassland birds. Research suggests that duck nest success is positively correlated with the amount of grassland cover interspersed throughout the landscape, indicating a possible link between land use and predation rates as well (Ron Reynolds, pers. com.). But, many factors likely are at play here and it remains unknown whether a similar relationship holds true for nongame birds. Relative abundance and species richness of grassland birds breeding in CRP fields in Northern Missouri also appeared to be influenced by land cover within a 1 km (.6 mi.) radius around a given site (McCoy 1996).

Given the indications that landscape patterns contribute to source/sink dynamics of landbirds, a model for landscape level grassland bird conservation was developed by research biologists at the Wisconsin Department of Natural Resources (Henderson and Sample 1995, Sample and Mossman 1997) and serves as the basic design for PIF grassland Bird Conservation Areas (BCAs) in the Midwest. The Wisconsin model seeks to mimic a landscape in which Greater Prairie-Chicken populations are stable, and in which other species of grassland birds are consistently present in high densities. It also is based on years of research, although intensive demographic studies were not done.

The PIF model for grassland BCA's recommends a minimum 800 hectare (2,000 acre) block as a core area, within a 1.6 kilometer (one-mile) wide matrix (approximately 4000 ha or 10,000 acre) surrounding the core (Figure 1). The matrix should provide another 1,000 hectares (2,500 acres) of grassland habitat of some sort, with suggested minimum field sizes of 40 hectares (100 acres) (Figure 1). Hayfields typically cut before July 15 do not qualify as suitable habitat and may even be viewed as ecological traps due to an almost complete loss of nests during mowing. The matrix also is intended to function as a buffer to the core area with the intention that relatively few nest predators and parasites will be supported by the distribution and amount of cropland/grassland within the matrix. Trees should occupy less than 5% of the BCA, and the preference for agricultural use within the matrix is pasture and small grains over rowcrops. In those areas within the Northern Tallgrass Prairie region where BCAs are a reasonable conservation tool, we recommend a minimum of two BCAs per approximately 40,000 hectares (100,000 acre) landscape unit. This may allow birds to move between sites when stochastic factors and/or successional changes render a particular site unsuitable for a particular species in the suite. It is also important that the grassland habitats in the BCAs are managed on a rotational basis so that an

array of successional stages is available across the landscape at any given time, requiring communication and coordination among managers. BCA core areas should be centered on leks of Greater Prairie-Chickens whenever possible, to provide sufficient nesting and brood cover during the breeding season. See Figure 2 for a diagram of the BCA model and Appendix 2 for a more well developed list of statements and assumptions associated with the grassland bird BCA concept.

With a goal of increasing population trends of declining grassland bird species by 3% or greater per year throughout the planning unit, it is evident that more than one BCA will be needed to increase habitat and support source populations. During a July 1996 meeting of PIF and PPJV representatives, it was decided that the Northern Tallgrass Prairie portion of the PPJV potentially could accommodate 60-70 Bird Conservation Areas. Research is underway to determine the effectiveness of the BCA concept and will provide information about species densities and reproductive rates from which the numbers of BCAs necessary to reach target increases can be evaluated.

Grassland conservation opportunities:

Great opportunity exists for establishing BCAs within the Northern Tallgrass Prairie portion of the PPJV. Because many species of ducks utilize grasslands for nesting habitat, waterfowl production areas already have restored many acres to grassland within wetland complexes, and good potential exists for securing more.

In addition to the conservation efforts of the PPJV, a prairie conservation initiative called the Northern Tallgrass Prairie Habitat Preservation Area (HPA) is being led by the U.S. Fish and Wildlife Service (USFWS or the Service). The purpose of the HPA is to preserve, restore, and manage a portion of the remaining critical northern tallgrass prairie and associated habitats at widespread locations throughout western Minnesota and northwestern Iowa. The HPA, a voluntary program, is proposed as a new way for the Service to cooperatively meet its responsibilities within the tallgrass prairie landscape. The Service wishes to work with individuals, groups, and governmental entities to preserve tracts of northern tallgrass prairie (USFWS Northern Tallgrass Prairie HPA Final Environmental Impact Statement, 1998). The HPA project goal is to protect approximately 30,800 hectares (77,000 acres) of native prairie and buffer lands through acquisition from willing sellers via fee title, easement, lease or other

management rights transfer arrangements. Restoration and enhancement of degraded prairie tracts is also a goal, as well as the conservation of fish and wildlife diversity.

Evaluation of assumptions - research and monitoring:

The following actions are needed to further conservation of grassland birds in the Northern Tallgrass Prairie, and to help conservation efforts continue to evolve in a responsible and adaptive atmosphere:

1. Monitor grassland bird populations to determine whether sustained long-term population increases of 3% per year or greater are being met for species currently in decline, and that trends of non-declining species increase or remain stable.

2. Evaluate and compare grassland bird population growth rates in different kinds of grassland habitats, patch sizes and landscapes.

3. Acquire data on abundance, productivity and survivorship of birds to determine the ability of grassland Bird Conservation Areas (BCAs) to support source populations of grassland bird species of concern. Determine the level at which BCAs contribute to regional population increases.

4. Determine the minimum area requirements of grassland birds in the Northern Tallgrass Prairie, and how densities and reproductive success of grassland bird species vary with habitat patch size.

5. Investigate the dynamics of avian dispersal and colonization of sites in ephemeral systems such as Northern Tallgrass Prairie grasslands.

6. Determine the influence of landscape patterns on movements of nest parasites and predators of grassland birds.

7. Continue to evaluate the effects of management practices, especially burning, mowing, grazing and haying, on grassland birds.

8. Continue to develop Geographic Information Systems to identify existing and potential grassland Bird Conservation Areas.

Outreach:

Outreach programs should encourage private landowners and agency biologists to implement best management practices and to make the best use of USDA Farm Bill and other incentive programs to provide habitat for grassland birds. Outreach also should make the public (especially private landowners) aware of the overlap of conservation efforts for waterfowl and nongame birds in the PPJV, and foster overall pride in the Region's prairie heritage. Partnerships should continue to be encouraged to accomplish cooperative conservation ventures. Conservation successes should be recognized and celebrated whenever possible.

Wetlands:

Ecology and conservation status:

Prairie pothole wetlands in the Northern Tallgrass Prairie developed in natural, non-integrated basins or kettles created during the middle advances of the Wisconsin stage of glaciation. Vegetation of prairie ponds and lakes often occurs in zones with distinct plant species assemblages and vegetative structure. One zone typically occupies the central or deeper portions of the basin, with others occurring in concentric peripheral bands. Zones include wetland-low-prairie, wet-meadow, shallow-marsh, deep marsh, and permanent-open-water. Cover interspersion within zones of emergent vegetation is related to average water depth and its relative permanence. For example, semi-permanent wetlands that hold water throughout the breeding season are likely to have all zones, but only the low-prairie zone may be present in ephemeral wetlands that can dry out by early May. Thus, horizontal and vertical habitat heterogeneity typically increases with duration of standing water (Stewart and Kantrud 1971, Kantrud and Stewart 1984, Kantrud et al. 1989).

Many wetlands in the Northern Tallgrass Prairie physiographic area that previously were drained and converted to agriculture are now being restored. However, while previously drained wetlands quickly revegetate after artificial drainage is disrupted, there is marked variation in vegetative response, with low-prairie and wet-meadow zones absent at least at some recently restored sites

(Delphy and Dinsmore 1993, VanRees-Siewert 1993). Vegetative response appears to be more rapid and complete at sites that were drained for less than 20 years or in basins where drainage was incomplete, perhaps due to the presence of seed banks that remain from the period prior to drainage (Hemesath and Dinsmore 1993). Wetlands restored in complexes or near naturally occurring wetlands also appear to revegetate more quickly and completely (VanRees-Siewert 1993).

Zonation and cover-water ratios of wetlands also vary over time in response to annual variation in spring runoff, precipitation and evapotranspiration (reviewed by Kantrud et al. 1989). The general cycle is as follows: Droughts result in drawdowns that expose part or all of the marsh bottom, allowing seeds of perennial emergents and mudflat annuals to become established. After reflooding, emergents spread by vegetative propagation and characteristic vegetative zones develop. Dense stands of emergent vegetation attract muskrats that proliferate over time and largely eliminate the vegetation, although senescence also occurs in the marsh in response to prolonged flooding. When drought returns to the prairies, the cycle begins again.

Management activities, such as grazing and burning, also affect marsh structure (reviewed by Kantrud et al. 1989). Light to moderate grazing can result in greater plant species diversity or a change in dominance types, more complex distribution patterns and sharper boundaries between zones. Livestock trampling alters density and height of wetland vegetation. Overgrazing can decrease primary productivity, increase water turbidity and eliminate all vegetation in extreme cases. Burning also alters the composition of wetland vegetation, but the effects vary with fuel load, time of year and the species involved. Removal of plant litter by fire may expose the soil to erosion and reduce the trapping of snow during winter. (Snow accumulation may be the primary source of water for potholes in some years). However, Kantrud and Stewart (1984) suggest that burning or grazing, alone or in combination, enhance wetland conditions by decreasing the extent of monotypic stands of emergent vegetation and creating openings that allow insolation and greater biological productivity within shallow-water zones. Chemical and mechanical control of vegetation also can be employed in marsh management. Water level manipulation can be effective in providing habitat for wetland birds; detailed management guidelines for moist-soil management can be found in Fredrickson and Taylor (1982) and Rundle and Fredrickson (1981). The effects of sedimentation on wetland vegetation have not been documented, nor have the impacts of nutrients and pesticides carried into the wetlands by those sediments. However, macroinvertebrate populations and communities in restored wetlands have been found to be comparable to those of natural wetlands (VanRees-Siewert 1993).

Marsh bird niches generally are characterized by plant life-form, vegetation zones and water depths. Weller and Spatcher (1965) recognized four general categories: 1) birds that nest in low trees or shrubs at the edge of the marsh, 2) birds that utilize edge or shallow water emergents, 3) species that prefer tall, robust emergents in standing water, and 4) species that use low mats of vegetation, often in open areas of the marsh. It is typically during the midpoint of the marsh cycle of semi-permanent wetlands, when the cover-water ratio is approximately 50:50 and the wetland is in the "hemi-marsh" condition, that these conditions occur simultaneously within a given wetland and bird species diversity is maximized (Weller and Spatcher 1965).

Bird habitat requirements:

This section outlines the general habitat requirements of suites of wetland species of concern in the Northern Tallgrass Prairie, and provides general management guidelines that will result in those conditions.

Wet Meadows: Yellow Rail/Sedge Wren/Nelson's Sharp-tailed Sparrow

Very little is known about the habitat requirements of Nelson's Sharp-tailed Sparrow (Greenlaw and Rising 1994) so few specific recommendations can be made for the species. Sedge Wrens breed in wet meadows and grasslands with dense herbaceous vegetation (see grasslands section above) but have the least specific requirements of the suite. Therefore, management recommendations for this suite will be determined largely by the needs of Yellow Rails, although that species is understudied as well.

Breeding Yellow Rails typically inhabit sedge meadows and marshes that are largely devoid of cattails and woody vegetation. They generally prefer areas with saturated soils or water depths less than 15 cm (6 in.). Their diet is composed primarily of freshwater snails, but other aquatic invertebrates and seeds also are consumed. Nests are placed on or slightly above the ground, and concealed under a canopy of dead vegetation. Yellow Rails do not seem to exhibit fidelity to breeding sites; instead, numbers appear influenced by water depths, with fewer birds present in drier years. Management of Yellow Rail habitat should focus on maintenance of wet sedge meadows and marshlands, with mowing or burning employed in dry years to prevent invasion of cattails and woody vegetation. Management of wetlands for hemi- or deep water marshes will not provide suitable habitat for Yellow Rails. (Information on habitat requirements and management of Yellow Rails was taken from Bookhout , 1995).

Emergent Wetlands: Pied-billed Grebe/American Bittern/Virginia Rail/Sora/Marbled Godwit/Wilson's Phalarope/Franklin's Gull/Black Tern/Trumpeter Swan/Marsh Wren

The following Birds of North America accounts are the reference documents for the species in this suite unless otherwise noted. Black Tern: Dunn and Agro (1995); Wilson's Phalarope: Colwell and Jehl (1994); Franklin's Gull: Burger and Gochfield (1994); Sora: Melvin and Gibbs (1996); Virginia Rail: Conway (1995); American Bittern: Gibbs et al. (1992). Information on Marbled Godwit is from Johnson et al. (1998), that on Pied-billed Grebe from an unpublished species management abstract from The Nature Conservancy. A summary of the habitat requirements of each species is given in Table 4.

Table 4. General habitat requirements of priority bird species in the emergent wetland suite.

Species	Nest site vegetation	Foraging vegetation	Other
American Bittern	Tall, dense emergent vegetation; water depths 5-20 cm (2- 8 in.)	Vegetation fringes and shorelines; may avoid even-aged stands of older, dense or dry vegetation.	Nests also found in tall, dense upland cover in the Dakotas; 2-5 years of accumulated residual vegetation seemed essential (Duebbert and Lokemoen 1977).
Pied-billed Grebe	Nests in shallow water surrounded by dense vegetation.		
Virginia Rail	Robust emergent vegetation; water depth < 30 cm (12 in.).	Mudflats and shallow water.	Prefers a moderate cover:water ratio within wetland. Needs an abundance of macroinvertebrates.

Species	Nest site vegetation	Foraging vegetation	Other
Sora	Mix of robust and fine emergents: water depths 18-22 cm (8-9 in.).	Stands of robust emergent vegetation with shorter seed-producing emergents in understory.	Uses a wider range of water depths than Virginia Rails. Sedges are an important food item. Differences in breeding-habitat use were not discernable between Sora and Virginia Rails in an Iowa study (Johnson and Dinsmore 1986), although the two species did not always occur at the same restored Iowa wetlands studied by VanRees-Siewert (1993).
Wilson's Phalarope	Tall dense vegetation within 100m (33 yds) of wetlands.	Open water, flooded meadows.	High stem densities can impede movement; prefers wetlands in early stages of succession.

Species	Nest site vegetation	Foraging vegetation	Other
Franklin's Gull	Nests colonially over water on floating mats, muskrat houses or on floating debris. Prefers to nest in areas of low vegetation density or at edges of dense clumps.	Forages in or on water for aquatic organisms, in wet pastures for worms and arthropods, and aerially on swarming insects.	Needs large prairie marshes for nesting; breeding range can expand and contract depending on water conditions. Water must remain deep enough to prevent drying before young fledge. Sensitive to human disturbance early in breeding cycle and will entirely desert a colony with excessive exposure.
Black Tern	Nests semi-colonially amidst emergent vegetation; many nests afloat. Predation appears to be greater if water levels drop below 30 cm (12 in.).	Forages primarily over water.	
Marbled Godwit	Short to intermediate height grassland with < 40% dead vegetation and average cover height 17 cm (7 in.).	Forages along sparse to moderately vegetated shorelines; needs wetland complexes containing a diversity of wetland classes from ephemeral to permanent.	Rarely occurs on blocks of contiguous grasslands <100 ha (250 acres); tall dense cover avoided; prefers native vegetation and avoids tilled fields.

Species	Nest site vegetation	Foraging vegetation	Other
Trumpeter Swan	Site in or surrounded by water 0.5m deep (1.5 ft.). Nests on muskrat *(Ondatra zibethicus*) or beaver (*Castor canadensis*) houses or other floating platform.	Nesting pairs select sites with more total macrophytes, more muskgrass (*Chara spp*.) and pondweeds (*Potamogeton spp.*) and fewer spatterdock *(Nuphar spp.*) in water < 0.3m (1 ft.).	Needs room for take off; is more productive in wetlands with an irregular shoreline, with early ice off and multiple nest sites available.
Marsh Wren	Uses diversity of vegetation to support nests. Nest height 75-95 cm (30-37 in.) or higher.	Forages near or at surface of water, among cattail (*Typha spp.*) stalks.	

Naugle (1997) recently generated habitat models and evaluated minimum area requirements (MARs) for wetland birds species in the Prairie Pothole Region of Eastern South Dakota. MARs were only derived from data on wetlands with intermediate cover-to-water ratios that correspond to the hemi-marsh phase of Weller and Spatcher (1965), and are based upon the size at which there was a 50% probability of the species' occurrence. Significant habitat variables and MARs associated with Northern Tallgrass Prairie priority species are given in Table 5. High MARs could not be assigned to species using seasonal wetlands, as none sampled were greater than 15 ha (38 acres).

Table 5: Habitat model variables and minimum area requirements (MARs) associated with PIF wetland priority species in the Northern Tallgrass Prairie physiographic area.

Species	Semipermanent wetland variables	Seasonal wetland variables	MARs sp = semiperm ss = seasonal
Black Tern	AREA, SEMIA, GRASS		sp: 5- 15ha ss: few occurrences

Species	Semipermanent wetland variables	Seasonal wetland variables	MARs sp = semiperm ss = seasonal
American Bittern	COVER, AREA		sp: > 15 ha ss: few occurrences
Wilson's Phalarope	AREA, STEM(-), VEGNUM, GRASS	AREA, STEM (-)	sp: > 15 ha ss: no area requirement
Marsh Wren	COVER, AREA, STEM	STEM, COVER, SHORGRAZ (-), AREA, LANDUSE	sp: 5-15 ha ss: 5-15 ha
Pied-billed Grebe	AREA	AREA	sp: 5-15 ha ss: 5-15 ha
Sora	COVER, SHORGRAZ (-), AREA, SEMIA(-), VEGNUM		sp: no area requirement ss: no area requirement
Virginia Rail	COVER, AREA, STEM		sp: > 15ha ss: no area requirement

Definition of variables:

AREA: natural log of the wetland area (ha)
SEMIA: natural log of total semipermanent wetland area within 25.9 km^2 (10 mi^2) cells
GRASS: proportion of untilled upland habitat within 25.9 km^2 (10 mi^2) cells
COVER: percent of vegetated wetland area
STEM: indicates whether herbaceous hydrophytes were thick-or-thin stemmed
VEGNUM: number of emergent hydrophyte species composing $\geq$ 10% of the vegetated wetland area
SHORGRAZ: index to grazing intensity on shorelines adjacent to wetlands
LANDUSE: indicates whether land adjacent to wetland was tilled or untilled

Factors such as proximity to other types of wetlands, cover type, presence of trees and indices to grazing were included in the model, but were not significant.

With the exception of Wilson's Phalarope and Black Tern, the presence of dense stands of emergent vegetation was positively associated with the presence of the species suite. Neither the tern nor phalarope forage in emergents, although the tern will place nests within it. The probability of occurrence of all the species except the phalarope increased with wetland area, the significance of which is discussed further in the Habitat Objectives section. Wilson's Phalarope also was the only species negatively associated with thick-stemmed vegetation such as cattails around wetland perimeters; Virginia Rails and Marsh Wrens both seem to favor sites with such. Although there is some variation in microhabitat needs of these species, Naugle (1997) did find a significant positive relationship between wetland area and the probability of detecting multiple area-dependent species within both seasonal and semipermanent wetlands and that species diversity was greater where wetland complexes were available.

Population objectives and habitat strategies:

Perhaps the most important population objective for the species suite as a whole is to implement better monitoring so that population trends can be adequately determined. Only Marsh Wren, Wilson's Phalarope and Marbled Godwit have significant BBS trends, although the latter two occur only on a small number of BBS routes. We would like to see better baseline data gathered so that population sizes can be estimated and population growth rates determined. Population increases of at least 3% per year seem reasonable to expect if habitat restoration and enhancement efforts are successful, and should be maintained at that level throughout the planning unit for the next ten years. At that time, a thorough assessment should be made to determine whether further conservation action is warranted.

In order to increase populations, two requirements must be met. First, adequate habitat must be provided to breeding individuals in the population base as well as the increasing number of individuals produced by population growth. Second, birds in those habitats must produce enough offspring to maintain the targeted growth rate. Providing adequate habitat requires meeting minimum area requirements as well as microhabitat needs. Minimum area requirements may vary among areas in the planning unit, although those given by Brown and Dinsmore (1986) for Iowa and Naugle (1997) for South Dakota are similar for Black Tern, American Bittern, Pied-billed Grebe. While Wilson's Phalarope and Virginia Rails showed high area sensitivity in South Dakota, neither appeared area sensitive in the Iowa study. Marsh Wren also appeared less area sensitive in Iowa. However, in a study of breeding bird densities at 1,321 wetlands in North Dakota by Kantrud and Stewart (1984), only permanent and alkali wetlands exceeded 10 hectares in average

size, and no American Bitterns were found in those wetland types. Densities of Pied-billed Grebes, American Bitterns, Virginia Rails and Sora were highest at fens, whose average size was 3.7 hectares (9.3 acres), but wetlands of this type are relatively scarce. Densities of these species were second highest in either seasonal or semi-permanent wetlands, which averaged 0.6 hectares (1.6 acres) and 3.9 hectares (9.8 acres), respectively. Densities of Black Terns were highest in semi-permanent wetlands, while Wilson's Phalarope reached highest densities in undifferentiated tillage, and second-highest at seasonal wetlands. Thus, preservation and restoration of larger wetlands may need to be emphasized more in the southern and eastern portions of the Prairie Pothole Region. All the authors, however, encourage the restoration and preservation of wetland complexes to maximize conservation value. Further, the amount of grassland in wetland landscapes should be maximized for Wilson's Phalaropes, Black Terns and Marbled Godwits. A minimum of 100 ha of relatively short native grasslands should be available around wetland complexes for Marbled Godwits, meaning over 400 ha of grassland are needed where disturbance cycles are at 4-year intervals.

Nest predation is thought to be the factor most limiting recruitment of wetland birds. A wide array of predators pose potential threats, including gulls, snakes, striped skunks, ground squirrels, raccoons, etc. While some work has focused on habitat use by raccoons, fox, etc. and the impacts of those predators upon duck populations (e.g. Sargeant 1972, Frizell 1978, Johnson et al. 1989), little is known about how landscapes surrounding wetlands influence densities and foraging patterns of predators.

With regard to numbers of wetlands needed in a given "complex", more needs to be determined about what proportion of wetlands in an area are used by the species of concern, and what makes some more attractive to the birds than others. For example, VanRees-Siewert (1993) investigated bird use of 18 and 24 recently restored wetlands in Iowa during the 1991 and 1992 breeding seasons, respectively. Breeding American Bitterns, Virginia Rails and Soras were not found at any of the sites in 1991; in 1992, 3 sites were used by Virginia Rails, 1 by Soras, and 2 by American Bitterns. Wetlands used varied in time since disruption of drainage from 2 to 4 years. While the internal variability and ephemeral nature of these systems is likely to drive habitat selection in any given year, the dynamics of use of both restored and natural wetlands must be better understood before functional wetland complexes can be identified. Other research needs are identified later in this document.

Wetland conservation opportunities:

Development of wetland complexes emphasizing relatively large seasonal and semi-permanent wetlands should overlap wherever possible with ongoing conservation efforts to provide adequate breeding habitat for waterfowl in the Northern Tallgrass Prairie and with guidelines for shorebirds as the National Shorebird Conservation Plan develops. Although dabbling ducks are known to use smaller wetlands, ducks also need larger semipermanent wetlands for brood habitat and for feeding prior to migration in the fall. However, more research is necessary to determine the extent to which management for waterfowl truly does benefit nongame wetland birds. Further, the numbers and dispersion of wetland complexes needed to sustain populations of priority nongame wetland birds should be estimated based upon results of the kind of research described below. Geographic Information Systems and National Wetland Inventory data also would be useful in developing such estimates, as well as in identifying the locations of potential sites for conservation. Partnerships will become ever more important as resources are gathered to accomplish cooperative projects.

Evaluation of assumptions - research, monitoring:

The following actions are needed to further conservation of wetland bird species of concern in the Northern Tallgrass Prairie physiographic area, and to help conservation efforts continue to evolve in a responsible and adaptive atmosphere:

1. Evaluate the number, type and size of wetlands needed in a given "landscape" to provide a "complex" capable of supporting source populations of wetland species of conservation concern. This includes measurements of productivity and survivorship, investigation of the dynamics of dispersal and colonization of sites (given that wetlands in the Northern Tallgrass are ephemeral in nature) and variability in use of sites throughout climatic cycles.

2. Determine population replacement rates of priority species and how habitats, landscapes and other conditions affect those.

3. Determine how landscapes surrounding wetlands influence densities and foraging patterns of predators.

4. Determine where wetland complexes can functionally overlap grassland Bird Conservation Areas.

5. Evaluate the effects of waterfowl and other conservation management practices on nongame wetland bird species.

6. Develop monitoring techniques that will assess changes in relative abundance and population trends of wetland bird species of concern.

Outreach:

Implement education and outreach to encourage private landowners to implement best management practices and to make the best use of USDA Farm Bill and other incentive programs to provide habitat on private lands for wetland birds. Outreach also should include making the public (especially private landowners in the area) aware of the overlap of conservation efforts for waterfowl and non-game birds in the PPJV, and foster overall pride in the region's prairie heritage.

Riparian Woodlands:

Ecology and conservation status:

While species in this suite such as Black-billed Cuckoo, Red-headed Woodpecker and House Wren are also found in forests and upland woodlands, these habitats probably were not widespread in the Northern Tallgrass Prairie prior to fire suppression and the planting of trees around farmsteads. Given the high priority placed upon grassland birds in this physiographic area, and the increased incidence of nest predation and parasitism of grassland birds with habitat fragmentation and woody encroachment, this plan will not recommend a conservation focus on non-native woodlands. Areas where soils and topography may have supported savannas and brush-prairie away from riparian areas should be considered important for the conservation of this suite in addition to focusing on those habitats in floodplains and adjacent slopes and tablelands.

The ecology of riparian systems of the Northern Tallgrass Prairie physiographic area has received little treatment to date. Information in this section is based largely on personal communication with the following individuals: Wayne Ostlie and Kim Chapman of The Nature Conservancy;

Robert Dana of the Minnesota Department of Natural Resources; John Pearson of the Iowa Department of Natural Resources; Jim Leach, Barbara Pardo and Rick Schultz of the U.S. Fish and Wildlife Service.

Forests of elm, ash, maple and willow are known to have occurred in the larger floodplains of the physiographic area. In other riparian areas, linear "gallery" forests probably were more common. Oak woodlands, savannas and brush prairies are thought to have occupied slopes and tablelands on the downwind side of rivers where they were protected from fire and where the water table was adequate to support woody growth. This mosaic of habitats may have adjoined all of the rivers in the region and, to varying degrees, their major tributaries. Note that the structure of these habitats and their juxtaposition within the riparian landscape would provide the very combination of factors necessary to support all the species in the suite as outlined below. Although a much more in depth study of floodplain ecology is needed to better determine habitat associations in riparian systems of the Northern Tallgrass Prairie, restoration efforts should target large riparian habitat complexes wherever possible.

Bird habitat requirements:

The following species are Partners in Flight priorities for riparian areas in the Northern Tallgrass Prairie physiographic area: Wood Duck, Hooded Merganser, Black-billed Cuckoo, Red-headed Woodpecker, Northern Flicker, Bald Eagle and House Wren. All but the eagle and cuckoo are cavity nesters. While the House Wren is included in this suite because a high percentage of its population occurs within the Northern Tallgrass Prairie area, management or nest box programs for this species should be discouraged as it is known to destroy eggs of other songbirds and populations trends currently appear stable. Wood Ducks, Hooded Mergansers and Bald Eagles are poorly sampled by the Breeding Bird Survey, although all appear to be increasing in the physiographic area. The cuckoo, woodpecker and flicker are all showing significant declines in the Northern Tallgrass Prairie, as well as throughout much of their range. Habitat requirements are given in Table 6.

Table 6. Habitat requirements of riparian priority bird species in the Northern Tallgrass Prairie.

Species	Nest type	General Habitat Requirements	Diet
Hooded Merganser (from Dugger et al., 1994)	Secondary cavities near water.	Closely tied to forested wetland systems or non-forested wetlands associated with riparian corridors.	Aquatic insects, fish and crustaceans (particularly crayfish).
Black-billed Cuckoo (from Ehrlich et al. 1988)	Small platform in trees or shrub 0.7-2 m (2-6 ft.).	Deciduous and coniferous forest and open woodland.	Especially caterpillars, but also molluscs, fish, small vertebrates, eggs, fruits and berries.
Red-headed Woodpecker (from Ehrlich et al. 1988)	Primary or secondary cavity, usually in barkless dead tree or dead stub of live tree.	Open woodlands, oak savannas.	Mostly insects, but some vertebrates, seeds and fruits.
Wood Duck (from Hepp and Bellrose 1995)	Secondary cavities.	Need feeding area such as shallow, freshwater wetlands near suitable nest sites.	Aquatic and terrestrial plants and invertebrates.
Northern Flicker (from Moore 1995)	Primary cavities.	Open woodlands.	Insects, especially ants and ground beetles.
House Wren (from Ehrlich et al. 1988)	Secondary cavities.	Open woodland, shrubland, farmland and suburbs.	Invertebrates such as millipedes, spiders, snails.
Bald Eagle (from Ehrlich et al. 1988)	Large platform nest typically placed in fork of tall tree at 10-20 m (30-60 ft.).	Rivers and large lakes in open areas.	Fish, small mammals, waterfowl, carrion.

Population objectives and habitat strategies:

As with grassland and wetland birds, we would like to see declining trends reversed and populations of declining species increasing regionally at the rate of 3 or greater percent per year until the species attain 1960's levels. Monitoring needs to be increased or better programs developed to document trends in species undersampled by the Breeding Bird Survey.

In order to increase populations, two requirements must be met. First, adequate habitat must be provided to breeding individuals in the population base as well as to the increasing number of individuals produced by population growth. Second, birds in those habitats must produce enough offspring to maintain the targeted growth rate. Little is known about minimum area requirements or the demographics of birds in riparian ecosystems of the Northern Tallgrass Prairie. However, assuming that predation and parasitism rates in these systems are lower on larger tracts, restoration or regeneration of the potential natural vegetation in riparian corridors and their associated woodlands and brush-prairies should be done on a landscape scale, impacting the full width of the river corridor where possible. Target areas should be identified where large-scale conservation can be successful.

Riparian woodland conservation opportunities:

At present, the greatest opportunity for restoration of riparian habitats in the Northern Tallgrass Prairie physiographic area is through utilization of landowner incentive programs such as the Wetlands Reserve Program, Conservation Reserve Program, Conservation Reserve Enhancement Program, and perhaps the Clinton Administration's new Clean Water Initiative. These programs are being used most fully in the Minnesota River Valley, where the Minnesota Valley National Wildlife Refuge also has acquired over 10,000 acres of riparian habitat. Partners in Flight must become more involved in these initiatives at the grass-roots level, so that the needs of PIF priority birds are recognized and satisfied.

Evaluation of assumptions - research, monitoring:

The following actions are needed to further conservation of riparian forest birds in the Northern Tallgrass Prairie, and to help conservation efforts continue to evolve in a responsible and adaptive atmosphere:

1. Determine the minimum area requirements of the priority riparian species in the Northern Tallgrass Prairie, and how densities and reproductive success vary with habitat patch size.

2. Monitor populations to determine whether sustained long-term population increases of 3% per year or greater are being met.

3. Determine the influence of landscape patterns on movements of nest parasites and predators.

4. Evaluate the effects of riparian restoration, particularly with respect to tree species composition, on use by birds.

Outreach:

Information on the habitat requirements of the PIF priority species should be made available to landowners in riparian habitat, including all public land-managing agencies holding title or easements in a given area. The Partners in Flight community should take a more active role in communicating the needs of PIF priority species to decision makers at both the local and regional level.

Section 4: Summary of habitats, representative species and draft goals.

Grassland birds are a very high priority in the region, as many species are characterized by consistent and dramatic population declines. Greater Prairie-Chickens, for example, now number less than 2,000 in Iowa, Minnesota, and North Dakota (Westmeier and Gough, unpublished data). Dickcissels, Bobolinks and Grasshopper Sparrows all have exhibited significant long-term declines range-wide and are declining in the physiographic area as well. Much of this can be attributed to loss of habitat and the negative effects of habitat fragmentation, such as increased predation and nest parasitism. A model for grassland Bird Conservation Areas, consisting of an 800 ha (2,000 acre) core within a 4,000 ha (10,000 acre) matrix which also contains relatively large tracts of

grassland is being promoted as a landscape in which source populations of grassland birds are supported. It appears that 60-70 BCAs could be sustained in the Northern Tallgrass Prairie portion of the PPJV. The population objective is to increase populations of declining priority species at 3% per year or greater until 30 year declines are reversed, and to maintain stable or to increase population trends of other priority grassland bird species. The BCA concept currently is being tested by Northern Prairie Wildlife Research Center scientists.

Many non-game wetland bird species are under-sampled in the region, and their long-term population trends are unknown. Better baseline data are needed so that population sizes can be estimated and population growth rates determined. However, many of the PIF priority species are known to need large wetland complexes, and relatively large acreages of grass cover in the matrix surrounding the wetlands. The population trends of the PIF priority species should be monitored as restoration and enhancement of these habitats continues, with population increases of at least 3% per year targeted for the planning unit during the next ten years. At that time, a thorough assessment should be made to determine whether further conservation action is warranted. While some of the species' requirements are more stringent than those of waterfowl, waterfowl should benefit from efforts to meet the additional needs of the non-game wetland bird community .

Riparian forest ecosystems in the Northern Tallgrass Prairie have received relatively little treatment from ecologists to date, yet it is an important habitat type for a suite of PIF priority species. The two species of waterfowl that use such habitat, the Hooded Merganser and Wood Duck appear to be doing well, perhaps as a result of waterfowl conservation programs. But other cavity nesters, such as the Northern Flicker and Red-headed Woodpecker are declining significantly both in the physiographic area and range-wide. Little is known of the area requirements, habitat needs or demographics of those species in Northern Tallgrass Prairie riparian systems, or how factors in the surrounding landscape influence those parameters. Some habitat restoration is occurring in the region as private landowners in many of the river valleys in the Northern Tallgrass Prairie take advantage of Federal incentive programs such as the Wetland Reserve Program and the Conservation Reserve Program. The U.S. Fish and Wildlife Service's Minnesota Valley National Wildlife Refuge and other partners in the new Conservation Reserve Enhancement Program on the Minnesota River appear to have the most focused effort to date. The PIF community is encouraged to bring non-game bird conservation into the central arena of these efforts.

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Appendix 1: The Partners in Flight Prioritization Scheme and criteria for the development of priority species lists.

The Partners in Flight Species Prioritization Scheme was first developed in 1991 (Hunter et al. 1993) and has been continually reviewed and refined in the years following its inception (Carter et al., in prep). The system ranks each species of North American breeding bird based upon seven measures of conservation "vulnerability". These factors include relative abundance (interspecific), size of breeding and non-breeding ranges, threats to the species in breeding and non-breeding areas, population trend, and the relative density (intraspecific) in a given planning unit compared to the maximum reached within the species' range. Each species is given a score of 1-5 in each category, with 1 indicating the least amount of vulnerability with regard to that parameter and 5 the most. The threats breeding and population trend scores can represent the species' ranking in a given physiographic area or across its range, although only the former are considered in physiographic area Bird Conservation Plans. Intraspecific relative density, known as Area Importance, is always specific to a given planning unit. Scores in each category are then summed to produce a composite score potentially ranging from 7-35. Species with relatively high overall scores are considered most vulnerable to extinction (although they often are not endangered at present) and need at least to be carefully monitored throughout their ranges. Scores for PIF species are posted on the internet at: http://www.rmbo.org/pif/pifdb.html under "Partners in Flight prioritization process".

Another measure of a species' importance in a given planning unit is the percentage of its population that occurs there. Physiographic areas with large percentages are able to take greater conservation responsibility for that species because affecting an increase or decrease in a population trend has greater potential impacts in areas where numbers of individuals are greater. For example, many more individuals are lost by a sustained 3% per year decrease in an initial population of 10,000 than in a population of 100. The rationale for giving an Area Importance (AI) score in the PIF prioritization scheme is similar, although it is a relative density score that is independent of the size of a given planning unit while percentage of population is not. Thus, relative density could be the same in a 100,000 and 200,000 sq. kilometer planning unit, but the percentage of the population would be twice as great in the latter.

The third factor that comes into play when identifying species of conservation priority is the species' population trend. Species whose populations are declining range wide may or may not be declining in a given planning unit. It is important to focus active management in those areas where

declines should be stabilized or reversed and to identify the factors responsible for stable or increasing trends in other areas so that similar conditions can be achieved where needed. Again, a declining trend has the greatest effect on a species' total numbers where the populations are greatest, so population trend and measures of abundance often are examined in tandem.

After taking into account the factors described above, a list of criteria was developed by which species in a given planning unit are identified as priority species. Those criteria are as follows:

1. Its total score (based upon the PIF Prioritization Scheme) within the physiographic area is 23 or greater and it occurs in the region in manageable numbers. This is meant to highlight the species that appear most vulnerable based upon a combination of the seven factors identified by the prioritization scheme.

2. Its total PIF score is 19-22, with the sum of Area Importance and Population Trend being 8 or greater. Thus, species with moderate relative densities in the planning unit are included only if their population trends are declining significantly. Species with high relative densities in the area are included if population trends are unknown or declining. Population trend is based upon 30 year trends from Breeding Bird Survey data when available.

3. It's a PIF "Watch List" species with an AI = 3 or greater. (Watch List species are those with the highest PIF prioritization scores based upon the species' ranks across their entire range. Some Watch List species may already have met criteria 1 or 2. (For more information, see the WatchList Website at http://www.audubon.org/bird/watch/)

4. Its Area of Importance and Population Trend score both are 5, regardless of its total score.

5. The percentage of the population breeding in the planning unit is greater than 5% in planning units smaller than 200,000 sq. kilometers or 10% in areas greater than 200,000 sq. kilometers. The Northern Tallgrass Prairie Physiographic Area is approximately 155,000 sq. kilometers.

6. A species is Federally listed as Threatened or Endangered.

7. The species is of local concern and was identified by the Nongame Technical Committee of the Prairie Pothole Joint Venture.

Partners in Flight species prioritization scores for all species in the physiographic area can be found at the Colorado Bird Observatory's homepage: http://www.rmbo.org/pif/pifdb.html

Appendix 2: Statements and assumptions associated with grassland Bird Conservation Areas.

The following is a list of statements, assumptions, corollaries, and addenda associated with the development of grassland Bird Conservation Areas:

1. The nature of habitat objectives for a region is determined in part by the total percentage of area covered by "natural" high quality habitat (as defined by the needs of priority bird species). Objectives for regions in which the percentage of quality habitat falls below an imprecisely defined threshold should be phrased in terms of habitat blocks. Within blocks, objectives are phrased in terms of maintenance of "healthy" populations rather than numbers of individuals. A "healthy" population is difficult to define, but includes the concepts that: 1) there is a low probability of extirpation over time, and 2) birds breeding within the block are producing enough young to replace adult attrition. Populations producing at or above this level are considered "source" populations. Populations producing below replacement levels are called "sinks". Areas with sink populations sometimes appear to have stable populations because the birds present are coming from other areas with source populations.

2. It is suggested that a block must equal or exceed 800 hectare (2000 acres) of high quality protected grassland (in a polygon in which edge is minimized) in order to support source breeding populations of high priority bird species. A "protected grassland" is one on which appropriate management is assured for a long period of time, including private land under long-term easements or land under public or private conservation organization ownership. This recommendation is based on a model developed by Wisconsin Department of Natural Resources in which sustained populations of priority grassland birds have been related to block size. This assumption is critical to all that follows, and is currently being tested in the Northern Tallgrass Prairie physiographic area by scientists at the Northern Prairie Wildlife Research Center, Jamestown, ND.

3. Internal characteristics of identified quality blocks will vary, and no one block is presumed to be optimal for all breeding bird species. Any block should, nonetheless, consist almost entirely of quality habitat. Quality habitat can include native and/or restored prairie, old fields and non-native grasslands, appropriately grazed pasture, or properly managed CRP land (with the caveat that CRP land under short-term contracts does not enjoy the protection necessary to serve within a block designed for long-term conservation purposes). A block should contain a minimum of hostile habitat conditions (including woodlots, treed ditch and fencerows, and treed riparian

habitat that provide habitat and perch sites for avian parasites and predators or early-mowed hayfields that serve as a sink for breeding grassland birds). This minimum is tentatively defined as no more than 1% of the total area of the block (this figure may be unrealistically low and should be evaluated as experience in establishing blocks is gained).

4. Internal characteristics of blocks will change over time in response to disturbance, succession, and management practices. The effects of various conditions and practices on priority birds, species suites, and their habitats must continue to be evaluated. It may be necessary to maintain a spatially shifting balance of successional conditions over time to simultaneously and continuously provide habitat for all species of concern. Minimum necessary sizes for blocks should reflect these predicted needs.

5. Each block is embedded in a matrix that can have both positive and negative impacts on activities within the block. These impacts can include (but are not limited to): support of predators or parasites that have access to parts or all of the block; provision of additional foraging habitat for birds breeding within the block; additional breeding habitat that increases the functional size of populations within the block; habitat for birds dispersing from the block or as attractants to birds colonizing or re-colonizing the block. The distance from the edge of the block over which these impacts can originate is not defined, but can range from zero to several kilometers. This discussion tentatively settled on a matrix with a width of 1.6 km. (1 mile , or the side of one section of land) beyond the edge of an identified block. For a square or near-square block of 800 hectare (2000 acres), the total area of that block and its matrix would be approximately 4,000 hectares (10,000 acres). A block and its matrix make up a Bird Conservation Area (BCA, Figure 1).

6. Habitat in a matrix can be compatible, neutral, or hostile for bird populations within a block. Compatible habitat includes native or non-native grasslands, CRP land, pasture, old fields, and late-cut hayfields; neutral habitat includes most small-grain and some row crop agriculture; hostile habitat includes treed areas and early mowed hayfields (these designations must be more carefully considered). It is possible that the negative impacts of a matrix are more critical than the positive impacts. As a tentative step, it is recommended that a matrix include a minimum of 25% compatible habitat and a maximum of 5% hostile habitat. Of the 25% or more that is compatible, much should occur in patches of 40 hectares (100 acres) or greater (Fig. 1). The remainder should be neutral - an important point here is that it is implicit in this recommendation that many agricultural practices and a vibrant rural economy are desired features of these conservation recommendations.

7. Within a BCA, the relationship between the effective size of a block and the nature of its matrix is flexible. It is possible, for example, that a moderate increase in the size of the block can mitigate for some unavoidable hostile conditions in the surrounding matrix.

8. A landscape is herein defined as an area that includes two or more BCAs; a landscape will typically consist of approximately 40,000 hectares (100,000 acres; Fig. 2). The sum of the blocks within each landscape should include enough internal variability (over space and time) to maximize support of the array of priority species and species suites occurring in the physiographic area.

9. The nature of habitat within landscapes but outside of BCAs (blocks and their associated matrices) may be important. It is tentatively recommended that it be at least 15% compatible (as much as possible arrayed in patches exceeding 100 acres in size), no more than 10% hostile, and the remainder neutral.

10. BCAs should, to the extent feasible, coincide with the conservation of other natural communities and native vegetation and/or be integrated with objectives set for other bird taxa, such as waterfowl or shorebirds.

11. The distribution of BCAs should reflect concerns regarding interpopulational distances, colonization potential, gene flow, and representation of species over the extent of their ranges.

12. For those priority species that are rare, habitat specialists, and/or sparsely distributed, the total number and distribution of individuals supported under these objectives should be evaluated for sufficiency.

13. The assumptions inherent in the above objectives should be tested in both the short-term and long-term. In the short-term, a range of the above conditions, incorporating varying combinations of the assumptions regarding block size, the nature of matrices, and geographic juxtaposition among them, should be identified. These different situations should be investigated for the presence of high priority bird species and species suites, the health of populations (productivity, survivorship, etc.), and their ability to support source populations.

14. Principles of adaptive management should apply, in that all recommendations are subject to change as more and better information becomes available.

Fig. 1. The figure on the right depicts a Bird Conservation Area consisting of an 800 hectare (2,000 acre) block of permanent grassland as a core within an approximately 4,000 hectare (10,000 acre) matrix. 25% of the matrix contains compatible grassland habitat, with 51% in tracts greater than 40 hectares (100 acres).

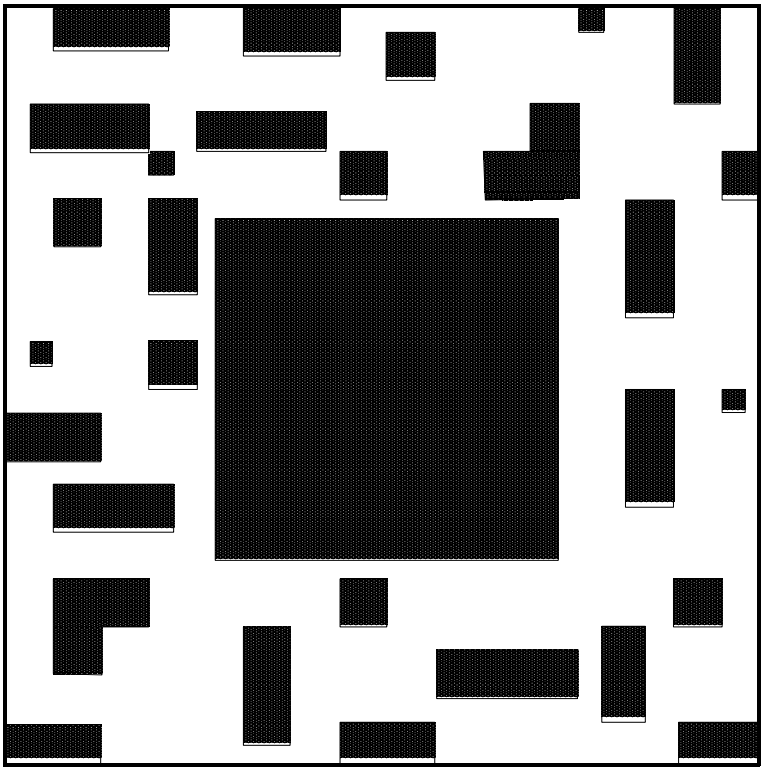
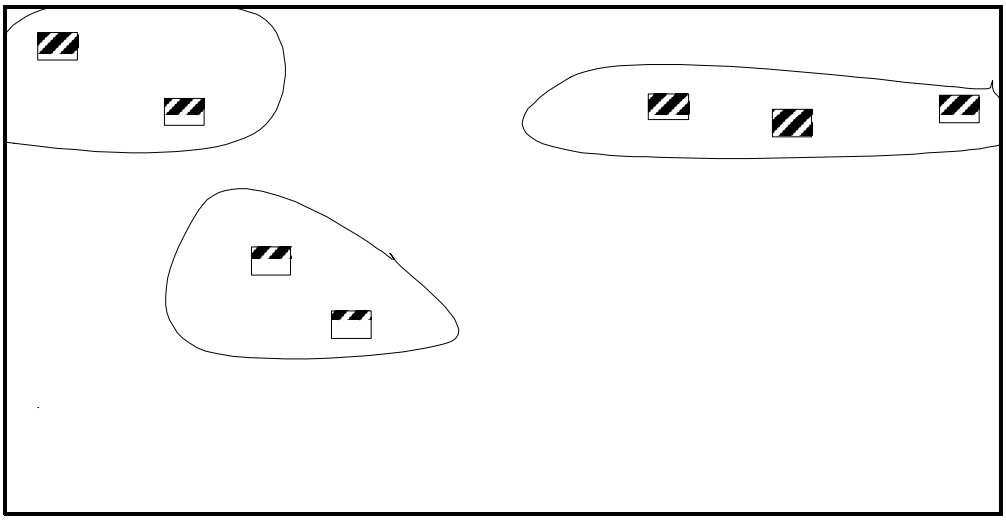


Fig. 2. The figure below represents a hypothetical dispersion of three approximately 100,000 acre "landscapes", each containing at least two Bird Conservation Areas.



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Front cover illustration of Dickcissels from ‘All the Birds of North America’ by Jack Griggs, courtesy of HarperCollins publishers.