Prairie Pothole
JOINT VENTURE

# 2005 Implementation Plan

## Section III – Shorebird Plan

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# Contents

# Background and Context

The U.S. Prairie Pothole Region (PPR) provides breeding habitat for 13 of 20 species that breed in the contiguous U.S., and offers important stopover habitat for 30 species of arctic breeders. The PPR also provides breeding habitat for the Piping Plover (of which the Great Plains population federally listed as threatened by the Endangered Species Act), as well as three species that are also considered highly imperiled: breeding Mountain Plover (proposed for listing under ESA but recently withdrawn), Long-billed Curlew, and migrating Buff-breasted Sandpipers. The importance of the PPR to shorebirds is due to the millions of shallow wetlands interspersed with large expanses of grasslands, occurring in various successional stages from high water to drawdown, grazed or burned to tall and stagnant. Most migrant and breeding shorebirds in the region thrive on early successional stages of drawdown and wet mud. Breeding species generally prefer short or sparse grass habitats for nesting, although taller grass habitats also are used.

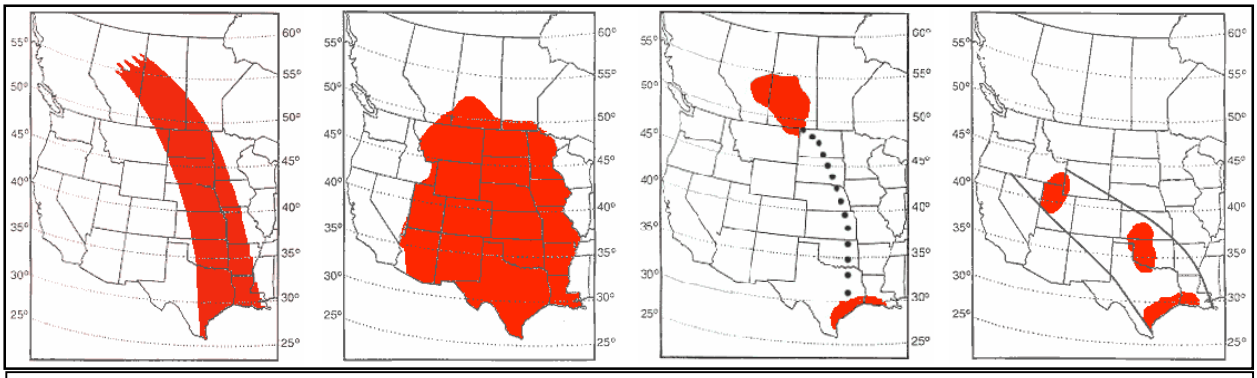
The northern Great Plains population of the piping plover is dependent on prairie pothole habitats, with >55% of this population nesting on alkaline and shallow wetlands within the Prairie Pothole Joint Venture (PPJV) boundary (Ferland and Haig 2001). More than 99% of designated non-riverine critical habitat is in the PPJV region of North Dakota and Montana (Federal Register 2002). These areas contain the wetlands required for breeding habitat and should support nesting pairs provided ecological and hydrological function of the wetlands can be maintained, but do not in themselves assure a stable population of Piping Plovers. It is likely that recruitment rates and or/amount of suitable habitat must be increased in order to sustain this population.

Marbled Godwit, Upland Sandpiper, and Wilson's Phalarope have >25% of their breeding population occurring within the PPJV. Marbled Godwit, Upland Sandpiper, and Willet (with 17% of their breeding population in the PPJV), have a similar dependence on large expanses of grassland habitats, with Marbled Godwits and Willets also requiring a shallow wetland component within their breeding territories. American Avocets are more widespread throughout the Great Plains and western states, but also prefer shallow water for feeding and sparsely vegetated habitats for nesting in the PPR. Wilson's Phalarope have a broader habitat niche in that they can make use of deeper water and will nest in a variety of substrates; however they have a preference for sparse or thin-stemmed wetland vegetation and large grassland blocks (Naugle 1997).

Killdeer, Spotted Sandpiper, and Wilson's Snipe have broad distributions throughout the U.S. and Canada. The remaining 4 breeding species are either peripheral to the PPR (American Woodcock and Black-necked Stilt) or present only in short grass habitats of Montana (Mountain Plover and Long-billed Curlew). Mountain plovers have two main strongholds, one of which is in short grass habitats of Montana. Long-billed Curlew had a more extensive historic distribution throughout the PPR but are now peripheral. Black-necked Stilt also have a more western distribution. American Woodcock are present only locally in the eastern edge of the PPJV in western Minnesota, eastern South Dakota, and in north-central Iowa. Concern for Woodcock has prompted development of a national recovery plan; due to this and the peripheral distribution, they will not be addressed further by this plan at this time.

Surprisingly little is known about the ecology of shorebird migration in the PPR; most studies of shorebird migration have been conducted along ocean shores and related estuaries. In coastal systems, shorebirds can concentrate by the millions in relatively few key areas. By contrast, the dynamic nature of prairie climate and variety of wetland types result in a landscape with constantly changing spatial patterns of suitable habitat. Shorebirds likewise disperse widely in the prairie potholes to find suitable stopover habitats. Most are seeking invertebrates from shallow water and alkaline or fresh water mudflats. The majority of species (>70%) use water depths <10 cm and many need water depths of <5 cm (Dinsmore et al. 1999). Heavy feeding on invertebrates provides fuel for their long journey, reserves for breeding in spring, and nutrients for molting in fall.

Spring shorebird migration patterns through the Great Plains were categorized by Skagen et al. (1999) into four general patterns (Fig. 1). Species using the narrow band pattern have >90% of their population passing between 90° W and 100° W longitude. Widespread species are distributed broadly throughout the central states. Species with a jump pattern are seen only infrequently in the PPR, but large numbers of these birds may stop in northern areas in some years. The only species classified as crossband, the Western Sandpiper, moves diagonally from the Texas Gulf Coast to the Pacific Coast in spring, and is seen only infrequently in the PPR.



Narrow band | Wide spread | Jumps | Crossband

**Figure 1.** Shorebird migration patterns through the U.S. Central Great Plains.

Skagen and Knopf (1993) also classified migration distance by using an index based on the shortest, median, and longest distances traveled by each species. Species with an index of <5,000 km were considered short distance, an index of 6-12,000 km was classified as intermediate, and long distance migrants had an index of >14,000 km. Pattern and distance categories can be combined to classify migrant shorebird species in the PPR (Table 1).

**Table 1.** Migrant shorebird use of the Prairie Pothole Region as classified by migration pattern and migration distance (slightly modified from Skagen et al. 1999).

| Migration Pattern | Migration Distance | | |
|---|---|---|---|
| | Short | Intermediate | Long |
| Narrow band | Piping Plover | Upland Sandpiper<br>Semipalmated Sandpiper<br>Semipalmated Plover<br>Greater Yellowlegs<br>Lesser Yellowlegs<br>Least Sandpiper[1]<br>Short-billed Dowitcher[1] | American Golden-Plover<br>Hudsonian Godwit<br>White-rumped Sandpiper<br>Baird's Sandpiper<br>Pectoral Sandpiper<br>Buff-breasted Sandpiper<br>Stilt Sandpiper |
| Widespread | Killdeer<br>Willet<br>Marbled Godwit | Black-bellied Plover<br>Solitary Sandpiper<br>Spotted Sandpiper<br>Whimbrel<br>Long-billed Dowitcher<br>Wilson's Phalarope<br>Red-necked Phalarope | |
| Jump | | Ruddy Turnstone<br>Red Knot<br>Sanderling<br>Dunlin | |
| Crossband | | Western Sandpiper | |

[1]Species that have only 80-90% (vs >90%) of their individuals within the 90-100° W band; the rest are widespread. Some individuals may be long-distance migrants.

# Habitat Changes and Trends

The pre-European settlement landscape of the PPR is usually described as a seemingly endless landscape of grassland and abundant wetlands. Less often is there reference to the variety of grassland and wetland habitats within those landscapes. It is this variety upon which most prairie wildlife depends to sustain it through the erratic conditions of the prairie climate and episodic disturbances of prairie fires and vast herds of nomadic grazing mammals. Wetlands of different water regimes provide needed shallow habitat through the continuum of water cycles from flood to drought. Grazing and fire cleared or greatly reduced vegetation to create preferred nesting and foraging habitat for breeders and migrants. These same disturbances invigorate prairie vegetation enabling higher productivity than areas with stable conditions.

Areas of the PPR which are now almost entirely cropland probably once provided the best shorebird habitat for both breeders and migrants. In particular, the Drift Prairie, Glacial Lake Agassiz, Des Moines Lobe, and the James River lowlands historically had the highest density of shallow wetlands, and would have provided an abundance of the sedge forage preferred by bison. Bison wallows likely provided mudflats for feeding migrant shorebirds.

Unfortunately, shallow wetlands were easily drained and converted to cropland along with the surrounding grasslands. Today, shorebirds migrating through these areas in spring make use of the shallow wetland remnants in crop fields following snow melt and spring rains. Although tillage may make these fields attractive to migrant shorebirds by reducing vegetation, little is known about the impact of pesticides, the potential for contaminant uptake, and nutrition. Euliss and Mushet (1999) found that constant tillage reduced invertebrate numbers and diversity. In general, the lack of grassland and more permanent water in severely converted landscapes precludes use by breeding shorebirds. The result of this whole-scale conversion has been severe range contraction for breeding shorebirds, especially those species whose primary breeding ground is within the PPR. Restoration potential is generally considered minimal because 1) much of the land is highly profitable in terms of commodity production, 2) restoration of function of temporary wetlands is more problematic than restoration of seasonal or semipermanent wetlands because of the difficulty in establishing compatible vegetation, 3) encroachment by reed canary grass and cattail hinders functional restoration, 4) sedimentation from cropping in and around drained shallow wetlands often obliterates the basin, and 5) the complete lack of grass or wetland habitat precludes placing any effort in such areas using current prioritization schemes. When shallow wetlands are restored, intensive management is required to prevent establishment of exotic plants.

In addition to outright loss of habitats, the wetlands that remain are often severely degraded. Native prairies, wet meadows, and wetland edges are subject to encroachment by woody species unless actively managed through grazing or fire. Because shorebirds prefer wetlands with minimal vegetation density and height, wetlands invaded by cattail or reed canary grass are avoided by both breeders and migrants.

Most of the breeding shorebirds have been eliminated from Minnesota, Iowa, and low lying areas of the Dakotas. Breeding shorebirds in Minnesota are generally confined to narrow remnant grassland and wetland landscapes on the beach ridges of Glacial Lake Agassiz, along the Minnesota River, and on the Prairie Coteau. In areas where remnant grasslands and wetlands remain, landowners seeking a means to earn income on native prairie are enrolling in USDA programs that promote tree planting; areas with trees are generally avoided by Marbled Godwits and Upland Sandpipers. Other landowners are mining rocks from native prairie to be sold for rip-rap. Once rocks are removed, the land can easily be put into commodity production.

Without adequate stopover sites, suitable habitats may become overused or birds will be forced to use suboptimal areas. The result would be that birds arrive at the breeding grounds in poor condition for breeding and either fail or production is reduced. Given that most shorebird populations are believed to be in decline, this scenario could already be happening.

# Population Estimates, Distribution, and Trends

The International Shorebird Survey (ISS) has the best information available regarding population trends for shorebirds. Initiated in 1974, the survey is conducted by volunteers at over 600 sites. The purpose of the survey was basic information on migration ecology, but restructuring of the survey and new analyses are underway that will help determine specific rates of population change. For now, it is only indicated that 19 of 36 species breeding in or migrating through the PPJV area are in significant decline, and none are currently showing a population increase.

Species conservation status was assessed nationally for the U.S. Shorebird Conservation Plan (USSCP) by using expert opinion and the method developed by Partners in Flight for landbirds (Brown et al. 2001, Carter et al. 2000). Each species is ranked 1-5 (low – high priority) on 6 criteria: population trend, relative abundance, threats during breeding, threats during non-breeding, breeding distribution, and non-breeding distribution. Regional conservation rankings were based on national ranks and an area importance score which reflects the region's importance to species' population stability. Table 2 compares scores for national and regional conservation status. Priority species for the PPR (in bold) are those with a regional score of 4-5.

While coordinated monitoring programs for shorebirds are under development, current population estimates were derived from a wide variety of sources, including the Maritimes Shorebird Surveys, International Shorebird Survey, peak counts at Western Hemisphere Shorebird Reserve Network sites, biogeographical profiles for mid-continental North America compiled by Skagen et al. (1998), and the Breeding Bird Survey (Brown et al. 2001, Morrison et al. 2001). Although shorebirds are known for their affinity for large aggregations at certain times during the annual cycle, many breeding areas are difficult to access, migration patterns are fleeting, and the sheer numbers gathering in staging and wintering sites present major challenges to accurate population estimates. Numbers were compiled seasonally and compared with estimates obtained throughout the annual cycle. Estimates are given confidence scores based on perceived accuracy. Population estimates and objectives are presented only for priority species at this time (Table 3).

The proportion of populations using the PPR was estimated for priority species (Table 3). For breeding species, BBS grid data were downloaded from the Patuxent website. Blocks were weighted by the relative abundance for each species and block weights were summed. The PPJV proportion of the total weight was used to estimate the proportion of the breeding population that occurs in the PPJV area. The caveats for BBS data listed on the website apply to using this method (e.g., unequal effort across strata, roadside bias, observer variability, etc.). Especially relevant for shorebirds is the lack of routes in the northern parts of the breeding range and that wetland species are often not well represented on BBS surveys. However, it is believed that the result are useful in indicating the relative importance of the PPR to breeding populations.

Target populations were based on the same percentage as a portion of the global target; this is an obvious oversimplification because some areas may be able to do more for some species, while others may be less suited to management for particular species. These numbers are presented to stimulate thinking about potential management strategies for shorebirds.

To quantify migrant shorebird use in the PPR we used data from spring migration surveys conducted in 2002 and 2003 that were based on stratified random sample of townships in the PPR of Minnesota, North Dakota, and South Dakota. Total number of birds using the study area during the study period was estimated by S. Skagen (USGS, Fort Collins Science Center, Ft. Collins, CO). Because this is the first time that a concerted effort was made to count shorebirds migrating through the PPR, many assumptions had to be made including length of stay, chronology adjustments for peak of migration, and extrapolations to townships and landscape strata (based on the abundance of wetlands and cropland). Estimates derived from the migration surveys were sometimes greater than the global population estimates; as better information becomes available, biologists are finding that previous estimates are probably too low. Many of those estimates were based on data that were not intended for enumerating populations. Wetland conditions are thought to have a large impact on stopover site selection and length of stay, but it is impossible to quantify this effect until a long term dataset is established.

**Table 2.** Conservation priority of regularly occurring shorebird species in the Northern Plains/ Prairie Potholes Region. Regional priority scores reflect several factors, including population status, abundance, and comparative importance of the region during migration. Sorted by breeding and regional priority status.

| | | | Priority scores | | Habitat associations[1] | | | |
|---|---|---|---|---|---|---|---|---|
| Species 2 | Status[2] | Abun-dance[3] | Nation | Region | Water depth | Vegetation density | Wetland size | Notes |
| **Piping Plover (Great Plains)** | B/M | R | 5 | 5 | s | s | l | Nationally threatened |
| **Mountain Plover** | B/M | R | 5 | 5 | | | | Species of concern |
| **American Avocet** | B/M | U | 3 | 4 | s,m | s,m | l | Species of concern |
| **Upland Sandpiper** | **B**/M | C | 4 | 4 | s | d | | Species of concern |
| **Marbled Godwit (Great Plains)** | B/M | U | 4 | 4 | s,m | s,m | s,l | Species of concern |
| **American Woodcock** | **B**/m | U | 4 | 4 | | | | Species of concern |
| **Wilson's Phalarope** | B/M | C | 4 | 4 | s,m,d | s,m,d | l | Species of concern |
| Willet | B/M | C(U) | 3 | 3 | s,m | s,m | l | |
| Killdeer | B/M | C | 3 | 3 | s | s | s,l | |
| Spotted Sandpiper | B/M | C | 2 | 3 | s,m | s,m | s | |
| Wilson's Snipe | b/**M** | C | 3 | 3 | s | d | s,l | |
| Long-billed Curlew | B/M | U | 5 | 2 | | | | Uncommon in region |
| Black-necked Stilt | b/m | R | 3 | 2 | s,m | s,m | l | |
| **American Golden-Plover** | M | C | 4 | 4 | s | s | | Area important to migrants |
| **Hudsonian Godwit** | M | C(R) | 4 | 4 | s,m | s | l | Species of concern |
| **Ruddy Turnstone** | M | U | 4 | 4 | | s | | |
| **Semipalmated Sandpiper** | M | C | 3 | 4 | s | s,m | l | Area important to migrants |
| **White-rumped Sandpiper** | M | C(R) | 2 | 4 | s | s,m | l | Area important to migrants |
| **Dunlin** | M | C(U) | 3 | 4 | s | s,m | l | Area important to migrants |
| **Buff-breasted Sandpiper** | M | U | 5 | 4 | s | s,m,d | | |
| Whimbrel[4] | m | R | 4 | 4 | s | s,m | | |
| Black-bellied Plover | M | U | 3 | 3 | s | s | l | |
| Semipalmated Plover | M | C | 2 | 3 | s | s | s,l | Area important to migrants |
| Greater Yellowlegs | M | C | 3 | 3 | s,m | s,m | l | |
| Lesser Yellowlegs | M | C | 3 | 3 | s,m | s,m | s,l | Area important to migrants |
| Solitary Sandpiper | M | C | 4 | 3 | s | s,m | s | |
| Least Sandpiper | M | C | 3 | 3 | s | s,m | s,l | |
| Baird's Sandpiper | M | C | 2 | 3 | s | s,m | s,l | Area important to migrants |
| Pectoral Sandpiper | M | C | 2 | 3 | s | any | s,l | Area important to migrants |
| Stilt Sandpiper | M | C | 3 | 3 | s | s,m | l | Area important to migrants |
| Short-billed Dowitcher | M | C | 3 | 3 | s | s,m | l | |
| Long-billed Dowitcher | M | C | 2 | 3 | s | s,m | l | Area important to migrants |
| Red-necked Phalarope | M | U | 3 | 3 | s,m | | s,l | |
| Red Knot | m | R | 4 | 2 | | s | | Uncommon in region |
| Sanderling | m | U | 4 | 2 | | s | | Uncommon in region |
| Western Sandpiper | m | R | 4 | 2 | s | s,m | l | Uncommon in region |
| | | | | | | | | |

[1]Water depth: s=shallow (<5"), m=moderate (5-10"), d=deep (>10"); vegetation density: s=sparse, m=moderate, d=dense; wetland size: s=small(<5 acres), l=large (>5 acres). from WRP Technical Note FW-RS-3.1 October 1999.

[2]B: breeding, M: migration; **bold** indicates that region is highly important to population; lower case indicates that region is less important.

[3]Common: very likely to be seen in the appropriate habitat; uncommon: present, but likely to be seen only in small numbers; rare: not likely to be seen, and then only in small numbers. One letter applies to both spring and fall; letters in parentheses apply to fall when different from spring.

[4]Species listed as high priority in regional plan but listed as irregular in the Northern Plains in USSCP supporting documents.

**Table 3.** Potential monitoring and population goals for priority species based on the U.S. Shorebird Conservation Plan and regional analyses.

| Species | Confidence in pop est. | Estimated world pop. | Target world population | % of pop in/ through PPR | Population in PPR[1] | Target for PPR |
|---|---|---|---|---|---|---|
| Piping Plover (Great Plains) | high | 3,000[2] | 6,000 | 55% | 1,650 | 3,300 |
| Mountain Plover | good | 9,000 | 20,000 | 0% | 0 | |
| American Avocet | moderate | 450,000 | 450,000 | 6% | 27,000 | 27,000 |
| Upland Sandpiper | poor | 350,000 | 470,000 | 27% | 94,500 | 126,900 |
| Marbled Godwit (Great Plains) | moderate | 168,000 | 258,500 | 27% | 45,360 | 69,795 |
| American Woodcock | - | no estimate | no estimate | <1% | | |
| Wilson's Phalarope | low | 1,500,000 | 2,800,000 | 28% | 420,000 | 784,000 |
| American Golden-Plover | low | 150,000 | ? | | 1,320,000 | |
| Hudsonian Godwit | low-mod | 50,000 | 54,700 | | 70,700 | |
| Ruddy Turnstone | moderate | 180,000 | >180,000 | <1% | 3,100 | |
| Semipalmated Sandpiper | low | 3,500,000 | 8,200,000 | 20% | 743,685 | |
| White-rumped Sandpiper | moderate | 400,000 | 400,000 | | 1,693,977 | |
| Dunlin | low | 225,000 | >225,000 | | 374,787 | |
| Buff-breasted Sandpiper | low | 15,000 | 150,000 | | 37,871 | |

[1]For migrants, only PPR region of Minnesota, North Dakota, and South Dakota. Migration population estimate often larger than world estimate due to underestimation of world population. See text.
[2] 2001 Piping Plover Census.

# Biological Foundation

Strategic planning for shorebirds is gaining momentum with the development and implementation of the U.S. Shorebird Conservation Plan and associated state and regional plans. The population estimates and appraisals previously mentioned are the most comprehensive conducted for this group of birds. Data that have been collected for decades are being analyzed in new ways. Such analyses help to clarify information gaps so that research can focus where it is most needed. The proliferation of GIS tools and expertise are being used as tools in developing monitoring plans and for analyzing new and existing data.

## Measures of Performance

Although dedicated shorebird conservation is making great strides, it is still in its infancy relative to waterfowl conservation. General goals have been established in terms of increasing populations and investigating suspected declines, however there is still much work to be done before a simple metric can be used to gauge the success of PPJV programs. Specific tasks include (1) developing measures of performance, (2) obtaining basic information on the nesting ecology of shorebirds to determine population performance, and (3) achieving a better understanding of the contribution of PPR wetlands to performance on northern breeding grounds. To date, information in these areas is rudimentary and has not been conducted over long time periods or across wide areas. In the meantime, simple measures of abundance are used to reflect PPJV performance. Although imprecise, well designed surveys can provide better information on distributions and landscape associations than is currently available. Such information may be used to help refine monitoring methods and to identify areas in need of additional research. Perhaps the best measure of performance will be progress made toward answering the questions needed to assess population performance.

# Assumptions and Key Uncertainties

We must assume that metrics of population abundance will be adequate to monitor population trends and will reflect population status. Only rudimentary information is available for life histories and habitat selection of many shorebirds species. A few species have been selected to represent the needs of other shorebirds. It is assumed that the species of greatest conservation concern are adequate to represent the needs of other shorebirds. Because limiting factors are not known, it is uncertain if these species will be responsive to management and if those responses can be detected.

# Research Needs

**Develop and improve monitoring programs.** The U.S. Shorebird Conservation plan has called for a coordinated monitoring program which is under development and known as the Program for Regional and International Shorebird Monitoring (PRISM). Most work at the national level is currently focused on arctic breeding grounds, temperate breeding, and migration components. Within the PPJV, there is involvement in species-specific, range-wide breeding surveys. The Habitat and Population Evaluation Team (HAPET) offices have begun implementation of a region-wide surveys for breeders, while the USGS Fort Collins Science Center has been piloting migration surveys with HAPET office support. The adequacy of these surveys needs to be ascertained in terms of sensitivity to population fluctuations and trends. A high priorities are (1) a need to understand the relationship between counts and population estimates, (2) determining how best to deploy our efforts given the annual variability in stopover sites for migrant species, and (3) determining the movements of shorebirds within the PPR and factors affecting length of stay in order to convert counts to reliable indices of populations.

**Determine limiting factors.** At this time, factors that limit shorebirds breeding in and migrating through the PPR are unknown. For breeders, detailed studies of population dynamics are needed, including proportion of breeders, nesting success, re-nesting rates, fledging success, predation effects, recruitment, and adult survival. Such studies should relate reproductive parameters to local and landscape habitat conditions. For migrants, more information is needed on their nutrition needs and availability and quality of stopover sites.

**Test and assign umbrella species.** Adequacy of currently selected umbrella species to represent the health of other shorebird species needs to be addressed. Additional umbrella species may need to be identified. These species would (1) have declining populations, (2) be sensitive to factors limiting several species (shorebirds and non-shorebirds), (3) be responsive to management that removes limiting factors, and (4) be relatively easy to monitor and/or be recognized as a priority species for the PPJV.

# Limiting Factors

The lack of long-term and species-specific studies precludes definitive statements about what limits shorebird populations in the prairie potholes. However, loss of grassland and wetland habitat can be assumed to be the cause of drastic reduction (e.g., Upland Sandpiper, Marbled Godwit) or elimination (e.g., American Avocet, Willet) of breeding species from the eastern pothole region. It is not known if reduced reproductive success led to eventual elimination or if birds simply chose not to nest in areas without some critical amount of grass and wetlands. In areas where birds are nesting, so little is known about basic population parameters, that it is unknown if local populations are self-sustaining, let alone what may be their limiting factors. For migrant shorebirds, although most species are believed to be in decline, it is not known if declines may be due to problems on breeding, wintering, or stopover areas.

# Biological Models

Limited information exists to guide landscape-level planning and management of breeding or migrant shorebirds in the PPJV. Although Breeding Bird Survey data (Patuxent Wildlife Research Center, USGS, http://www.pwrc.usgs.gov/bbs/) have been used to develop models of detectability in PPR landscapes for upland grassland birds (Niemuth et al. 2004), it is generally inadequate for monitoring breeding shorebirds. Breeding shorebirds are being addressed by regional and rangewide shorebird surveys designed to provide information specific to breeding shorebirds. These surveys are designed to monitor populations of breeding shorebirds as well as provide data for the development of spatial models that will assist in prioritization of landscapes for conservation. Data from these surveys have already provided some preliminary guidance. Continued collection of data will continue to inform these models and help refine or confirm target areas.

An alternative to models based on empirical data are models based on the expertise of shorebird biologists. Such a model was developed for Marbled Godwits, which had been chosen as a species of special interest by the PPJV because of 1) its declining population, and 2) its dependence on large blocks of grass and shallow wetlands that should represent the needs of many other shorebird species. To provide guidance for land use planning for marbled godwits in Minnesota, the region 3 HAPET office queried regional godwit experts on requisite and desirable landscapes and patches for breeding Marbled Godwits. These features were mapped to yield a spatially explicit conceptual model.

Migrant shorebirds have been addressed by the Region 6 HAPET office which recently completed analyses of a spring shorebird migration survey of agricultural landscapes of the Drift Prairie in North Dakota (Niemuth et al. *in review*). Migrant shorebirds preferred temporary (versus seasonal) wetlands with extensive shorelines and receding water through early spring, but without evidence of drainage. Since most migrant shorebirds need mud for foraging, tillage can create shorebird habitat near wetlands by controlling vegetation growth. However, constant tillage will likely result in loss of the wetland via

siltation, and the impact of agricultural chemicals on food resources has not been well studied. It was also noted that shorebirds chose wetlands with more semipermanent and permanent wetlands in the surrounding landscape, indicating the need to consider conservation of wetland complexes rather than isolated wetlands.

To address migrant shorebird needs region-wide, the USGS Fort Collins Science Center and Region 3 HAPET office are developing models to determine landscape characteristics associated with migrant shorebird use. Survey sites were townships selected using a stratified random sample based on the amount of cropland (more or less than 60%) and wetlands (more or less than 8%). Shorebirds were counted along 18 or more 1-mile road segments within each selected township. The initial models are based on landscape characteristics within townships. Predictor variables include average topographical slope, percent grass, percent palustrine wetland basins, and the proportion of palustrine wetlands with temporary or seasonal water regimes. Although the models predict the probability of detection, in this context they are used as an index to landscape suitability. More spatially refined models are being developed based on individual road segments and/or wetlands, allowing more flexibility in defining optimum landscape size and the use of local wetland features as explanatory variables.

# Implementation Framework

### Breeding shorebirds

The conceptual model for Marbled Godwits in Minnesota (Fig. 2) is based on grassland patches of >130 ha with shallow wetlands and a > 100-m buffer from trees. Patches should be within landscapes with a high amount of grass and low terrain relief. The most promising landscapes are along the Agassiz beach ridge, Minnesota River, and on the Prairie Coteau. In Figure 2, the dark red areas are the best habitat available for Marbled Godwits and should be protected; lighter red areas could be improved by adding more grass to surrounding landscapes. Green patches would benefit Marbled Godwits if adjacent areas could be added to the patch to make a wider patch (i.e., reduce the edge to patch ratio). Darker purple areas are landscapes with high potential for restoration of patches of adequate size with shallow wetlands.

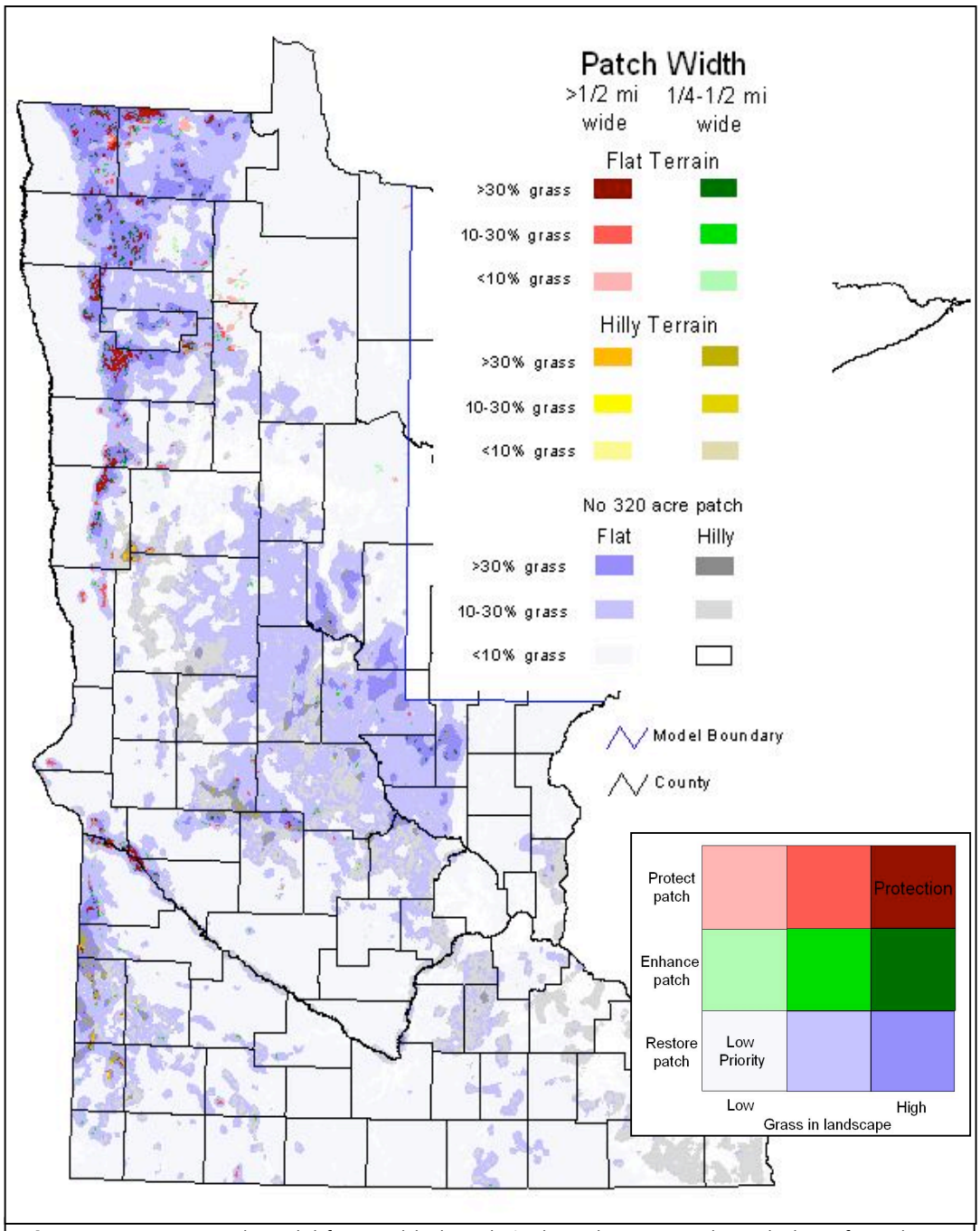



**Figure 2.** Conceptual model for Marbled Godwits based on expert knowledge of patch and landscape needs.

Although only recently initiated, the first year's data from HAPET breeding shorebird surveys in the Dakotas were used to develop spatially-explicit models predicting shorebird use (Figure 3). Preliminary models indicate that breeding shorebirds are positively associated with amount of native grassland in the landscape and area of temporary, seasonal, and semipermanent wetlands, as well as the variety of wetland types surrounding a sampling point. In addition, several species showed negative associations with forest cover (unpublished data, USFWS Region 6 HAPET office). Many breeding shorebird species are detected infrequently and data from subsequent years will improve our understanding of the population status of breeding shorebirds, as well as their distribution, response to water conditions, and response to landscape composition.

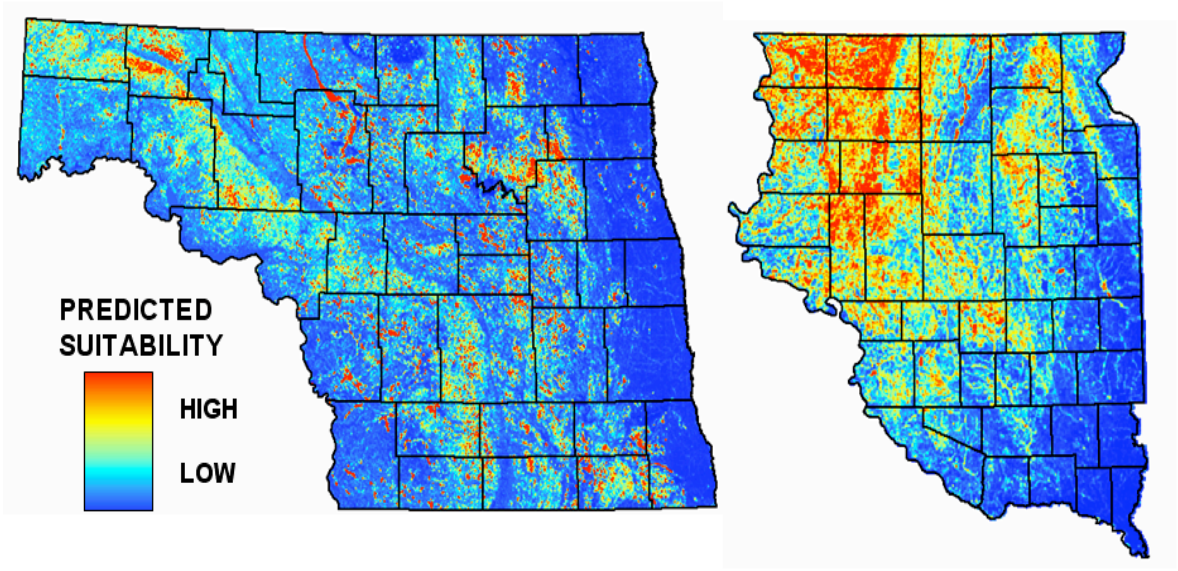



**Figure 3.** Preliminary models predicting suitability of breeding landscapes for Wilson's Phalarope in east-river North Dakota (left) and willet in east-river South Dakota based on 2004 HAPET Breeding Shorebird Survey data. Models are based on landscape characteristics within 800 m of sample points as well as trend surface (e.g. easting, northing) variables.

## Migrant shorebirds

Analyses of two years of migration surveys have yielded draft results for breeding and migrant shorebirds during spring migration. Three broad spatial patterns emerged (Figure 4). Marbled Godwit, American Avocet, and Willet were strongly associated with a high amount of grass in the landscape; highest suitability was on the Missouri and Prairie Coteaus, northern areas of the Drift Prairie, and the southern James River Lowlands (Fig. 4A). Wilson's Phalarope and Semipalmated Sandpiper were similar but with higher suitability only on the eastern edge of the Missouri Coteau, on the Prairie Coteau, and in the Drift Prairie (Fig. 4B). These two species were associated primarily with a high percentage of palustrine wetlands, then with the amount of grass. Upland Sandpiper, Dunlin, Hudsonian Godwit, and White-rumped Sandpiper were associated with shallow wetlands and not with a high amount of grass. These four species had an even lower suitability on the Coteaus and higher suitability in the Drift Prairie and James River lowlands (Fig. 4C). Although these analyses are preliminary, the apparent differences in high suitability areas for different species indicate that a 'one-size-fits-all' strategy may not be appropriate. However, strategies based on individual suitability for each species would also inappropriately increase the potential for wasting resources.

Suitable areas for Dunlins appeared differed between 2002 and 2003, in that wetlands were the dominant factor in 2002, whereas in 2003 the most important factor was level topography and the absence of grass. This indicates that inundated cropfields in the Glacial Lake Agassiz and Des Moines Lobe can play an important role in providing stopover habitat during the right climatic conditions.

All eight models are similar in that habitat suitability is low in the Glacial Lake Agassiz and Des Moines Lobe (with the exception of Dunlins noted above). The high agricultural value of these areas encouraged drainage and cultivation to such a degree that palustrine wetlands and grasslands are nearly absent in these areas. However, it should be noted that the analyses were based on the NWI which mapped only depressional wetlands. These areas, especially the Glacial Lake Agassiz, can have abundant sheetwater during wet springs which provides habitat for shorebirds even in (or because of) tilled cropland. Several areas in Minnesota are prominent on all maps, including the newly formed Glacial Ridge NWR as well as areas in Marshall, Kittson and Roseau Counties in northern MN. However, some of the northern and west central areas of MN may have lower suitability than predicted, due to the presence of shrubs and/or trees.

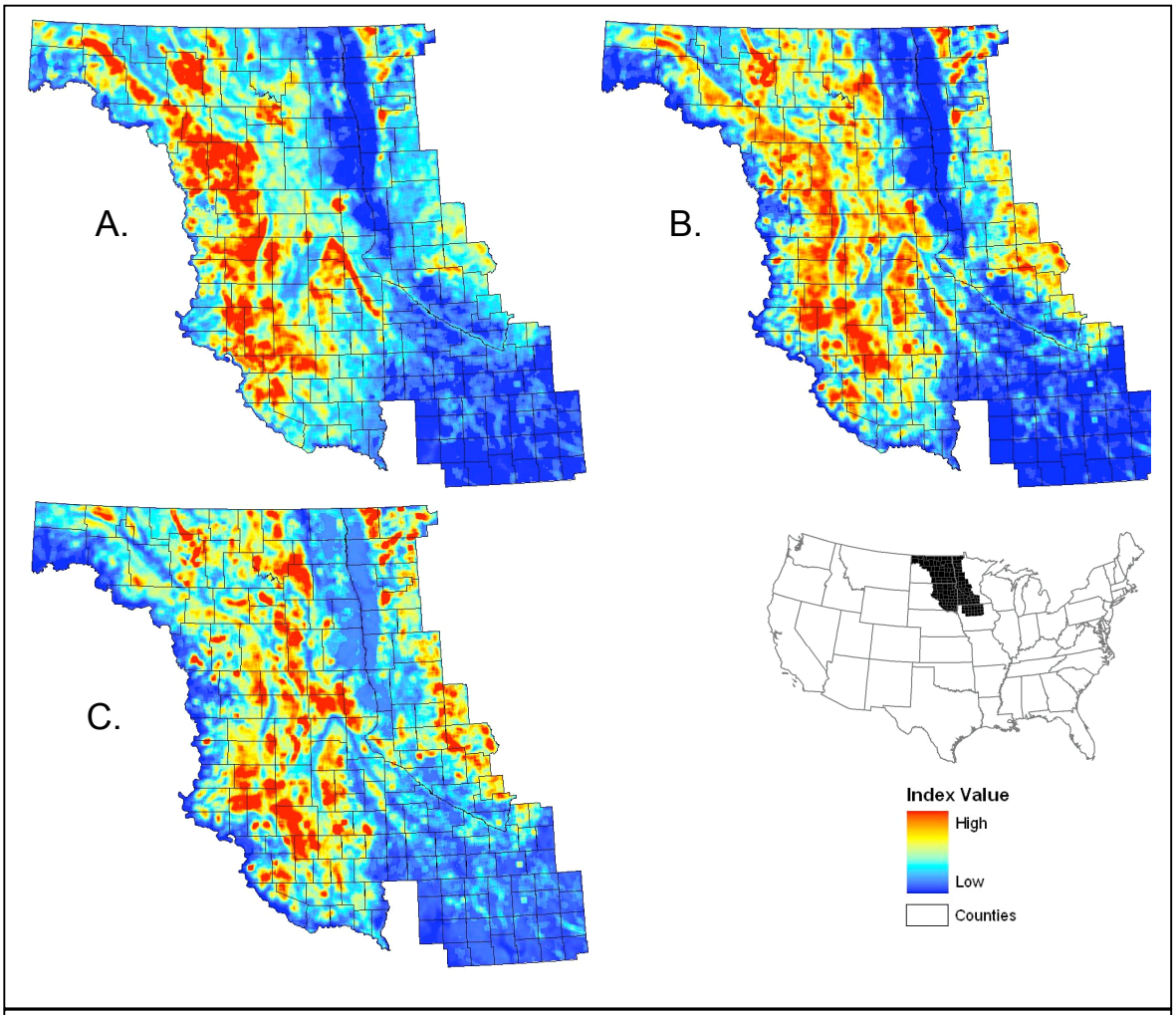



**Figure 4.** Predicted landscape suitability for priority breeding and migratory shorebirds during spring migration in portions of the Prairie Pothole Joint Venture. A. American Avocet, Marbled Godwit, and Willet show strong affiliation to the Missouri and Prairie Coteaus. B. Wilson's Phalarope and Semipalmated Sandpiper have an affiliation with the edge of the Missouri Coteau and into the drift prairie and James River lowlands. C.Upland Sandpiper, Dunlin, Hudsonian Godwit, and White-rumped Sandpiper have scattered distributions in low elevation, low relief areas

# Goals

The U.S. Shorebird Conservation Plan (USSCP) is an impressive effort to establish goals and identify deficits for each North American shorebird species (Brown et al. 2001). At this time, on both national and regional scales, population estimates are tentative, goals are general, and tools do not exist that specifically relate population numbers or productivity to habitat characteristics. Common regional goals identified in the USCCP are to ensure availability of adequate habitat, integrate management with other bird initiatives, and better understand how local factors affect regional and hemispheric shorebird use.

Goals from the Northern Plains/PPR Shorebird Plan (Skagen and Thompson 2000) are:

1) to attain self-sustaining populations of shorebirds breeding in the NP/PPR
2) to ensure that stopover habitat is not limiting for migrant species
3) to identify and fill in information gaps
    a. develop spatially explicit monitoring programs to determine population status (increasing, decreasing, or stable) and provide data for (b.).
    b. characterize landscapes that are conducive to high breeding productivity
    c. determine vital rates and identify limiting factors of breeding populations
    d. choose umbrella species, based on responses to threats and limiting factors, that represent the needs of multiple species
    e. identify factors that may limit the quality of stopover habitat
4) to coordinate with other conservation efforts at multiple spatial scales

From the viewpoint that much information on shorebirds is tentative, we must proceed with what is known in general terms about habitat needs and work on filling the information gaps. In particular, the is a need to understand how the PPR contributes to the stability of hemispheric populations, and to remove impediments to that stability. It is important to bear in mind that though surveys and studies are currently being initiated or planned, the dynamic nature of prairie ecosystems requires a long term commitment to determine factors influencing shorebird population throughout changing weather conditions and successional cycles.

### Protection, restoration, and enhancement objectives

Six key shorebird habitats for the PPR were identified in the regional plan:

1) grasslands
2) grassland-wetland complexes
3) freshwater wetlands including lake margins and impoundments
4) alkaline wetlands
5) riverine beaches
6) agricultural lands.

Strategies for habitat protection, restoration, and enhancement are similar to those for other bird groups in making wise use of available USDA and FWS programs. However,

shorebirds may be unique in some respects because their affinity for shorter grass habitats may allow a greater flexibility in using active farm and rangeland. Cropland should not be considered a substitute for stopover habitat in uncultivated areas; most of the preliminary analyses presented in this plan indicate a strong preference for grassy landscapes. However, it would be imprudent to ignore the potential value of cropland and we should seek ways to enhance its use by shorebirds. We need to promote restoration and protection of shallow wetlands and short grass habitats with the myriad agricultural programs available to private landowners, and to dovetail the implementation of these programs with the needs of landowners, shorebirds, and other migratory species. Many of the shorebird species that breed in the PPR are associated with uplands more than with wetlands, such as the Upland Sandpiper and Marbled Godwit, and management practices would be more aligned with promoting healthy grasslands. For those that use wetlands, the most important principle for shorebird management in the PPR is to maintain a wide variety of wetland and grassland types in various successional stages to ensure a consistent habitat base for breeders and migrants during all phases of the extreme climatic conditions that occur in prairie regions.

## Prioritization of Objectives

Piping Plover and Mountain Plover are the shorebird species in greatest need in the PPJV. Efforts should be made to support protection of Piping Plover designated critical habitats (Federal Register 2002), and to enhance the potential for the return of Piping Plovers by protecting shallow wetlands with extensive beaches. Protection applies not only to securing each site, but to maintaining hydrology by protecting surrounding areas. Practices that allow encroachment of vegetation should be discouraged. Shallow wetlands with sparse vegetation are also beneficial to many other breeding and migrating shorebirds. Protection is also a key component of strategies for Mountain Plover because their range is severely contracted. Supporting cattle grazing, burning, and prairie dogs will be key to this species persistence in the PPJV.

Protection of existing grassland and wetland complexes is necessary for the continuance of both breeding and migrating shorebirds in the PPJV, but probably not sufficient given the downward trends of most species. Enhancement of existing habitat quality and restoration of at least a portion of what has been lost must also be a priority. Existing habitat can be improved by promoting practices such as burning and grazing that reduce vegetation density around wetlands. Where burning is conducted on a rotational basis, habitat quality can be enhanced for other species that need greater densities of vegetation by increasing plant vigor, and would help to reduce woody encroachment which is a problem for most prairie species. In areas where reed canary grass and cattail encroachment reduce habitat value for shorebirds (and waterfowl and wading birds), rigorous control methods need to be developed not only to improve quality, but to reduce populations before the problem spreads to currently unaffected areas. Late season drawdowns in both spring and fall can provide feeding habitat for spring and fall migrants and likely provides for local birds during molt and post-fledging periods.

Many USDA and FWS private lands programs are designed to restore and improve wildlife habitat, but not all are fully implemented at this time. A related objective would be to ensure full funding and implementation staff for programs such as the Grassland Reserve Program (GRP), Environmental Quality Incentives Program (EQIP), and Wildlife Habitat Incentives Program (WHIP).

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