Prairie Pothole
JOINT VENTURE

2005 Implementation Plan
Section IV – Waterbird Plan

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Contents

Background and Context

The myriad wetlands that make the Prairie Pothole Region (PPR) valuable to waterfowl also make it important to waterbirds, and the PPR harbors a large proportion of the total population and breeding range for many North American waterbird species (Figure 1; Sauer et al. 2004).

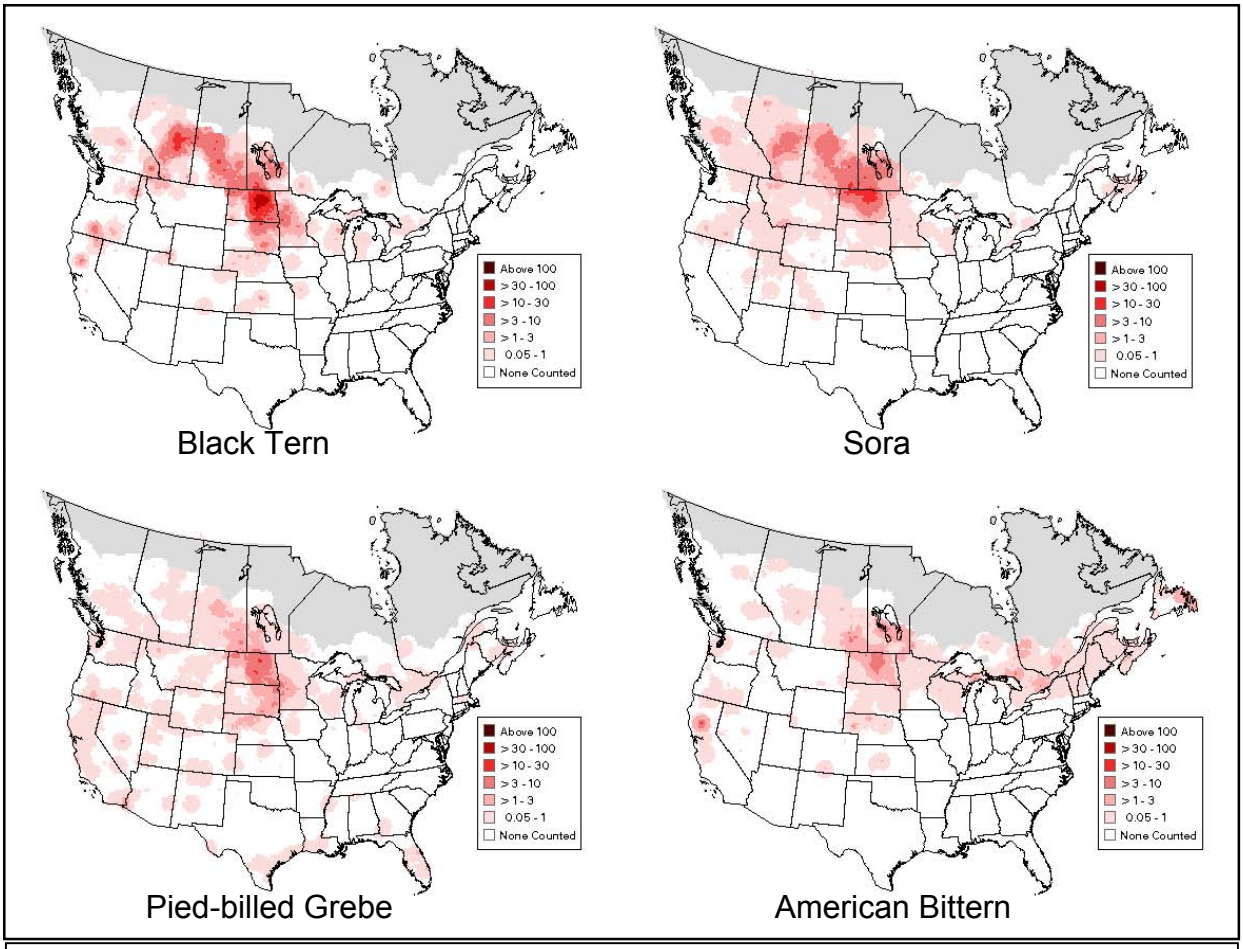

Figure 1. Summer distribution and density of Black Tern (top left), Sora (top right), Pied-billed Grebe (bottom left), and American Bittern (bottom right), 1993-2004, as detected by North American Breeding Bird Survey (Sauer et al. 2004).

Information on many waterbird populations is poor relative to waterfowl, but it is estimated that the proportion of the continental breeding population found in the PPR is > 60% for Franklin's Gull; > 50% for Pied-billed Grebe, American Bittern, Sora, American Coot, and Black Tern; and approximately 30% for American White Pelican and California Gull (Table 1; Niemuth et al. 2003). High populations and numbers of waterbird species signify the critical importance of the PPR to continental waterbird conservation.

The North American Waterbird Conservation Plan (NAWCP; Kushlan et al. 2002), was developed to provide a continental perspective on the status of and conservation efforts for waterbirds in North America. The NAWCP covers 210 species of waterbirds in 23 families that spend at least part of the year in the NAWCP planning area, which includes the interests of 29 nations in North America, Central America, and surrounding pelagic zones. However, the NAWCP specifically addresses colonial and semi-colonial waterbirds only; solitary breeders are to be addressed in the second version of the NAWCP, which has yet to be published. This information gap is particularly significant in the PPR, where 38% of species are generally solitary breeders, as opposed to only 20% of waterbird species across the continent.

The Northern Prairie & Parkland Waterbird Conservation Plan (Plan; Beyersbergen et al. 2004) was developed to address waterbird conservation issues specific to the PPR. The Plan describes the current knowledge, biology and conservation efforts for 40 waterbird species (Table 1) in the Plan area, which also includes the Canadian Peace Parklands (Figure 2).

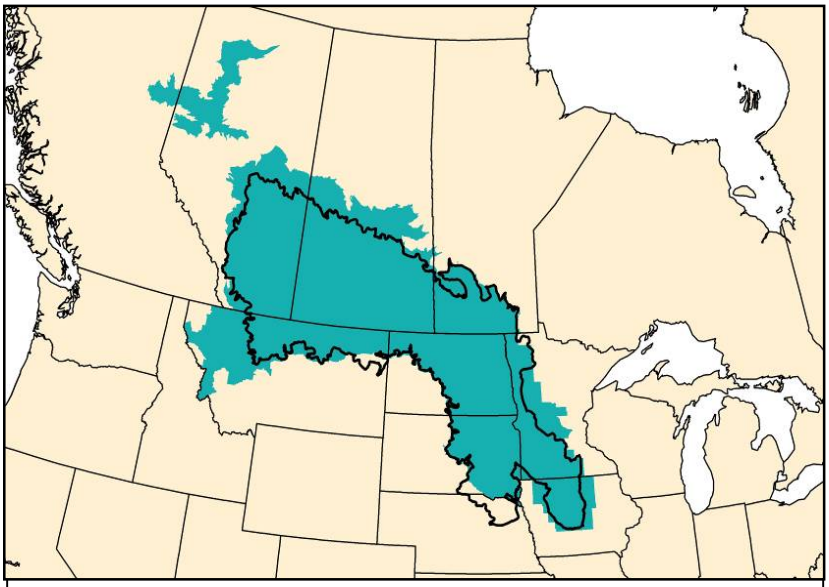

Figure 2. The Northern Prairie and Parkland Waterbird Conservation Region (green shading) consists of those areas covered by the Prairie Pothole Joint Venture (PPJV) in the United States and the Prairie Habitat Joint Venture (PHJV) in Canada and approximates Bird Conservation Region 11 (black outline) in north-central North America.

The overall goal of the Plan is:

"To provide guidelines for conservation that, when implemented, result in maintaining and managing healthy populations, distributions, and habitats of waterbirds throughout the Northern Prairie & Parkland Region of North America."

Waterbirds breeding in the PPR spend only a portion of their annual cycle there, and migration corridors, staging areas, and wintering grounds are also vital to waterbird conservation. Continental planning efforts must recognize and support conservation of linkages between different geographic regions, and regional plans should identify and address conservation issues within their respective boundaries.

Table 1. Estimated percent of continental population breeding in BCR 11, breeding status, breeding distribution, and conservation assessment ratings of waterbird species included in the Northern Prairie and Parkland Region Waterbird Conservation Plan.

Common Name	Continental population in BCR 11 (%)	Colonial or Non-colonial	Breeding distribution	Conservation assessment
Common Loon	<1	N	Widespread	Low
Pied-billed Grebe	>50	N	Widespread	Low
Horned Grebe	10-24	N/C[1]	Widespread	High
Red-necked Grebe	<10	N/C	Widespread	Low
Eared Grebe	~20	C/N	Widespread	Moderate
Western Grebe	<10	C	Widespread	High
Clark's Grebe	1-9	C	Local	Low
American White Pelican	~30	C	Widespread	Moderate
Double-crested Cormorant	~15	C	Widespread	Low[2]
American Bittern Least	>50	N	Widespread	High
Bittern	<10	N/C	Widespread	Moderate[3]
Great Blue Heron	~5	C	Widespread	Moderate
Great Egret	<1	C	Peripheral	Low
Snowy Egret	<1	C	Peripheral	Low
Cattle Egret	<1	C	Local	Low
Little Blue Heron	<1	C	Peripheral	Low
Tricolored Heron	<1	C	Peripheral	Low
Green Heron	<1	N/C	Widespread	Low
Black-crowned Night-Heron	<10	C	Widespread	Moderate
Yellow-crowned Night-Heron	<1	C	Peripheral	Low
White-faced Ibis	<1	C	Local	Low
Yellow Rail	Unknown	N	Widespread	High
Black Rail	<1	N	Peripheral	Moderate
King Rail	10-24	N	Widespread	High
Virginia Rail	<10	N	Widespread	Moderate
Sora	>50	N	Widespread	Low[4]
Common Moorhen American	10-24	N	Peripheral	Low[4]
Coot	>50	N	Widespread	Low[4]
Sandhill Crane	<1	N	Widespread	Low[4]
Whooping Crane[5]	Not applicable	N	-------	Listed
Franklin's Gull	~67	C	Widespread	High
Bonaparte's Gull	Unknown	C/N	Peripheral	Low
Ring-billed Gull	>5	C	Widespread	Low[2]
California Gull	~30	C	Widespread	Low[2]
Herring Gull	~2	C	Peripheral	Low
Caspian Tern	<1	C	Local	Moderate
Common Tern	10-24	C	Widespread	Moderate
Forster's Tern	8-10	C	Widespread	Low
Least Tern	<2	C/N	Local	Listed
Black Tern	>50	C	Widespread	High

[2]N/C: degree of coloniality varies; most typical behavior is listed first.
[3]May be of higher management concern due to problems associated with locally increasing populations.
[4]Federally listed in Canada.
May be of higher management concern because of harvest in some locations.

Landscape Changes and Their Implications to Waterbirds

Many species and ecological functions are being lost in the PPR as native habitat is altered or converted to other uses. Because agriculture is the primary land use, many of the threats to the ecological integrity of the PPR are related to agricultural practices and programs. Threats can be direct, as in habitat loss from wetland drainage and conversion of grassland to cropland, or indirect, such as pesticide-induced loss of invertebrate populations necessary for growth and survival of waterbirds or their prey.

Vast numbers of wetlands already have been converted to other uses in the PPR. Statewide estimates of number of wetlands lost are 89% for Iowa, 49% for North Dakota, 42% for Minnesota, 35% for South Dakota, and 27% for Montana. The percentage of surface area lost is smaller than the percentage of number of wetlands, as smaller wetlands, which are easier to drain, are drained first. However, small wetlands are disproportionately used by breeding waterfowl, and loss of small wetlands can disrupt habitat connectivity and reduce diversity and function of wetland complexes.

The strength of the agricultural economy influences incentives to convert native habitat to crop fields, as grassland and wetland conversion increase when crop prices are high. However, agriculture can have a tremendous impact on land use even in the absence of direct market forces. For example, the U.S. Department of Agriculture's Conservation Reserve Program (CRP), which takes land out of production by paying farmers to plant grass on croplands for a contracted time period, paid farmers in North Dakota approximately $100 million per year during the late 1990s. Wetlands in the U.S. presently receive some protection under the Swampbuster provision of the *Food Security Act of 1990* (a.k.a. U.S. Farm Bill), which denies federal agricultural benefits to farmers who drain wetlands, although wetlands can be farmed in dry years. Important as Swampbuster is to wetland-dependent wildlife, there is always the risk that such protection could be lost in a future farm bill. Wetland protection also may be jeopardized by other government regulations and decisions. For example, the U.S. Supreme Court ruled that isolated, non-navigable, intrastate wetlands (such as those typical of the PPR) are no longer protected under Section 404 of the *Clean Water Act of 1972*, which prohibits the dredging or filling of any portion of the waters of the United States without a permit.

Wetlands can be degraded even if they are not drained, as cultivation of wetland basins during dry years may reduce quality of wetland habitat during subsequent wet years when basins hold water. Marsh plants can survive several years of cultivation, but tillage of basins over extended periods can alter wetland plant community composition and reduce structure of wetland vegetation. In addition, wetlands in agricultural fields may have reduced numbers of invertebrates relative to wetlands in grasslands. Agriculture also has many less obvious, indirect effects that threaten the ecological integrity of the PPR, including siltation and fertilizer and herbicide inputs. Pesticides can decrease reproductive success as well as cause direct and indirect mortality of birds. Declines in populations of piscivorous raptors along with declines of some waterbirds such as pelicans and cormorants during the DDT era are well documented, but it is likely that smaller, less visible waterbirds species also were impacted, although the extent of any decline is unknown. Other pesticides such as carbofuran, chlorpyrifos, and parathion can cause

direct mortality of birds, kill invertebrates upon which many waterbirds feed, and contaminate food resources (Grue et al. 1986, Forsyth 1989).

Many non-agricultural threats to wetlands also exist. Increased burning of fossil fuels, particularly at coal-fired generating plants, causes acidification of precipitation, which has led to reduced productivity of some wetlands. Human-induced climate change (i.e., "global warming"), if it does occur, has the potential to alter temperature, precipitation amounts and patterns, growing season, plant evapo-transpiration, and a host of related factors such as snow cover, timing of migration, timing and duration of dormancy, species composition of native and agricultural systems, and urbanization, all of which could have dramatic impacts on many aspects of ecology in the PPR. Exotic species are spreading within the region, including terrestrial species such as leafy spurge and spotted knapweed and wetland/riparian species such as purple loosestrife and salt cedar. Many ecosystem functions are lost or altered as native species are displaced, alien species invade, and natural disturbances such as grazing and fire are altered (Collins and Wallace 1990).

Not all waterbird species have been negatively affected by human-induced landscape changes. Populations of several species of gulls have increased due to increased availability of food associated with humans. In addition, recent expansion of range into the PPR by several heron species may be a consequence of human-induced global warming.

Past Trends and Population Distributions

Populations of many waterbird species are poorly understood, and available population data are often imperfect. Nevertheless, available data indicate population declines for several species, which is a logical outcome of the extensive wetland and upland habitat loss that has taken place in much of the PPR. Least Tern and Whooping Crane are listed as endangered species in the U.S., and the Northern Prairie & Parkland Waterbird Conservation Plan identifies Western Grebe, Franklin's Gull, Black Tern, Horned Grebe, American Bittern, Yellow Rail, and King Rail as species of high concern (Table 1).

Although the effect of wetland availability on breeding distribution and density of waterbirds is poorly known, limited information indicates that waterbirds are affected in a manner similar to waterfowl. Numbers of several waterbird species are positively correlated with number of May ponds (Figure 3; Niemuth and Solberg 2003), and changes in Black Tern populations in the prairie provinces of Canada are correlated with changes in Mallard populations, both of which change with availability of wetlands (Peterjohn and Sauer 1997).

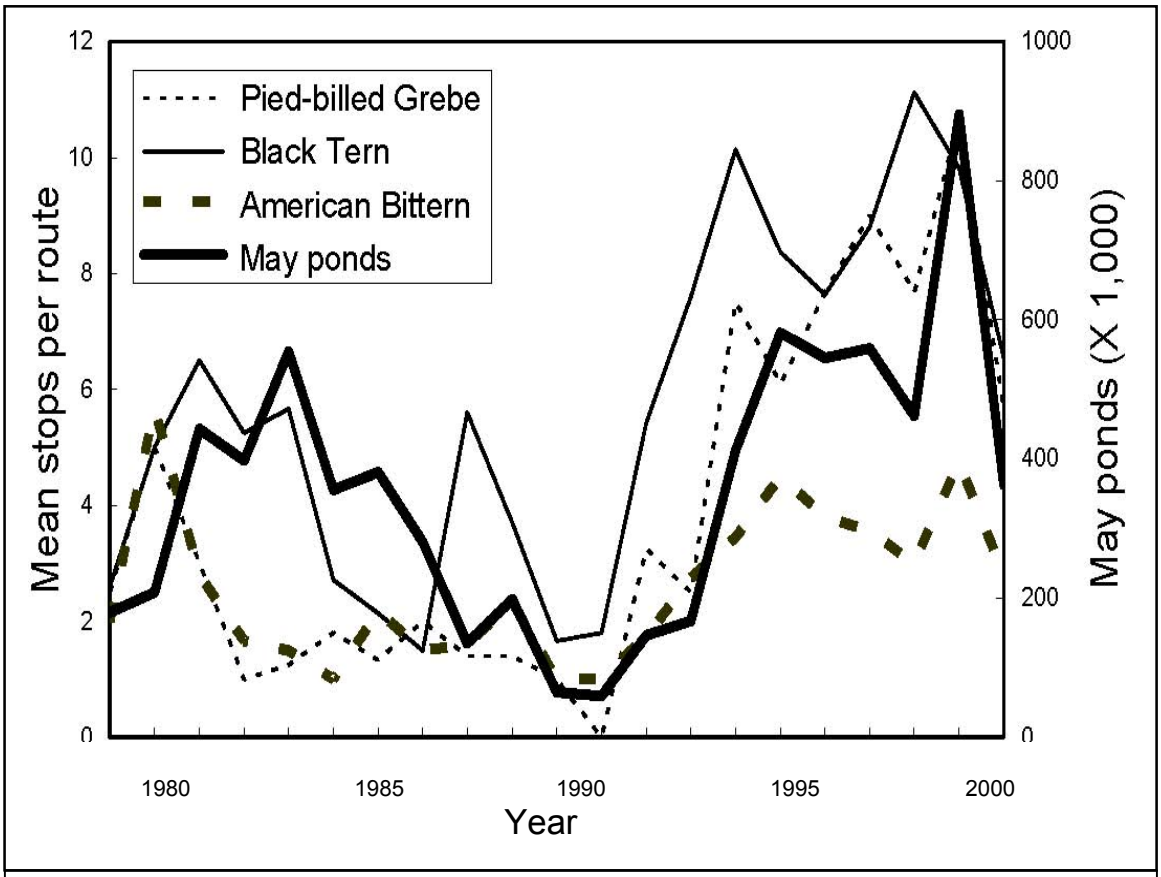

Figure 3. Relationship between wetland numbers and detection of Pied-billed Grebe, Black Tern, and American Bittern in north-central North Dakota, 1980-2000.

Fluctuations in waterbird numbers in response to wetland availability may be particularly important in the PPR, which is highly susceptible to drought and harbors a large proportion of the breeding populations for several species of waterbirds. Understanding the relationship between wetland numbers and waterbirds is likely as critical to the monitoring and management of waterbird populations in the PPR as it is for waterfowl. For example, if birds settle in different areas depending on water availability, apparent changes in local and regional populations may reflect wetland conditions instead of true population changes.

Biological Foundation

Healthy wetland complexes are the biological foundation of waterbird conservation in the PPJV. However, this foundation is influenced by a multitude of factors. For example, changes in water availability can alter habitat and influence local distribution and behavior of waterbirds. Temporal variation in water levels creates the "reservoir effect," which influences productivity of wetlands and potentially their suitability for waterbirds. Changes in water levels also encourage horizontal zonation of emergent vegetation, which is important to many species of waterbirds. Population movements, foraging tactics, breeding seasonality, prey availability, susceptibility to predation, foraging sociality, competition, nest site selection, and nest site tenacity of waterbirds all can be influenced by water availability, although effect varies with

species and location. Ultimately, altered behavior, prey availability, and susceptibility to predation can affect local reproductive success and population size. Effects of water availability on waterbirds within the PPR also may be influenced by water availability in other regions.

Other local conditions such as land use can also influence a wetland's ability to support waterbirds. Agricultural practices can affect the prey base, turbidity, and vegetation characteristics of a wetland, all of which will affect the wetland's ability to support waterbirds.

Assumptions and Key Uncertainties

Little is known about waterbirds in the PPR, and many assumptions are currently necessary in developing planning tools for waterbirds. As information is gathered to increase understanding and aid conservation of waterbirds in the PPR, the following key assumptions should be evaluated. First, the accuracy of existing survey information such as the Breeding Bird Survey should be assessed to assure it provides a useful index to population trends and is useful in prioritizing species. Second, we assume that waterbirds enjoy substantial benefits from waterfowl conservation activities in the PPR. However, the response to waterfowl conservation actions will vary among waterbird species, which have diverse habitat requirements. Finally, the assumption that landscapes are the appropriate scale for conservation planning should be evaluated. This may be particularly important given the value of wetland/upland complexes to waterbirds and the dynamic nature of the PPR.

Information Needs

Reliable, comprehensive population information that incorporates wetland availability (Fig. 3), and landscape context is the foremost information need identified in the Plan. Specific, high priority information needs pertinent to the PPJV include:

- Accurate distribution, abundance, and population trend data for all species, particularly non-colonial waterbirds.
- An understanding of habitat requirements at local and landscape levels for all waterbirds with emphasis on priority species.
- An understanding of factors affecting survival and productivity.
- Knowledge of the response of different waterbirds to various management treatments.

The Plan recommends a landscape approach to help integrate conservation planning for waterbirds with conservation planning for other species, particularly extensive, ongoing waterfowl conservation efforts. Priority recommendations for implementation of the Plan include:

- Initiation of standardized, region-wide surveys for colonial and non-colonial species.
- Development of statistically sound, defensible estimates of distribution, abundance, and population trends for all waterbird species.
- Understanding habitat requirements at local and landscape levels for all waterbirds.

- Development of region-wide spatially explicit habitat models for waterbirds.
- Completion of region-wide wetland inventory, to be updated at regular intervals.
- Completion of region-wide upland habitat inventory, to be updated at regular intervals.

Preliminary spatially-explicit habitat models have been developed for some species to guide waterbird conservation planning in the PPJV (Fig. 3). However, the low numbers and cryptic nature of some species (e.g., Yellow Rail) hamper data collection and development of rigorous models. Implementation of standardized, region-wide surveys will provide a georeferenced species database that will serve as the foundation for development of additional spatial planning tools. Other decision support tools for waterbird conservation, such as assessments of risk of wetland drainage, will be developed in conjunction with ongoing waterfowl conservation efforts.

Results of two research projects at Northern Prairie Wildlife Research Center will provide further direction for waterbird conservation planning in the PPR. The first, presently being conducted by Mark Sherfy with support from a North Dakota State Wildlife Grant, evaluates landscape-level factors influencing waterbird distribution in North Dakota. The second project, spearheaded by Doug Johnson and supported in part by the USFWS, looked at similar questions in the PPR of North Dakota and South Dakota with an emphasis on evaluating restored wetlands. Data for this project were collected in the 1990s and are presently awaiting analysis.

Factors Limiting Waterbird Populations

Primary factors limiting waterbird populations in the PPJV are largely unknown. Loss and degradation of wetland and upland habitats likely limit carrying capacity of the landscape. Carrying capacity may not decline linearly with wetland loss, as some waterbird species (e.g., Yellow Rail) key in on specific wetland types and several waterbird species respond to wetland complexes and structure of vegetation within wetlands (Kantrud and Stewart 1984, Johnson and Dinsmore 1986, Fairbairn and Dinsmore 2001, Naugle et al. 2001). Factors influencing nesting success, chick survival, and adult survival certainly vary among species, but are simply unknown or have only been studied in short-term, localized studies. It is likely that some of the factors and processes that affect waterfowl populations also affect waterbirds. For instance, composition of landscapes and predator communities might influence nesting success of waterbirds. However, colonial nesting, mobbing of potential predators, and over-water nesting of some waterbirds will likely produce patterns of nesting success and survival that differ from those of waterfowl.

Biological Models for Waterbirds

Biological models for waterbirds vary among species, as well as at different spatial and temporal scales. Waterbird habitat and behavior vary depending on season, as birds may use one habitat or area for courtship, another for nesting, another for brood-rearing, and still others for post-breeding molt and pre-migration staging. Availability of wetland habitat also may vary among years, depending on precipitation. On a spatial scale, waterbird habitat may be characterized at nest site, wetland, wetland complex, and landscape scales, among others.

Colonial waterbirds may be subdivided according to the substrate that they choose for nesting. In general, these species may nest on a floating platform, on an island, or in trees or tall shrubbery. With few exceptions, most species fall neatly into one of these categories. Species using the same nesting substrate often are found nesting in association with other colonial waterbirds. Species nesting on platforms in marshes include the Eared, Western, and Clark's grebes, Black-crowned Night-Heron, White-faced Ibis, Franklin's Gull, and Forster's and Black terns. The solitary nesting American Coot may be found nesting with these species. Among the island-nesting species, American White Pelicans, Double-crested Cormorants, California, Herring and Ring-billed gulls, and Caspian and Common terns often are found nesting together. Tree-nesting species include most of the herons and Double-crested Cormorants in some areas. These colonies may be composed of single species or, especially in the southeastern portion of the BCR, many species. Non-colonial species may nest on a floating platform of vegetation, in emergent vegetation over water, or on the ground in drier sites such as sedge meadows, or even in dry upland vegetation. Cranes build a mound of vegetation that may be constructed in shallow water on or near the edge of a wetland. Waterbirds also can be categorized by their preference for a general type of wetland utilized for nesting during the breeding season in the PPR (Table 2; adapted from Beyersbergen et al. 2003).

Table 2. General waterbird habitat preferences based on amount of emergent vegetation, open water, and preferred nesting habitat.

GROUP				
A	**B**	**C**	**D**	**E**
Wetland with: -much emergent vegetation - variable open water	Wetland with: - emergent vegetation - partial open water	Wetland with: - emergent vegetation - extensive open water	Wetland with: - emergent vegetation - open water - nesting trees	Lake or River: - open water - barren ground - islands
American Bittern	Sandhill Crane	Common Loon	Great Blue Heron	American White Pelican
Least Bittern	Franklin's Gull	Pied-billed Grebe	Great Egret	Double-crested Cormorant
Black-crowned Night-Heron	Bonaparte's Gull	Horned Grebe	Snowy Egret	
Yellow Rail	Forster's Tern	Red-necked Grebe	Tricolored Heron	Ring-billed Gull
Black Rail	Black Tern	Eared Grebe	Little Blue Heron	California Gull
King Rail		Western Grebe	Cattle Egret	Herring Gull
Virginia Rail		Clark's Grebe	Green Heron	Caspian Tern
Sora		White-faced Ibis	Yellow-crowned Night-Heron	Common Tern
		American Coot		Least Tern
		Common Moorhen		

Wetlands in Group A generally have extensive stands of emergent vegetation. These sites range from flooded sedge meadows to cattail or bulrush stands in deep water marshes and may be seasonal to permanent wetlands. The second group of wetlands (B) includes mostly larger, permanent freshwater marshes with patches of emergent vegetation interspersed with open water. Wetlands in the third group (C) have emergent vegetation (e.g., sedges, rushes, *Phragmites*) with extensive areas of open water. Some shallow-water marshes are included in this set but the majority are deep-water marshes or lakes. The fourth group (D) of wetlands is typified by the presence of wooded areas that serve as nesting sites on islands, flooded stands of trees, or uplands near the wetland; some waterbirds using this group also will nest on barren sites. The

final group (E) includes wetlands or waterways with an island (vegetated or barren), sandbar, or exposed shoreline. Although these species are separated into general categories, habitat preferences will overlap across the region. Many wetlands have multiple vegetation zones that reflect basin substrate and water depth; distribution and structure of vegetation in a basin may change depending on variation in water levels. Maintaining appropriate interspersion of vegetation and wetland complexes is important because waterbirds may use multiple zones throughout the year or in different years.

Waterbirds also select habitat on a broader spatial scale that encompasses characteristics of landscapes. Conservation planning at the landscape level is appropriate for a several reasons. As mentioned previously, bird habitat selection is hierarchical and influenced by a variety of biotic and abiotic factors, with birds first selecting habitat at broad scales, then making fine-grained selections such as nest and foraging sites (Johnson 1980, Wiens 1989). Landscape-level conservation thus provides a broad habitat foundation within which birds can select habitat at a fine-grained scale. Landscape characteristics also are important from logistical and management standpoints. If habitat is purchased or otherwise selected for management based on landscape characteristics, local characteristics (e.g., vegetation composition and structure) within a patch can be modified relatively easily. But it is difficult to modify the landscape around a patch with suitable local characteristics if landscape characteristics are not suitable. For these reasons, most bird conservation initiatives (e.g., North American Waterfowl Management Plan, Partners In Flight, North American Bird Conservation Initiative) explicitly promote a landscape approach to bird conservation.

Habitat selection varies among species, but available information indicates that many waterbirds are strongly influenced by proximity to other wetlands, presence of grassland/wetland complexes, and presence or absence of trees (Brown and Dinsmore 1986, Naugle et al. 1999, Fairbairn and Dinsmore 2001, Naugle et al. 2001). Obviously, fine-grained habitat characteristics also influence use of wetlands by waterbirds, but broad-scale features can be used to assess suitability of landscapes for waterbird conservation planning. For example, Black Terns in South Dakota were positively associated with total wetland area, area of semipermanent wetlands within a complex, and amount of grassland surrounding wetlands (Naugle et al. 2001). Similar analysis of BBS data from North Dakota and South Dakota in 1993, 1995, and 1997 indicates that Black Terns were positively associated with amount of seasonal wetland, semipermanent wetland, and grassland surrounding survey points and negatively associated with forest cover; detection was also influenced by geographic location and observer ability (Figure 4; unpublished data; USFWS Region 6 HAPET office).

Development of spatially explicit habitat models throughout the PPJV is ongoing; existing models will be refined and new models developed for additional species as appropriate data become available.

Implementation Framework

Given the voluntary nature of joint ventures and present lack of support for waterbird conservation, it is difficult to identify specific roles and assign duties for more than a few tasks. The Habitat and Population Evaluation Team (HAPET) offices in Bismarck, North Dakota and Fergus Falls, Minnesota will be responsible for development of spatial planning tools and evaluation and implementation of regional waterbird surveys. As spatial planning tools become available, the HAPET offices will be better able to (1) quantify the extent of waterbird habitat conservation that has occurred because of waterfowl conservation efforts; (2) identify priority waterbird conservation areas that are presently unprotected and have potential to be protected through waterfowl conservation efforts; and (3) identify priority waterbird conservation areas that are presently unprotected and need waterbird-specific programs and funding for conservation.

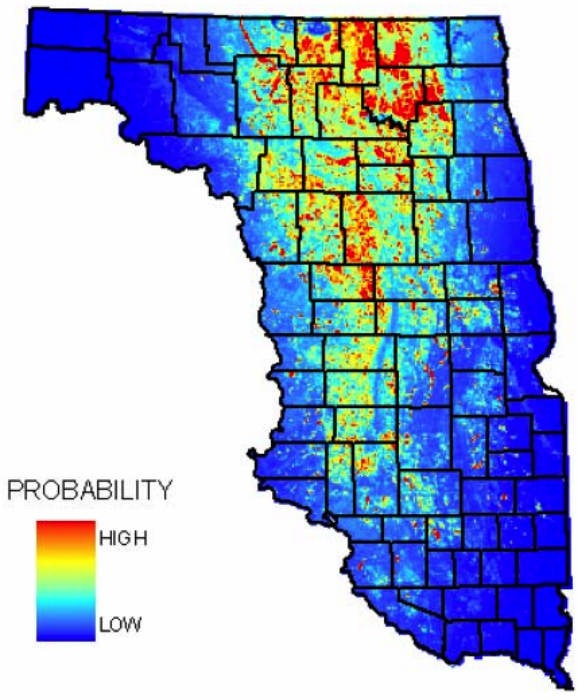

Figure 4. Estimated probability of detecting Black Tern in the Prairie Pothole Region of North Dakota and South Dakota in June of 1995. Model developed using georeferenced BBS data, digital National Wetlands Inventory data, and landcover information derived from LandSat Thematic Mapper imagery (Niemuth et al.2003).

In respect to continental waterbird conservation programs, Gerald McKeating of Bird Studies Canada presently serves as the liaison between the PPR and the continental Waterbird Conservation Council. Version 2 of the continental waterbird plan, which is to address marshbirds, is presently in development.

Overall Goals and Objectives

Highest priority conservation issues affecting waterbirds in the PPR are:

- Loss and degradation of wetland habitats, which directly affects all waterbird species throughout the PPJV.
- Loss and degradation of upland habitats surrounding wetlands, which directly affects most waterbird species throughout the PPJV.

Because of limited information on population sizes for waterbirds in the PPR, population goals were not set by the Plan. For colonial species where fairly accurate population estimates exist, the Plan identified refining estimates and setting a "no-net loss" of population size as a reasonable first step. For species identified as potentially over-abundant, management strategies should ensure these species are not detrimental to the environment or other bird species using similar habitats. The next step the Plan identifies is accurate and range-wide surveys of existing and potential colonial breeding sites within the PPR to refine population estimates. For species lacking concrete population estimates, the Plan recommended determining population trends. This focus would cover most non-colonial species. The baseline for all species should be "no net loss." For species where numbers are extremely low and the PPR has a high level of responsibility, the Plan identified better population estimates and increased populations as goals. In some cases, local populations of Double-Crested Cormorant and some gull species may need to be lowered to reduce depredation of Piping Plover eggs and young and also to reduce conflicts with humans.

Protection Objectives

The first protection objective to waterbird conservation in the PPJV is protection of existing wetlands and grassland. Areas to be conserved can be prioritized through application of spatially explicit habitat models (e.g., Fig. 3); risk assessment should also be included in the prioritization process. Retention and development of wildlife-friendly agriculture programs (e.g., "Swampbuster" provision in U.S. Farm Bill) will have a major impact on waterbird conservation in the PPR by helping preserve the existing wetland and upland habitat base. Specifically, addressing waterbird conservation issues in the PPR necessitates that limited resources directed toward waterbird conservation are strategically applied, which will require considerable knowledge of waterbird ecology that is presently lacking. Effective waterbird conservation in the PPR will require a shift in focus of federal agriculture programs as well as significant programs and funding specifically directed at waterbirds.

Restoration Objectives

Because deep-water wetlands are currently less likely to be drained, they are relatively safe. Therefore, shallow wetlands, including fens, wet meadows, and sedge meadows should be the PPJV's highest priority for restoration. Restoration of uplands surrounding wetlands is also important, as some waterbird species use uplands for foraging and nesting, and grassy uplands improve water quality and suitability of wetlands for waterbirds and other species.

Enhancement Objectives

Development of biological models will help identify key components of waterbird habitat. Application of spatially explicit models and their composite data layers will help identify areas where key components (e.g., certain wetland types or complexes, grassland) are missing. These components can then be selectively restored or added to enhance the area for waterbirds.

Measures of Performance

Measuring the performance of conservation actions on waterbird populations will be difficult given the limited information currently available on most waterbird species in the PPJV. Wildlife populations are often assessed in terms of presence/absence, density, long-term population size, and demographic performance, with the cost of assessment typically increasing in the same order. Except for a few isolated cases (e.g., monitoring of the American White Pelican colony at Chase Lake), information on reproductive success of waterbirds in the PPJV is lacking or limited. Targeted surveys will provide information on presence/absence and density of waterbirds, and, over time, these surveys will provide insight into long-term population size. However, such surveys provide limited insight into the mechanisms behind population dynamics, as well as how populations within the survey area relate to populations outside the survey area. For all these reasons, it will be important to focus monitoring, conservation, and assessment efforts on priority species, questions, and landscapes.

Monitoring and Adaptive Management

Waterbird monitoring in the PPR is presently limited to the North American Breeding Bird Survey and a few localized, short-term surveys. BBS data likely provide an index that is useful for tracking populations of some common species of waterbirds (e.g., Sora, Black Tern), but the design of the BBS limits detection of nocturnal and rare species. As mentioned previously, development of a regional waterbird monitoring program is a high priority for the PPR. Once established, a monitoring program will provide information on distribution, density, and long-term numbers of priority waterbird species.

The continental Waterbird Conservation Council is supporting the development of sampling protocols and study design for regional and continental waterbird monitoring programs. Members of the HAPET offices are supporting these efforts where there is overlap between continental objectives and those of the PPJV.

Program Delivery, Coordination, and Timetable

Given the voluntary nature of joint ventures and present lack of support for waterbird conservation, it is difficult to identify specific roles and assign duties for more than a few tasks. In the U.S. portion of the PPJV, the HAPET offices in Bismarck, North Dakota and Fergus Falls, Minnesota will be responsible for development of spatial planning tools and evaluation and implementation of regional waterbird surveys. Gerald McKeating of Bird Studies Canada will serve as the liaison between the PPR and the continental Waterbird Conservation Council. We will coordinate regional efforts with continental goals when compatible.

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