



Partners in Flight
Bird Conservation Plan
for
The Upper Great Lakes Plain
(Physiographic Area 16)



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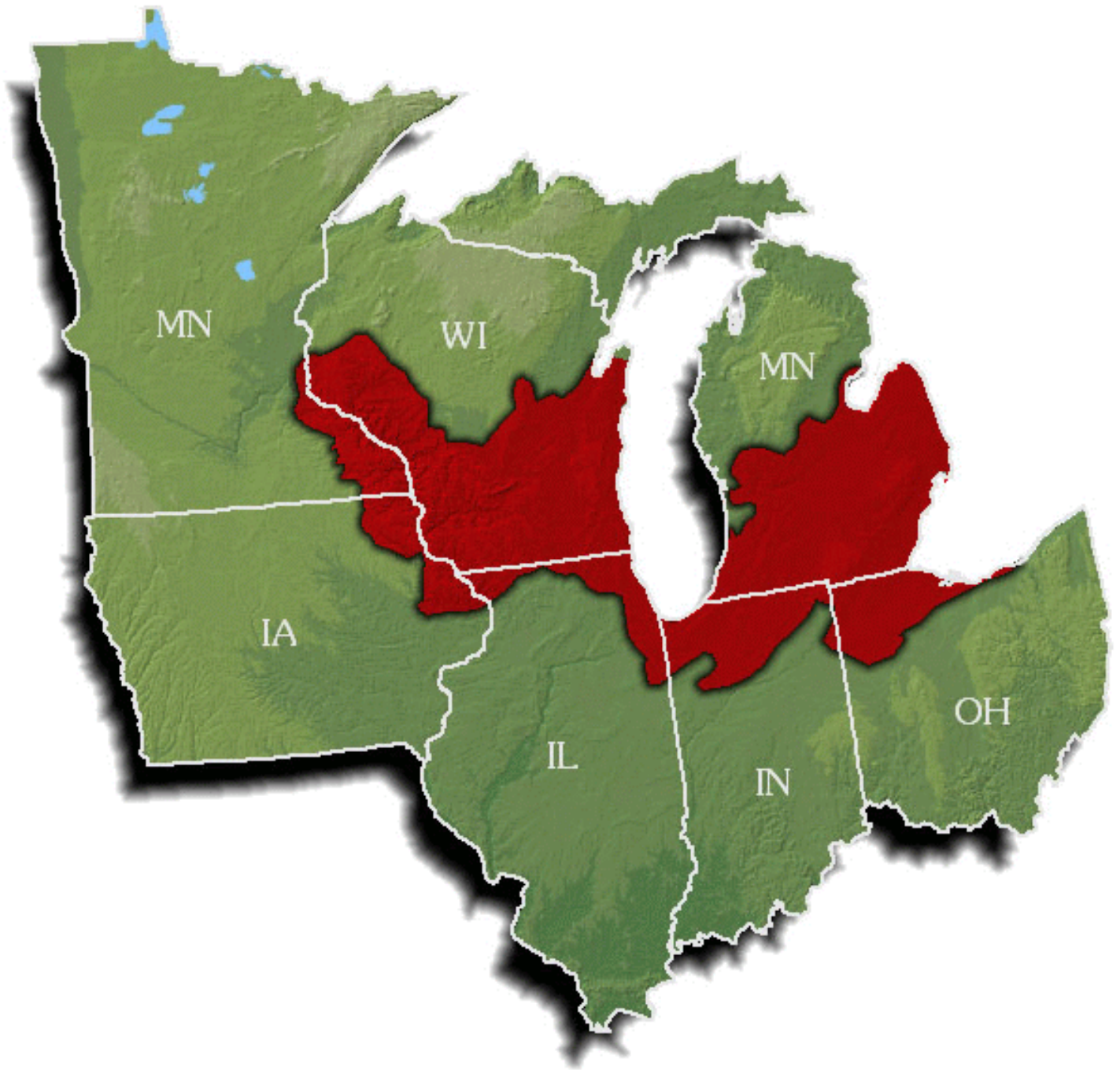
by

Melinda G. Knutson, Greg Butcher, Jane Fitzgerald, and Julie Shieldcastle
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Please direct comments to:

Greg Butcher
PIF Midwest Regional Coordinator
21375 Ann Rita Drive
Brookfield, Wisconsin 53045
262-797-8463
gregbutcherwi@hotmail.com



Partners in Flight Physiographic Area 16, The Upper Great Lakes Plain

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Partners in Flight
Bird Conservation Plan
For the Upper Great Lakes Plain
(Physiographic Area 16)

(Area - 19,159,100 ha)

Executive Summary

Description – The Upper Great Lakes Plain covers the southern half of Michigan, northwestern Ohio, northern Indiana, northern Illinois, southern Wisconsin, southeastern Minnesota, and northeastern Iowa. Glacial moraines and dissected plateaus are characteristic of the topography. A “driftless area” was not glaciated during the Pleistocene and emerged as a unique area of great biological diversity. Broadleaf forests, oak savannas, and a variety of prairie communities are the natural vegetation types. Today almost half of the area is covered by corn or soybean agriculture and more than a quarter of the area is devoted to pasture, hay, and mixed crops. More than 7% of the area is urbanized, with several large and growing urban areas, including Chicago, Illinois, and Detroit, Michigan.

Priority Bird Populations and Habitats

Grasslands

Henslow’s Sparrow – Requires tall and dense vegetation, with a deep litter layer; will not tolerate heavy or moderate grazing or early or late haying.

Greater Prairie-Chicken – Extirpated from the area, except in Wisconsin, where the population is small but stable. Requires large areas of grass (800 hectares or more), with short grass for leks and tall grass for nests and young.

Dickcissel – Populations vary from year to year, depending on precipitation in the core of its range. Requires medium-height and medium-dense vegetation with a moderate litter layer.

Bobolink – Habitat requirements similar to Dickcissel.

Upland Sandpiper – Prefers short grass with a moderate litter layer; displays from posts.

Short-eared Owl (winter) – Rare breeder in area, but more common in winter;

populations variable from year to year. Requires large areas of tall, dense grass with a deep litter layer.

Savanna-woodlands

Red-headed Woodpecker – Found in a variety of woodland habitats; prefers savannas and open woodlands. Requires dead trees for nesting and roosting.

Shrubs

Golden-winged Warbler – Center of range retreating northward from this area, probably due to competition and hybridization with Blue-winged Warbler. Requires large openings in forests with extensive shrubs and grass; does well in wetlands.

Blue-winged Warbler – Expanding range northwestward into this area; competes and hybridizes with Golden-winged Warbler. Requires large openings in forests with shrubs and grass; prefers uplands to wetlands.

Bell's Vireo – At northeastern edge of range in this area; declining throughout its range.

Field Sparrow – Requires oldfield habitats: grass with emerging shrubs and young trees.

Black-billed Cuckoo – Populations variable, high during caterpillar outbreaks. Requires dense shrubs, with or without trees; prefers riparian areas.

Forests

Cerulean Warbler – At northwestern edge of range in this area. Requires large areas of deciduous forest, with uneven canopy.

Acadian Flycatcher – At northern edge of range in this area. Requires large areas of deciduous forest.

Kentucky Warbler – At northern edge of range in this area; expected to breed only in southwestern Wisconsin and northeastern Iowa. Nests on ground in shrubby portions of large, mature forests.

Prothonotary Warbler – At northern edge of range in this area. Nests in cavities in wet forests.

Wetlands

Black Rail – Status in Midwest unclear; no known breeding population, but scattered spring sightings are reported. Requires wet meadows.

American Black Duck (winter) – Populations in this area have declined

precipitously due to competition and hybridization with Mallards. Prefers wooded swamps for nesting.

Wilson's Phalarope – Near eastern edge of range (except for population in southern Ontario). Requires wet meadows next to ponds, such as prairie potholes.

Conservation recommendations and needs - Geographic areas where opportunities exist to restore large tracts of high-quality grassland, forest, savanna, wetland, and riparian habitats should be identified so conservation efforts can be directed toward them. Monitoring and inventory efforts should be increased for species whose habitat affinities and population trends are unknown. Research is needed to better determine associations between landscape condition and parameters of population growth so conservation efforts can be implemented at the scale most effective in producing a population response.

Policy makers, wildlife agencies, private-lands specialists, and the general public need more information about habitat requirements of priority birds and useful tools to undertake conservation actions. Because 94% of PIF16 is privately owned, the actions of private landowners are critical to the success of conservation initiatives. Private-lands programs should address the economic realities of local communities and provide incentives for practices that produce the habitat structure needed by priority bird species, especially in landscapes where those habitats are in short supply. Partnerships that pool resources and avoid duplication of efforts are encouraged. Outstanding efforts to educate and to conserve habitat should be appropriately recognized by communities and states.

The following specific recommendations address research, monitoring, and outreach needs of high priority species in PIF16:

1. Grassland and forested habitats over a wide range of hydrological conditions, from wet to dry, are needed to sustain the high diversity of bird species found historically in PIF16. Identify large tracts of grassland and mature forest, as well as high quality savanna, shrub, wetland, and riparian forest habitats, and high quality migration habitat as a basis for conservation actions.
2. Promote science-based management of bird habitats; integrate research, modeling, planning, and management efforts.
3. Monitor populations to determine whether population objectives are being met.
4. Increase inventory and monitoring efforts for those species whose trends are unknown.
5. The Bird Conservation Area (BCA) concept sets specific landscape size and configuration prescriptions for habitats based on the needs of high priority species. Evaluate the usefulness of the BCA concept for

- sustaining populations of high priority species and revise prescriptions as our knowledge of population requirements for species advances.
6. Identify and conserve bird population sources in grasslands, forests, savannas, shrubs, and wetland habitats, based on the best available science. Plan research to address gaps in our knowledge.
 7. Develop policy recommendations that address economic incentives for private landowners to manage their land in accordance with bird conservation plans.
 8. Work to build public/private partnerships to conserve and restore habitats for high priority species.
 9. Recognize outstanding efforts to educate landowners and conserve habitat.
 10. Partner with international groups to ensure adequate winter and migration habitat for migrating species.

We identify a few location-specific conservation opportunities in hopes of stimulating PIF partners to identify other conservation opportunities within PIF16:

1. Grassland habitats in southern Wisconsin hold potential as grassland BCAs (Sample and Mossman 1997).
2. Forest BCAs could be established in the Driftless Area of northeastern Iowa, southeastern Minnesota, and southwestern Wisconsin and in southwestern Michigan.
3. Riparian restoration along streams, rivers, and wetlands over the entire PIF16 could greatly enhance habitat for riparian/savanna and shrub nesting species.

Preface

Partners in Flight (PIF) is a voluntary, international coalition of government agencies, conservation groups, academic institutions, and private businesses and citizens dedicated to “keeping common birds common.” The goal of PIF is to direct resources toward the conservation of birds and their habitats through cooperative efforts in North America and the Neotropics. The focus of PIF is generally limited to the conservation of land birds, but the intent is to complement similar efforts for waterfowl, shorebirds, and other taxa. Partners in Flight now joins with the North American Waterfowl Management Plan, United States Shorebird Conservation Plan, and North American Waterbird Conservation Plan under the umbrella of the North American Bird Conservation Initiative (NABCI). The focus of NABCI is long-range planning to ensure viable populations of all native bird species and management of native ecosystems to support functional avifaunal communities.

The foundation of PIF’s bird conservation strategy is a series of Bird Conservation Plans (BCPs), of which this document is one. Recommendations in the plans are based upon sound science and consensus among interested

groups and knowledgeable individuals. The goals of the BCPs are to:

1. Identify species and habitats most in need of conservation.
2. Establish objectives for bird populations and habitats in physiographic areas (ecoregions) and states.
3. Identify the general habitat requirements of priority species at the site level.
4. Identify the quantity and quality of habitat required by birds at the landscape scale.
5. Recommend needed conservation actions and suggest opportunities to accomplish them.

Many bird species of the United States migrate through or winter in other countries in the Western Hemisphere. Many species have lost important migration or wintering habitat and some are directly exposed to toxicants and persecution (Basili and Temple 1999). It is beyond the scope of Bird Conservation Plans to recommend conservation objectives for other countries. However, PIF is partnering 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 Web site www.partnersinflight.org.

Section 1: The planning unit

Background

Partners in Flight Physiographic Area 16, the Upper Great Lakes Plain (PIF16) is approximately 19.2 million ha (45 million acres) covering southeastern Minnesota, northeastern Iowa, southern Wisconsin, southern Michigan, northern Illinois, northern Indiana, and northwestern Ohio (see map at <http://www.cast.uark.edu/pif/main/mainmap.htm>). The area comprises the northern portion of Bailey's Ecoregion 222, Eastern Broadleaf Forest (Continental) Province (Bailey et al. 1994) and includes North Central United States Driftless and Escarpment Section (222L), Southwestern Great Lakes Morainal Section (222K), South Central Great Lakes Section (222J), and Erie and Ontario Lake Plain Section (222I). Two Breeding Bird Survey (BBS) (Sauer et al. 2001) Regions compose PIF16: the Driftless Area and the Great Lakes Plain.

Geologically, the area is composed of morainal hills and dissected plateaus (McNab and Avers 1994). The geomorphology of all sections, except the Driftless Area, is dominated by glacial drift. The soils are Alfisols and Mollisols arising from Cenozoic till and Paleozoic carbonates. Elevations range from 177 to 503 m (580 to 1650 feet). The growing season is from 140 to 175 days.

Presettlement vegetation was broadleaf forest dominated by oak-hickory, beech-maple and oak savanna communities (McNab and Avers 1994). Drought-resistant communities of oak savanna were historically more common in

the drier, western portion of the region and on sandy soils. Curtis (1959) described the historical landscape of interspersed prairie, oak savanna, and mesic forests occupying southern Wisconsin. Today, the dominant land cover is corn, soybeans, hay, pasture, and mixed crops (see map set attached at end of document or at <http://www.cast.uark.edu/pif/main/midwest/16table.htm>). Scattered forests of oak-hickory and elm-ash-cottonwood are found across the region. Large human population centers include Milwaukee, La Crosse, Madison, and Green Bay, Wisconsin; Chicago and suburban Illinois; Gary and Fort Wayne, Indiana; Flint, Grand Rapids, Detroit, and Lansing, Michigan; and Toledo, Ohio.

Water is abundant in the region; precipitation ranges from 67 to 114 cm (27 to 45 in.) per year (McNab and Avers 1994). The Great Lakes form part of the northern boundary of the region. Smaller lakes also occur in the northern portion where the postglacial soils are poorly drained. The southern portions are dominated by large river systems, including the Chippewa, Mississippi, Wisconsin, Rock, Illinois, Grand, and Maumee.

Of the 19.2 million ha in PIF16, 94% (18.1 million ha) is in private ownership. Federal land comprises 1% of the total land area (Table 1). All of PIF16 falls within Region 3 of the U.S. Fish and Wildlife Service (USFWS) and is the focus of two ecosystem management efforts by the USFWS, the Upper Mississippi River Tallgrass Prairie Ecosystem and the Great Lakes Ecosystem (U.S. Fish and Wildlife Service 1994). Thirteen National Wildlife Refuges (2,700 ha) are located in this region (<http://midwest.fws.gov/>) as well as four properties managed by the National Park Service (17,300 ha; <http://www.nps.gov/htdocs3/hfc/carto/NPSMAP.html>), including the St. Croix National Scenic River, Effigy Mounds National Monument, and the Indiana Dunes National Lakeshore. Two National Scenic Trails meander through the region (<http://www.nps.gov/htdocs3/hfc/carto/TRAILMAP.html>). A 3,600-ha portion of the Manistee National Forest in Michigan is included in our region, and Department of Defense lands total 32,400 ha. State parks and forests occupy about 842,900 ha.

Table 1. Land ownership in PIF16.

Description	Area (acres)	Area (ha)	% of Total
Other	44,610,446	18,053,600	94.23
National Wildlife Refuge	234,251	94,800	0.49
National Forest	8896	3600	0.02
National Recreation Area	6178	2500	0.01
State Park	219,919	89,000	0.46
Military, government reservation	80,060	32,400	0.17
Indian reservation	70,176	28,400	0.15
Wilderness, wild and scenic river	206,823	83,700	0.44
State Forest	1,862,887	753,900	3.93

Description	Area (acres)	Area (ha)	% of Total
National Monument, National Landmark	42,501	17,200	0.09
Total	47,342,136	19,159,100	100.00

Conservation issues

Most of the presettlement forests and oak savanna grasslands in PIF16 have been converted to agricultural crop lands, primarily corn, soybeans, hay, pasture, and mixed grains (see maps at <http://www.cast.uark.edu/pif/main/midwest/16table.htm>). There have been heavy losses in forest communities, which now occur primarily as remnants in fragmented landscapes and occupy about 14% of the area. Oak savanna and prairie communities have virtually disappeared, except in a few locations where conservation efforts have saved or restored them. Fire suppression and intensive agricultural and urban land use are the primary factors preventing the land from reverting to presettlement conditions. Despite heavy habitat losses, the bird communities are still rich, especially forest and prairie bird communities. Prairie birds in PIF16 may be more abundant now than in presettlement times because of the dramatic conversion of land to agricultural crops, including hay. Wetland bird communities are favored by the moist climate and abundance of water. However, cowbird parasitism and nest predation are potential limiting factors in fragmented habitats (Herkert 1994a, Robinson et al. 1995), but see (Knutson et al. In prep., Gustafson et al. In press).

PIF16 encompasses portions of both the Great Lakes and the Mississippi River. The Great Lakes basin is the largest body of freshwater in the world. The Upper Mississippi River and tributary corridors provide the largest area of contiguous fish and wildlife habitat remaining in the Central United States (Wiener et al. 1998). The Upper Mississippi River National Wildlife and Fish Refuge alone provides breeding and migration habitat for over 290 bird species (Knutson and Klaas 1998). The Mississippi River and its associated tributaries have always provided an important migration route for fish and wildlife. However, because of continuing wetland and forest losses, expansion of urban and agricultural areas, navigation, and channelization of many rivers, the Mississippi River's importance has greatly increased in recent history (Wiener et al. 1998, U.S. Geological Survey 1999). Wetlands of the Great Lakes and the Mississippi River serve a critical role as migration and stopover sites for many species of waterbirds and shorebirds. The concentrations of individuals (Appendix A) found during these brief but critical migration times are a function of the enormous food resources provided by highly productive wetland systems.

Wetland losses in the Midwestern states are estimated to range from 35 to 99% (Noss et al. 1995). Of the 25.8 million ha (64 million acres) of original wetland habitat in Region 3 of the USFWS (eight states: Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Michigan, and Ohio), only 9.4 million ha remains, a loss of 64% (Mitsch and Gosselink 1993). The rate of wetland destruction has

slowed in the last decade, but sedimentation and pollution of wetlands continues. Even where many wetlands remain, land-use changes have reduced their biodiversity. Small wetlands have been drained into larger ones. The resulting loss of small, shallow wetlands negatively affects native species dependent on these areas and reduces wetland edge habitat critical to the life cycles of many species. Wetlands also play an important role in maintaining ecosystem functions by protecting shorelines, recharging groundwater, cycling nutrients, and storing floodwater.

Nationwide, riparian zones have suffered the worst losses of any type of wetland from the 1970s to the 1980s (1.4 million ha, 3.5 million acres). The area of riparian forest in the North-central U.S. in 1940 was estimated at 6.9 million ha, dropping to 5 million ha in 1980 (-27.5%; Mitsch and Gosselink 1993). Estimates of Midwestern losses of riparian forest vary from 20-90%, depending upon state and investigator (Noss et al. 1995). Functions of riparian forests include shading and temperature regulation of streams, contributions of woody litter, and the provision of other unique habitat values (Knutson et al. 1996, Shaw and Bible 1996).

Vegetative dynamics in a floodplain result from a complex interplay between sediment deposition and flood disturbance over long time scales (Junk et al. 1989, Sparks et al. 1998). Today, most rivers and streams are anthropogenically controlled with channelization, levees, and locks and dams (Sparks et al. 1998). Resultant changes in the annual hydrograph are affecting riparian forest regeneration (Yin et al. 1997, Sparks et al. 1998). Early successional floodplain species are disappearing, and chronically wet conditions do not favor late successional species. With the loss of American elm (*Ulmus americana*) as a canopy tree from Dutch elm disease, silver maple (*Acer saccharinum*) dominates most riparian forests. Tree species diversity in floodplain forests tends to be lower than it was historically (Yin et al. 1997, Knutson and Klaas 1998).

Losses of tallgrass prairie in the Midwest and Great Plains are estimated at roughly 90% west of the Mississippi River and about 99% east of the Mississippi River (Noss et al. 1995). Large blocks of grassland habitats are very rare because of the intensity of farming (Herkert et al. 1996, Best et al. 1997, Ryan et al. 1998b), although the Conservation Reserve Program has temporarily provided additional grassland habitat. As a group, grassland birds are experiencing steeper population declines than any other group (Herkert 1995, Herkert et al. 1996) and are a focus of management concern for the USFWS (U.S. Fish and Wildlife Service 1999).

Drought-adapted oaks and hickories dominate upland forest habitats in the western portion of the region, with maple-basswood in moist locations and on north slopes (Bailey 1995). In the eastern portion of the region, beech-maple forest predominates with oak and hickory found on sites with dry or sandy soils. These forests are considered climax communities for the region and will maintain dominance in the absence of fire. Before European settlement, periodic fires

created oak savannas on poor or dry soils.

Savanna and woodland habitats were once common in the Driftless Area of Minnesota, Iowa, Wisconsin, and Illinois (Kline 1997). More than 99% of the original 11-13 million ha (27.9-32.1 million acres) of savanna-woodland in the Midwest has been converted to cropland or degraded by fire suppression and over-grazing (Nuzzo 1985). This savanna community is now considered endangered, with less than 1% of presettlement land area remaining (Noss et al. 1995). Frequent fires (naturally-occurring or set by Native Americans) maintained savannas and prevented succession to closed-canopy forest. Fire suppression and conversion to agriculture has eliminated oak savannas as functioning ecosystems. Biodiversity in savanna communities is typically high because savannas represent an ecotone between forest and prairie (Leach and Givnish 1999).

The Driftless Area was not covered by glaciers during the latter part of the Pleistocene epoch and is characterized by highly dissected uplands with deeply cut valleys (Curtis 1959). Streams cutting through karst bedrock have created cliffs and algal talus slopes, providing habitat for plant and animal species that are either unique to this area or at the limits of their ranges (Glenn-Lewin et al. 1984). As a result, the region is characterized by high biodiversity (Pusateri et al. 1993, Minnesota Department of Natural Resources 1994b, a, Knutson and Klaas 1997).

General conservation opportunities

PIF16 is included in the Upper Mississippi River & Great Lakes Region Joint Venture (UMRGLR JV) of the North American Waterfowl Management Plan (NAWMP) (U.S. Fish and Wildlife Service 1998). The goals of this joint venture are to restore grassland and wetland habitats and return waterfowl populations to mid-1970 levels. Originally, the UMRGLR JV focused on enhancing habitat for migrating and breeding waterfowl. Since 1986, more than 238,000 acres of wetlands and retired croplands in the UMRGLR JV have been restored to native vegetation. NAWMP is an ambitious conservation initiative and has been highly successful due to conservation actions undertaken by the partners as well as exceptionally good hydrologic conditions during the 1990s. Recently, UMRGLR JV voted to become an all-bird initiative and is expected to play a major role in coordinating and catalyzing conservation for all birds in PIF16 (which corresponds closely to Bird Conservation Region 23 – the Prairie Hardwood Transition).

The Nature Conservancy (TNC) is actively working to protect rare habitats and examples of large, intact ecosystems in PIF16 (www.tnc.org). Examples of TNC initiatives in this region include the Baraboo Hills, Wisconsin (Last Great Place), the Tallgrass Prairie and Oak Savanna Initiative in Wisconsin, Kankakee Sands prairie restoration in Indiana, and forest restoration initiatives in the Chicago area.

Many Important Bird Areas (IBAs) have been designated in PIF16 (Appendix A). The IBA program was first developed by BirdLife International, Cambridge, United Kingdom (www.birdlife.net), with sites identified on the basis of significant bird concentrations during migration, breeding, or nonbreeding seasons. Records of IBAs of global, continental, or national significance are kept by the American Bird Conservancy in The Plains, Virginia, and will be published soon. Additional state-level IBAs will be identified over the next few years by state chapters of the National Audubon Society. Once sites are identified, however, action should be taken to ensure that they maintain their integrity over time.

There is particularly high potential for conserving and enhancing wildlife habitat values in the Driftless Area. The proportion of the landscape presently forested (30-50%) means that modest conservation efforts could greatly enhance habitat quality for birds. Small changes in land-use practices such as consolidating fragmented forests, planting native prairie species on marginal agricultural land, enlarging existing grasslands, and improved riparian zone management could move the landscape from moderately to very productive for many wildlife species.

Geographic information systems (GIS) and ecoregional descriptions at the Section, Subsection, and Sub-subsection (Albert 1995) levels also can be used to identify areas within PIF16 where grassland, forest, and other landscapes currently are most intact and would benefit most quickly from restoration or other conservation efforts. Subsection units may be of the appropriate size for developing conservation guidelines for specific locales. Restoration planners should consider patterns of soil distribution, potential natural vegetation, existing vegetation and land use, and other kinds of ecological information specific to the planning unit in question. This information is now available for a large portion of PIF16 (Albert 1995).

Section 2: Avifaunal analysis

General characteristics

More than 197 bird species breed in PIF16. Various approaches have been used to identify high priority bird species. All states in PIF16 designate species as threatened, endangered, or special concern based on population status within the state (Appendix B). The U.S. Fish and Wildlife Service has identified Resource Conservation Priority (RCP) Species for each region. Region 3, which includes PIF16, lists 36 bird species on their RCP list (<http://midwest.fws.gov/pdf/priority.pdf>). Population trends for nesting or migration guilds, based on the national Breeding Bird Survey, have been used to examine general population trends for large groupings of birds (Sauer et al. 2001). If fewer than half of the species in these groups have positive trends, the species group is considered to be of conservation concern. Grassland and wetland birds seem to be faring the worst among the groupings in PIF16 (Table 2).

Table 2. Adjusted proportion of bird species with significant positive population trends (1966-2000) among selected bird groups in the Driftless Area and the Great Lakes Plain subregions of PIF16. Adapted from Sauer et al. (2001).

Bird group	Adjusted proportion of species with significant positive trends	
	Driftless Area (N) ^a	Great Lakes Plain (N) ^a
Grassland	0.00 (10)	0.00 (13)
Wetland	0.00 (6)	0.35 (20)
Successional/scrub	0.21 (14)	0.39 (18)
Woodland	0.48 (21)	0.57 (28)
Urban	0.27 (11)	0.42 (12)
Neotropical migrant	0.29 (34)	0.38 (42)
Short distance migrant	0.30 (30)	0.39 (36)
Permanent resident	0.38 (13)	0.56 (16)
All species	0.29 (82)	0.41 (111)

^aNumber of species used in the analysis (encountered on >14 routes).

Priority species

One goal of Partners in Flight is to keep common birds common by focusing conservation attention on vulnerable species before they require legal protection as threatened or endangered. Species are considered of conservation priority for Bird Conservation Plans if they meet one of several criteria (Carter et al. 2000, see Appendix C). The criteria assign rankings based upon a species' relative abundance, size of breeding and nonbreeding distributions, local or global population trends, and the degree to which PIF16 in question is a center of abundance for that species. It is inferred that these criteria are indicators of a species' vulnerability to extinction (Beissinger et al. 2000).

Species for which the planning unit is a center of abundance and also show significant declines in population trend need immediate conservation attention. Species that have a large proportion of their population breeding in the planning unit, but are not declining, do not warrant immediate conservation action. However, they should be considered of high conservation responsibility and their needs considered in long-range planning. In addition, species currently listed as threatened or endangered may be the focus of federal and state restoration efforts in PIF16. These species do not have PIF16 scores because they currently have no populations in the area, but land managers should seek to maintain or increase appropriate habitat for these species, especially if they were present historically.

The priority species for PIF16 are given in Tables 3 (breeding) and 4 (wintering),

arranged by habitat preference. The importance of this region to birds during migration is beyond the scope of this plan. Waterfowl are not addressed because they are the focus of the North American Waterfowl Management Plan. Breeding shorebirds and nongame waterbirds are considered in this plan when they have a high priority score, although they will also be covered in plans focused on those groups. Species common names follow the Check-list of North American Birds, 7th ed. (American Ornithologists' Union 1998).

Table 3. Priority Species during the breeding season by habitat type for the Upper Great Lakes Plain, Physiographic Area #16, from the Partners in Flight Species Prioritization Database 2000.

Species	7 th seq	Habitat	G- RA	G- BD	G- ND	G- TN	TB	AI	PT	x7	Tier	% POP	AI+ PT	TB+ TN	WL status
Henslow's Sparrow	2111	GR	4	3	5	4	4	3	5	28	I.	6.77	8	8	EHP
Greater Prairie-Chicken	358	GR	3	5	5	4	4	2	3	26	I.		5	8	
Dickcissel	2198	GR	2	2	4	4	4	2	5	23	I.	0.68	7	8	MHP
Bobolink	2199	GR	2	2	2	4	4	3	5	22	I.	4.09	8	8	MP
Upland Sandpiper	475	GR	3	2	3	4	3	2	5	22	I.	0.45	7	7	
Short-eared Owl	796	GR	4	1	1	4	4	2	3	19	II.C.		6	8	MP
Grasshopper Sparrow	2112	GR	3	1	2	3	3	2	5	19		1.00	7	6	
Northern Bobwhite	372	GR	2	2	2	3	3	2	5	19		1.26	7	6	
Northern Harrier	258	GR	4	1	1	3	4	3	3	19	II.C.	0.83	6	7	
Sedge Wren	1614	GR-WE	3	3	3	3	4	3	2	21	II.C.	3.40	5	7	
Sandhill Crane	429	GR-WE	3	2	4	3	3	4	1	20		1.98	5	6	
Golden-winged Warbler	1781	SH-F	4	4	4	4	4	2	3	25	I.	0.34	4	8	EHP
Blue-winged Warbler	1780	SH-F	4	3	4	3	3	3	3	23	I.	6.23	6	6	MP
Bell's Vireo	1423	SH	3	3	5	3	4	2	3	23	I.	0.06	4	7	EHP
Field Sparrow	2095	GR-SH	3	2	2	3	3	4	5	22	I.	5.76	9	6	
Black-billed Cuckoo	726	SH-F	4	2	2	3	3	4	4	22	I.	3.40	8	6	
Brown Thrasher	1732	SH	3	1	3	2	3	4	5	21	II.A.	2.79	9	5	
Willow Flycatcher	1296	SH	3	1	4	2	3	4	3	20			7	5	
White-eyed Vireo	1412	SH-F	3	2	4	2	3	2	3	19		0.03	4	5	
Yellow-billed Cuckoo	727	SH-F	3	1	2	3	3	2	5	19		0.39	7	6	
Yellow-breasted Chat	1886	SH	3	1	3	2	3	2	5	19		0.05	6	5	
*Bewick's Wren	1601	SH	3	2	2	3	3	2	3	18			5	6	
*Loggerhead Shrike	1409	GR-SH	3	1	1	3	4	2	3	17		0.01	4	7	
Red-h.	1067	SA	4	2	2	3	3	4	5	23	I.	4.16	9	6	MP

Species	7 TH seq	Habitat	G- RA	G- BD	G- ND	G- TN	TB	AI	PT	x7	Tier	% POP	AI+ PT	TB+ TN	WL status
Woodpecker															
Baltimore Oriole	2260	SA	3	2	3	2	3	5	2	20		6.69	7	5	
Cerulean Warbler	1828	BF	4	4	4	4	4	2	3	25	I.	0.44	4	8	EHP
Acadian Flycatcher	1294	BF	3	2	4	3	3	2	5	22	I.	0.41	7	6	
Kentucky Warbler	1841	BF	4	3	4	3	3	2	3	22	I.		5	6	MP
Canada Warbler	1866	BF	4	2	3	4	3	2	3	21		0.01	4	7	
Whip-poor-will	819	BF	4	2	3	3	3	2	3	20		1.06	5	6	
Hooded Warbler	1864	BF	3	2	4	3	3	2	3	20		0.02	4	6	
Mourning Warbler	1843	BF	3	3	3	3	2	2	3	19		0.27	5	5	
Wood Thrush	1693	BF	3	2	4	4	3	2	1	19	II.C.	1.47	3	7	MHP
Yellow-throated Vireo	1428	BF	4	2	3	3	3	3	1	19		5.31	4	6	
Blackburnian Warbler	1812	CF	3	2	3	3	3	2	3	19			5	6	
Prothonotary Warbler	1835	RF	4	3	4	3	3	2	3	22	I.	0.12	4	6	MHP
American Woodcock	521	RF	4	2	3	3	3	3	3	21	III.B	2.05	6	6	MHP
La. Waterthrush	1840	RF	4	2	3	4	3	2	3	21	II.C.		5	7	
Peregrine Falcon	324	U	5	1	1	3	4	2	3	19		0.14	4	7	
Whooping Crane	184	WE	5	5	5	5	5	2	5	32	I.	0	7	10	EHP
Piping Plover	445	WE	5	4	4	4	5	2	5	29	I.	0	7	9	EHP
Black Rail	398	WE	5	4	4	4	4	2	3	26	I.		5	8	EHP
Trumpeter Swan	184	WE	4	4	4	4	1	2	5	24	I.		7	5	EHP
Wilson's Phalarope	522	WE	3	2	5	4	3	2	3	22	I.		5	7	MHP
American Black Duck	197	WE	4	2	3	3	4	2	3	21	II.C.	0.20	5	7	MHP
Am. White Pelican	100	WE	2	3	3	3	3	3	3	20			6	6	
Black Tern	586	WE	3	1	2	3	4	2	5	20	II.C.	0.40	7	7	
Hooded Merganser	237	WE	4	2	4	2	3	2	3	20		0.71	5	5	
Forster's Tern	574	WE	3	3	3	2	3	2	3	19		1.24	5	5	
King Rail	404	WE	4	2	4	2	2	2	3	19			5	4	
Marsh Wren	1615	WE	3	2	2	3	4	2	3	19	II.C.	0.87	5	7	
N. Rough-w. Swallow	1530	WE	3	1	3	2	2	5	3	19	II.A.	3.84	8	4	
Redhead	216	WE	3	2	2	3	4	2	3	19	II.C.		5	7	
Swamp Sparrow	2126	WE	3	2	2	2	2	4	4	19	II.A.	1.86	8	4	

Species - Official common name from the AOU Checklist, 7th Edition.

7th seq - A number that allows the list to be sequenced in taxonomic order according to the 7th Edition of the AOU checklist.

G-RA - Global relative abundance, usually based on Breeding Bird Survey data.

1=100+ per BBS route (abundant), 2=30-99.9 (common), 3=10-29.9 (fairly common), 4=1-9.9 (uncommon), 5=less than 1 (rare).

G-BD & G-ND - Global scores for breeding distribution (BD) and wintering distribution (ND)

1=20% or more of North America, 2=10-19.9%, 3=5-9.9%, 4=2.5-4.9%, 5=less than 2.5% (551,500 km²).

G-TN - Global score for threats in the nonbreeding season; 1=population should maintain present level or increase, 2=75-99% should remain, 3=50-74%, 4=25-49%, 5=less than 25% may remain.

TB - Threats to successful breeding in PIF16; 1=population should maintain present level or increase, 2=75-99% should remain, 3=50-74%, 4=25-49%, 5=less than 25% may remain.

AI - Importance of PIF16 for breeding of the species, calculated, if possible, by comparing relative abundance on the Breeding Bird Survey within PIF16 to the species' highest relative abundance in any physiographic area (see G-RA, below) 1=0-0.9% of max., 2=1-9.9%, 3=10-24.9%, 4=25-49.9%, 5=50%+.

PT - Population trend for PIF16, usually determined from the Breeding Bird Survey; 1=significant increase, 2=stable, or apparent increase, 3=uncertain, 4=apparent decline, 5=significant declines

x7 - A total score that sums PT, AI, TB, G-RA, G-BD, G-ND, & G-TN.

Tier - Priority Tier; I=total score 22+; IIA=score 19-21, AI+PT 8+; IIB=19-21, high %pop; IIC=19-21, TB 4+; IIIA=19-, high %pop; IIIB -listed as a national species of concern; IVA - Federally listed (E/T); IV-B - state listed, game bird, overabundant, or other local interest.

% pop - Percentage of the species' population breeding in PIF16.

AI&PT - A combined score that, if high, suggests a species is a local priority regardless of total score.

TB&TN - A combined threats score.

WL status – Watch List status (a global designation of the National Audubon Society, based on scores from a previous version of the database) – EHP = Extra High Priority, MHP = Moderate High Priority, MP=Moderate Priority.

Table 4. Priority Species in winter by habitat type for the Upper Great Lakes Plain, Physiographic Area #16, from the Partners in Flight Species Prioritization Database 2000.

Species	7 TH seq	Habitat	G-RA	G-BD	G-ND	G-TB	TN	AI-W	G-PT	x7	Tier	AI+PT	TB+TN	WL status
Gr. Prairie-Chicken*	358	GR	3	5	5	4	4	2	3	26	I.	5	8	MP
Short-eared Owl*	796	GR	4	1	1	4	4	4	5	23	I.	9	8	
Northern Bobwhite*	372	GR	2	2	2	3	3	3	5	20	II.A.	8	6	
Northern Harrier*	258	GR	4	1	1	4	3	2	4	19	II.C.	6	7	
Field Sparrow*	2095	GR-SH	3	2	2	3	3	4	5	22	I.	9	6	
Am. Tree Sparrow	2091	GR-SH	2	2	2	2	2	4	5	19	II.A.	9	4	
Red-h. Woodpecker*	1067	SA	4	2	2	3	3	3	5	22	I.	8	6	MP
Long-eared Owl	2260	SA	3	2	3	2	3	5	2	20		7	5	
Northern Goshawk	267	BF	5	1	1	3	3	3	3	19		6	6	
Ruffed Grouse	349	BF	4	2	2	3	2	3	3	19		6	5	
E. Screech-Owl	759	BF	4	2	2	3	2	5	1	19		6	5	
Rusty Blackbird	2216	V	4	1	2	2	3	2	5	19		7	5	MHP
Am. Black Duck+	197	WE	4	2	3	4	3	5	5	26	I.	10	7	
Redhead+	216	WE	3	2	2	4	3	3	4	21	II.C.	7	7	
Greater Scaup+	221	WE	3	2	2	2	3	4	5	21	II.A.	9	5	
Bald Eagle	254	WE	4	2	1	3	3	3	3	19		6	6	
Canvasback+	215	WE	3	1	2	4	3	2	4	19	II.C.	6	7	
Bufflehead+	233	WE	4	2	1	3	3	3	3	19		6	6	

+PIF plans do not address waterfowl.

*These species are also considered breeding season priorities in PIF16.

Species - Official common name from the AOU Checklist, 7th Edition.

7th seq - A number that allows the list to be sequenced in taxonomic order according to the 7th Edition of the AOU checklist.

G-RA - Global relative abundance, usually based on Breeding Bird Survey data, 1=100+ per BBS route (abundant), 2=30-99.9 (common), 3=10-29.9 (fairly common), 4=1-9.9 (uncommon), 5=less than 1 (rare).

G-BD & G-ND - Global scores for breeding distribution (BD) and wintering distribution (ND) 1=20% or more of North America, 2=10-19.9%, 3=5-9.9%, 4=2.5-4.9%, 5=less than 2.5% (551,500 km²).

G-TN - Global score for threats in the nonbreeding season; 1=population should maintain present level or increase, 2=75-99% should remain, 3=50-74%, 4=25-49%, 5=less than 25% may remain.

TB - Threats to successful breeding in PIF16; 1=population should maintain present level or increase, 2=75-99% should remain, 3=50-74%, 4=25-49%, 5=less than 25% may remain.

AI - Importance of PIF16 for breeding of the species, calculated, if possible, by comparing relative abundance on the Breeding Bird Survey within PIF16 to the species' highest relative abundance in any physiographic area (see G-RA, below) 1=0-0.9% of max., 2=1-9.9%, 3=10-24.9%, 4=25-49.9%, 5=50%+.

PT - Population trend for PIF16, usually determined from the Breeding Bird Survey; 1=significant increase, 2=stable, or apparent increase, 3=uncertain, 4=apparent decline, 5=significant decline.

x7 - A total score that sums PT, AI, TB, G-RA, G-BD, G-ND, & G-TN.

Tier - Priority Tier; I=total score 22+; IIA=score 19-21, AI+PT 8+; IIB=19-21, high %pop; IIC=19-21, TB 4+; IIIA=19-, high %pop; IIIB -listed as a national species of concern; IVA - Federally listed (E/T); IV-B - state listed, game bird, overabundant, or other local interest.

% pop - Percentage of the species' population breeding in PIF16.

AI&PT - A combined score that, if high, suggests a species is a local priority regardless of total score.

TB&TN - A combined threats score.

WL status – Watch List status (a global designation of the National Audubon Society, based on scores from a previous version of the database) – EHP = Extra High Priority, MHP = Moderate High Priority, MP=Moderate Priority.

Section 3: Habitats and Objectives

Habitat-species groupings

In general, species showing the greatest population declines are associated with disturbance-dependent systems such as grasslands (Henslow's Sparrow, Dickcissel, Bobolink, and Upland Sandpiper), grass-shrub habitats (Field Sparrow and Brown Thrasher), and savannas (Red-headed Woodpecker). Several savanna and shrub species have relatively high PIF Area Importance scores (Table 3). Populations of several of the highest priority species (e.g., Greater Prairie-Chicken, Black Rail, Golden-winged Warbler, Blue-winged Warbler, Bell's Vireo, and Cerulean Warbler) are poorly sampled by the Breeding Bird Survey (BBS), and therefore population trends are poorly known. Inventory and monitoring should be priority efforts for these species. The Cornell Laboratory of Ornithology has completed an atlas project for Cerulean Warbler (<http://birds.cornell.edu/cewap/>) and is undertaking one for Golden-winged Warbler (<http://birds.cornell.edu/gowap/>). These projects are designed to identify concentrations of the species, but provide no information on trends.

We address the needs of high priority species grouped into grassland, shrub, savanna, forest, and wetland habitats. Management recommendations address both umbrella species such as the Greater Prairie-Chicken and the Cerulean Warbler, as well as general habitat requirements of other priority species associated with a habitat type.

Grasslands

Ecology and conservation status

Before European settlement, tallgrass prairie was interspersed within oak savanna, beech-maple (*Fagus* sp. and *Acer* sp.), and maple-basswood (*Acer* sp. and *Tilia* sp.) forests and woodlands (McNab and Avers 1994). Today, roughly 50% of PIF16 is planted in corn and soybeans. Native prairie now covers less than 1% of the land surface, although surrogate grasslands such as pastures and hayfields occupy approximately 25% of the area. Whereas pasture and hayfields provide habitat for some species of grassland birds, the vegetation structure of heavily grazed pastures is not attractive to high priority species (Sample and Mossman 1997), and eggs and nestlings in early-mown hayfields are destroyed when hay is cut and harvested (Rodenhouse et al. 1995, Herkert 1997a). Grasslands that have resulted from the Conservation Reserve Program (CRP), however, may be helping to stabilize declines of priority species such as Henslow's Sparrow (Johnson and Schwartz 1993, Best et al. 1997, Herkert 1997b, Ryan et al. 1998b). Unfortunately, there is no assurance that the CRP program will continue to be offered in the long-term, and much of this land could revert to cropland once existing contracts expire.

Bird habitat requirements

Grasslands: Henslow's Sparrow, Greater Prairie-Chicken, Dickcissel, Bobolink, Upland Sandpiper, Short-eared Owl, Grasshopper Sparrow, Northern Bobwhite, and Northern Harrier

Greater Prairie-Chickens require the largest tracts of grassland of all grassland birds in PIF16, therefore their habitat requirements are the most difficult to attain (Schroeder and Robb 1993). They can be considered an umbrella species for many other grassland birds with less stringent habitat requirements (Merrill et al. 1999, Winter and Faaborg 1999, Niemuth 2000, Poiani et al. 2001). Greater Prairie-Chickens are nonmigratory, with home ranges >800 ha (2000 acres) during certain times of year (Robel et al. 1970, Horak 1985). Greater Prairie-Chickens prefer landscapes dominated by native prairie or mixed-grass pastures (Jones 1963, Schroeder and Robb 1993, Ryan et al. 1998a). Management practices such as rotational burning or light grazing can be employed to maintain desirable grassland structure (McKee et al. 1998, Niemuth 2000).

Habitats managed for prairie chickens in Wisconsin and Illinois also provide habitat for Short-eared Owls and Northern Harriers (Hamerstrom 1986, Walk

1998, Herkert et al. 1999). Northern Harrier is listed as a species of concern in Michigan and Wisconsin and as state endangered in Indiana and Iowa. Harriers require large, open, ungrazed, often wet, grasslands with adequate small mammal populations (MacWhirter and Bildstein 1996). Short-eared Owls use the same medium-to-tall grasslands for breeding and winter foraging that Greater Prairie-Chickens use for nesting and roosting (Hamerstrom and Hamerstrom 1957, Short and Drew 1962, Hamerstrom and Hamerstrom 1973, Voous 1988, Holt and Leasure 1993, Walk and Warner 1999). Disturbance regimes used to keep grasslands from succeeding to woody vegetation are credited with maintaining habitat for the microtine rodents that the owls and harriers prey upon (Colvin and Spaulding 1983, Hamerstrom 1986). Presence of Short-eared Owls is unpredictable, however, as populations fluctuate yearly because of variation in small mammal populations (Holt and Leasure 1993). Both Short-eared Owls and Northern Harriers have nested at two grassland sanctuary complexes in southeastern Illinois also occupied by remnant flocks of Greater Prairie-Chickens (Herkert et al. 1999). Harriers preferred fields not disturbed by management in the year prior to the breeding season, whereas Short-eared Owls were more likely to nest in areas that had been disturbed within the year.

A study of Wisconsin grasslands found higher grassland bird densities in landscapes where the cover types were less diverse and were dominated by grassland, pasture and hayfields (Ribic and Sample 2001). The Henslow's Sparrow, Dickcissel, Bobolink, Sedge Wren, and Grasshopper Sparrow prefer grasslands with moderate-to-tall and moderate-to-dense vegetation, and a moderate-to-deep litter layer (Martin and Gavin 1995, Pruitt 1996, Sample and Mossman 1997, Walk and Warner 2000). All will use nonnative hayfields and pastures as well as native grasslands if they find the vegetation structure attractive (Johnson and Igl 1999). Sedge Wrens and Henslow's Sparrows are intolerant of all but the lightest grazing pressure (Sample and Mossman 1997). Disturbances used to maintain grasslands, such as fire, grazing, and mowing, are tolerated by these species, but only if the disturbance occurs infrequently enough to allow the grass to attain the height and structure the species prefer (Swengel and Swengel 2001). Sedge Wrens and Henslow's Sparrows are unlikely to use fields until a few years after such disturbances (Sample and Mossman 1997). Mowing should be deferred until after the breeding season (May to mid-July), as it destroys nests and nestlings of these ground-nesting passerines and has a severe and negative effect on their annual reproductive output (Best et al. 1997).

The appropriate size for a grassland bird management unit is the subject of intense research (Walk and Warner 1999, Johnson and Igl 2001). The minimum-size management unit for Greater Prairie-Chickens in Missouri is estimated at 65 ha (160 acres) (Kirsch 1974, Horak 1985, Ryan et al. 1998a). Landscapes composed entirely of small prairie patches, regardless of total prairie habitat available, may be inadequate for conserving Greater Prairie-Chickens. Horak (1985), in Kansas, recommended that at least 33% of the land within the range of a flock of prairie chickens be kept in permanent grassland, with an interspersed

of 75% grassland and 25% cropland considered optimum. For grassland passerines in Illinois, a 50 ha (125 acres) patch had a 50% probability of containing Bobolinks, whereas 55 ha (138 acres) were needed for Henslow's Sparrows (Herkert 1994b). A meta-analysis of grassland passerine reproductive success in the Midwest (Herkert et al. In prep.) indicated that nest predation rates were lower in prairies >1,000 ha (2,462 acres) in all states and for all species examined. To clarify management unit recommendations for grassland birds, PIF developed the Grassland Bird Conservation Area (GBCA) Model. The GBCA model is now under research (D, Johnson, pers. comm.); results of this research will allow refinement of the model.

Grassland Bird Conservation Area (GBCA) Model

Habitat restoration aimed at reducing grassland fragmentation is needed to boost reproductive success and increase the acreage of suitable habitat for grassland birds. The Partners in Flight Grassland Bird Conservation Area (GBCA) model describes a theoretical landscape where grassland birds can be supported in high abundances and with adequate reproductive success (Sample and Mossman 1997). Research into factors affecting density and reproductive success of grassland-nesting birds in the Midwestern United States (Johnson and Igl 2001, Herkert et al. In prep., Fitzgerald et al. In press) support propositions of the model:

1. Large patches are better than small.
2. Blocks roughly 1000 ha (2,500 acres) or larger have a more positive effect on density and reproductive success than do patches of smaller size.
3. The ratio of grassland, and to a lesser degree woodland, in the landscape surrounding a patch also influences densities and reproductive success of grassland birds.

The BCA model calls for a 4,000 ha (10,000 acre or 16 square mile) management unit at the center of which is an 800 ha (2,000 acre, about 3 square mile) block of grassland referred to as the "core." Where Greater Prairie-Chickens are a focal species, the core should be centered upon one or more leks and managed in tracts >65 ha (160 acres). Rotational burning at 3-5 year intervals and light grazing are acceptable management practices, as long as the grassland structure remains adequate to attract and support the priority species. Management is planned so the preferred structure for the Greater Prairie-Chicken nesting, brood-rearing, and roosting cover are all available within each core area in any given year.

The 3,200 ha (8,000 acres) matrix surrounding the core contains >800 ha (2,000 acres) of grassland habitat, resulting in a conservation unit with >40% grassland. Minimum area requirements of high priority passerines should be met if 50% of the grassland tracts in the matrix are >40 ha (100 acres). The presence of woody vegetation is considered hostile to grassland bird density and reproductive success and should be <1% of the core or <5% of the matrix. Cereal and row crops may occupy the remaining area within the matrix and are assumed to have a neutral effect on grassland bird density and reproductive success.

In geographic areas where Greater Prairie-Chickens are not a target species, 800 ha core areas may not be necessary (Johnson and Igl 2001). In this case, high quality habitat for the target species should still occupy >40% of the BCA, hostile (wooded) habitat should occupy <5%, and the core area should be as large as possible to benefit other area-sensitive grassland species. At least 50% the grassland acreage should be in tracts >40 ha (100 acres) to reduce nest predation. Management of grassland tracts should be planned to provide for the habitat needs of all the target species in any given breeding season.

Table 5. Microhabitat associations and responses to management for selected high priority grassland species.

Species ^a	Grass cover	Forb cover	Litter cover	Native/cult ^b	Mowed ^c	Grazed ^d	Burned ^e	Area ^f
Greater Prairie-Chicken	Mod	Light to mod.	Mod.	Both	Delay	Light	Yes	100 ha (250 a)
Henslow's Sparrow	Dense	Light to mod.	Thick	Both	Delay	Light	Yes	50 ha (125 a)
Bobolink	Dense	Light	Thick	Both	Yes	Light	Yes	30 ha (75 a)
Sedge Wren	Dense	Light	Thick	Both	Delay	Light	Yes	10 ha (25 a)
Grasshopper Sparrow	Light to mod.	Light to mod.	Light to mod.	Both	Yes	Light	Yes	30 ha (75 a)
Northern Harrier	Dense	Mod	Mod.	Both	Delay	Light	Yes	100 ha (250 a)

^aBased on Sample and Mossman (1997) and Johnson and Igl (1999).

^bNative/cult: Species preference for nesting in native grass, non-native or cultivated grass, or both.

^cMowed: Yes = species will nest in a site the first breeding season after mowing; Delay = species avoids a site for 2 years after disturbance.

^dGrazed: No = species avoids grazed areas; Light = species will tolerate light grazing.

^eBurned: Yes = species tolerates burning as a management practice, but may delay occupation for ≥ 2 years after the disturbance.

^fArea: Minimum size of grassland tract for 50% probability of occurrence.

Population objectives and habitat strategies

Henslow's Sparrow populations have been declining at a rate of 6.2% ($P < 0.01$) per year from 1966-2000 in Region 3 of the USFWS (includes PIF16) (Sauer et al. 2001). Greater Prairie-Chicken populations have been declining at a rate of 5.7% ($P < 0.29$) per year from 1966-2000 in Region 3 of USFWS (Sauer et al. 2001).

1. Increase Henslow's Sparrow and Greater Prairie-Chicken populations by 3%/yr in USFWS Region 3 from 1980-2010, based on BBS data.
2. Monitor populations of other grassland species to ensure that population trends are stable or increasing through 2010.
3. Restore ≥ 10 GBCAs within PIF16 by 2010.
4. Restore grasslands to $> 30\%$ of the landscape in 3 (17 total in PIF16) ecoregional subsections (Albert 1995) of PIF16 by 2020. Apply recommendations for GBCAs in these ecoregions. At a minimum, encourage the planting of native grassland plant species and appropriate rotational mowing or grazing practices to control woody plant succession.

Grassland conservation opportunities

1. Identify large areas of grasslands within PIF16 as targets for conservation and restoration. The greatest opportunities in PIF16 for applied management of open grasslands are in conjunction with existing grasslands on federal, state, or other conservation lands. Examples include reclaimed mine lands and abandoned military lands. Some states are engaged in proactive conservation planning for GBCAs. For example, the Wisconsin DNR has identified potential GBCAs in southwestern Wisconsin and is seeking conservation partners for this effort (D. Sample, pers. comm.).
2. Apply GIS models developed for grassland birds in other ecoregions within PIF16.
3. Recent developments in agricultural management practices such as intensive rotational grazing may also provide opportunities for grassland bird habitat management on private lands (D. Sample, pers. comm.).
4. Work to build public-private partnerships to conserve and restore habitats for high priority species. Partner with the USDA Natural Resources Conservation Service to maximize wildlife benefits of federal agricultural incentive programs such as the Conservation Reserve Program (CRP). Work with landowners to better understand new agricultural management practices and their implications for grassland bird conservation. Provide economic incentives for private landowners to manage their land in accord with bird conservation plans.

Evaluation of assumptions - research and monitoring

1. Additional research is needed on the fundamental assumptions of the GBCA model. Specific questions include: (a) Is nesting success consistently influenced by patch size? (b) Does the amount of grassland in the surrounding landscape influence nesting success within specific patches? (c) Does forest cover negatively impact grassland bird nest success within patches? (d) How many trees create a negative impact and at what distance from nesting territories?
2. Additional research is needed on the effects of various management practices (e.g., burning, haying, and grazing) on the nest success of grassland birds breeding within managed grasslands in the region.
3. More information is needed on the effects of scale on grassland bird response to habitat management (i.e., is bird response to management similar on large and small patches and in landscapes with high and low levels of grass in the surrounding landscape?).
4. Specific management recommendations should be tested with GIS modeling.
5. Monitor populations to determine whether population objectives are being met. Increase monitoring and inventory efforts for those species whose trends are unknown.

Outreach

1. Educate the public about the importance of conserving grassland habitats for grassland birds.
2. Educate land managers about habitat requirements for high priority species.
3. Recognize outstanding efforts to educate and to conserve habitat.
4. Partner with international groups to ensure adequate winter and migration habitat for Neotropical migrants.

Savanna-woodlands

Ecology and conservation status

Before European settlement, fire frequency varied spatially and temporally with fluctuations in climate and population densities of Native Americans (McClain and Elinga 1994), influencing the proportion of woody-to-herbaceous plants in prairie-woodland ecotones (McPherson 1997). Savanna-woodland habitats resulted from trees and shrubs invading prairies during periods of infrequent fire and from prairies invading woodlands during periods of increased fire frequency (Nuzzo 1985, Taft 1997). As a result, the structure of habitats in the ecotone may have ranged from open prairie with a few scattered trees and shrubs to woodlands with intermediate canopy closure. Savannas are defined as areas with a well-developed herbaceous ground cover composed principally of prairie species and tree densities ranging from one per acre to roughly 50% canopy closure. Woodland refers to sites with a comparable understory, but with canopy closure of 50-80% (Packard 1993, Taft 1997). Fire-adapted tree species such as bur, black, northern pin, and white oak dominate the canopy in both instances (Nuzzo 1985). Several species of birds that respond favorably to savanna-woodland restoration in Illinois either nest or forage in shrubs or small trees, indicating the importance of the shrub layer to birds in those habitats (Brawn 1998).

Whereas savanna-woodland habitats are known to be floristically diverse, the faunal composition of those habitats is less well known. Few globally rare species occur in savanna-woodland habitats; however, many species occurring here have become regionally rare (Taft 1997). Numerous plant taxa reach their peak densities in savanna-woodland habitats rather than in prairies or closed canopy forests (Packard 1988, 1991, 1993). Differences in bird community structure between savanna-woodland and forest habitats in an Illinois study were significant, with 63% of the variation between bird communities in fire-disturbed savanna-woodland and closed-canopy woodlands accounted for by habitat type. Species such as the Northern Bobwhite, Red-headed Woodpecker, Eastern Towhee, Indigo Bunting, Summer Tanager, and Baltimore Oriole were significantly more abundant in savanna-woodland habitats (Brawn 1998).

Unfortunately, more than 99% of the original 11-13 million ha (27.9-32.1 million acres) of savanna-woodland in the Midwest has been converted to cropland or degraded by fire suppression and over-grazing (Nuzzo 1985). Wide-scale restoration of savanna-woodland habitats would greatly benefit the species that reach their highest densities in those habitats.

Bird habitat requirements

Savanna-woodland: Red-headed Woodpecker, Baltimore Oriole, Long-eared Owl (winter)

Red-headed Woodpecker is the classic savanna bird, preferring areas with relatively large, widely-spaced canopy trees with an open, grassy understory (Brawn 1998, Smith 2000). However, the species can be found in habitats with a variety of canopy cover, from floodplain forest to relatively open golf courses. The Red-headed Woodpecker is a cavity-nesting species, requiring dead and dying trees for nest sites. The wintering Long-eared Owl roosts in dense, woody vegetation of riparian woodlands or isolated tree groves adjacent to open habitats used for foraging (Marks et al. 1994). It is an opportunist that feeds upon a variety of small mammals in open habitats. Neither species is known to have large habitat area requirements.

Recent work by Brawn (1998) in savanna-woodland habitats in Illinois indicated that 10 of 12 species of birds experienced greater nesting success in woodlands that were restored by prescribed burning than in undisturbed closed-canopy forests, although size of tract had little effect. On sites >100 ha (250 acres) “landscape burns” or fires that are allowed to burn the tract differentially with respect to aspect, slope, moisture gradients, etc., should be employed to create a mosaic of habitats and variation in the proportion of woody-to-herbaceous understory plants at the landscape scale.

Table 6. Habitat requirements for selected high priority savanna-woodland species in PIF16

Species (Source)	Nesting habitat	Habitat limitations	Parasitism risk ^a
Red-headed Woodpecker (Smith 2000)	Open deciduous woodland, savanna, old burns or clearings. Prefers dead trees >70 cm dbh, needs high density of cavity trees.	Population declines attributed to competition from European starlings and declining availability of suitable nest-cavity substrate	None
Baltimore Oriole (Rising and Flood 1998)	Open deciduous or riparian woodlands. Tall (>10m), widely spaced trees, especially elm, maple, birch, willow, sycamore, and cottonwood	Not area-sensitive, compatible with urban and agricultural land use	Low: rejects cowbird eggs

^a (Friedmann 1963, Friedmann et al. 1977, Friedmann and Kiff 1985)

Population objectives and habitat strategies

Red-headed Woodpecker populations have been declining at a rate of 3.8% ($P < 0.001$) per year from 1966-2000 in Region 3 of the USFWS (Sauer et al. 2001). Populations of wintering Long-eared Owls have experienced significant declines across their wintering range (Sauer et al. 1996).

1. Increase Red-headed Woodpecker populations by 3%/yr in USFWS Region 3 from 1980-2010, based on BBS data; increase populations of wintering Long-eared Owls as measured by the Christmas Bird Count.
2. Monitor populations of savanna species (Baltimore Oriole) to ensure that population trends are stable or increasing through 2010.
3. Since savanna bird species do not appear to be area-sensitive, savanna restoration is appropriately applied to sites <800 ha (2,000 acres) in size with soils, floristic composition, topography and other indications of historical savanna/woodlands. On sites >100 ha (250 acres) landscape burns will provide a mosaic of habitats (fire intensity varies across the management unit) and variation in the proportion of woody and herbaceous understory plants at the landscape scale. Many species of birds require the presence of shrubs or small trees in the understory; this habitat component should be maintained.
4. Restore at least 50 blocks of savanna >100 ha (250 acres) in PIF16 by 2010. The savanna should have no more than 0.5-4.7 trees/ha within a native prairie grassland matrix (Nelson et al. 1998). Trees within savanna blocks should be allowed to attain maturity and continue to stand after death, with a mean minimum snag size of 30 cm diameter at breast height (dbh).

Savanna-woodland conservation opportunities

Conservation actions should focus on maintaining some public lands as savanna-grasslands. Frequent use of fire is required to maintain open savanna habitats; the landscape quickly reverts to shrub-forest habitats in the absence of fire. Successional pressures make it difficult for private landowners to maintain these habitats. Livestock grazing can partially substitute for fire in maintaining savanna habitats and grazing is an economically valuable tool for private landowners. GIS is potentially useful for identifying existing savanna-grassland habitats within PIF16. Non-profit groups like The Nature Conservancy are experimenting with management approaches for savanna-grassland habitats in Wisconsin.

Evaluation of assumptions- research and monitoring

1. More research is necessary to determine habitat associations, densities, and reproductive success of savanna bird communities in PIF16.

2. Information is needed about the effects of savanna restorations (usually directed at restoring plant biodiversity) on bird populations.
3. Savanna birds don't appear to be area-sensitive; however, the importance of landscape context (adjacency to urban areas, contiguous forests or grasslands) in savanna restoration and effects on avian community structure and population viability should be examined.
4. Little is known about how bird species use savanna-woodland habitats during migration.
5. Determine winter population trends for Long-eared Owls using Christmas Bird Count data.

Outreach

Outreach efforts directed toward private landowners willing to devote small acreages to conservation are needed to provide sufficient habitat to stabilize regional populations of savanna species. Outreach efforts should encourage private landowners, municipalities, and non-profit groups to create savanna-like habitats in backyard woodlots, urban parks, and other semi-natural sites such as cemeteries while maintaining dead trees and snags. These management options should be evaluated to determine their value for stabilizing savanna-associated bird populations.

Shrubs

Ecology and conservation status

Shrub habitats are early successional habitats that occur on abandoned agricultural land, recently logged forest lands, hedgerows bordering crop fields, powerline rights-of-way, and riparian buffer strips. In the absence of fire or intensive management, shrublands tend to succeed to forests in PIF16. Hedgerows and powerline rights-of-way tend to be stable features of the landscape, whereas the other types of shrublands either quickly convert to forests or are maintained as grasslands or crops (Knick and Rotenberry 2000). Burning may provide managers with a tool for managing shrublands (Aquilani et al. 2000); however, burning will be difficult to implement in long, narrow habitat patches (powerline rights-of-way and hedgerows). Selective cutting and herbicidal treatment of trees may be needed to maintain these types of shrub habitats.

Bird habitat requirements

Grass-shrub: Field Sparrow, Loggerhead Shrike, Northern Bobwhite, American Woodcock, American Tree Sparrow (winter)

Shrub: Bell's Vireo, Brown Thrasher, Willow Flycatcher, Yellow-breasted Chat, Bewick's Wren

Grass and shrub species differ mainly in the height and density of shrub habitats they use. Robinson et al. (1999) found that shrub bird species in Illinois were generally not area sensitive, although Brown Thrashers were twice as abundant in fields >6 ha (15 acres) than in smaller fields. Nests of Brown Thrashers typically were located in hedgerows and shrubs at edges of fields, while Field Sparrows used the interior of fields. Brown-headed Cowbirds and Blue Jays (potential nest predators) also were more frequent in hedge and tree rows. Brown Thrashers and Field Sparrows prefer grasslands with relatively high shrub densities (Carey et al. 1994, Cavitt and Haas 2000). The Woodcock prefers young forest edges and, unlike other members of the grass-shrub community, is a game species.

Bell's Vireo reaches the northeastern edge of its range in PIF16 (Brown 1993). It is apparently undergoing a rangewide decline and may be lost from the edges of its range unless sufficient shrub habitat is maintained (Budnik et al. 2000).

Northern Bobwhite is at the northern edge of its range in PIF16. It is susceptible to cold winters and to intensive farming practices (Brennan 1999). This species also appears to be undergoing a rangewide decline and is a game species.

Although the Loggerhead Shrike does not score high as a priority species in PIF16, the migratory subspecies that breeds in this region is nearly extirpated (Pruitt 2000). Reasons for the decline are unclear. Speculation focuses on habitat loss and changes in farming practices both here, on the breeding grounds, and on the wintering grounds (Chabot et al. 2001), where our migrant subspecies must compete for space and food with resident shrike populations (Yosef 1996). The Loggerhead Shrike was included as 1 of 15 species in a pilot project by the Commission for Environmental Cooperation aimed at enhancing international cooperation between Canada, Mexico and the U.S. on transboundary/migratory species of concern (Pruitt 2000).

Similarly, Bewick's Wren does not score as a high priority species, but the eastern subspecies is nearly extirpated from PIF16 and other areas east of the Mississippi River. Population decline may be due to lack of shrub habitat needed by the species or increased competition with expanding populations of the House Wren (Kennedy and White 1997).

The American Tree Sparrow is only a winter resident in this region. American Tree Sparrows inhabit grassy areas interspersed with shrubby vegetation during winter, where they feed on seeds and other plant material (Naugler 1993). Populations vary greatly from year to year, depending especially on snow cover.

Shrub-Forest: Golden-winged Warbler, Blue-winged Warbler, Black-billed Cuckoo, Yellow-billed Cuckoo, and White-eyed Vireo

Golden-winged Warblers and Blue-winged Warblers breed exclusively in early successional patches within a larger forested matrix (Confer 1992). The Golden-winged Warbler is listed as a species of very high priority on the Partners in Flight Watchlist and is of higher conservation concern than the Blue-winged Warbler, with which it hybridizes. Both species inhabit openings within the forest with well-developed herbaceous and shrub layers, such as bogs, swamps, recently logged or burned sites, abandoned farmland and windthrows (Confer 1992). Habitat becomes unsuitable approximately 20 years after disturbance. Golden-winged Warblers seem to prefer 10-15 ha (25-40 acre) sites, each supporting several pairs. Territories typically include a forest edge along their perimeter. Both species nest on or close to the ground.

Historically, Golden-winged and Blue-winged Warblers were geographically isolated, but the populations came into contact as abandonment of farmland spread westward, providing an expansion route for the Blue-winged Warbler (Confer 1992). Competition and hybridization with Blue-winged Warblers may be negatively affecting Golden-winged Warbler populations, but more research is needed to better understand the interactions between these closely related species.

In Illinois, Black-billed Cuckoos were found in thickets adjacent to waterways where the surrounding vegetation was predominantly grass, but not at forested sites (Robinson et al. 1999). Other studies have found them in young woodlands (Spencer 1943).

Table 7. Habitat requirements for selected priority shrub species in PIF16.

Species (Source)	General habitat	Nesting substrate	Foraging substrate
Field Sparrow (Best 1978)	Grasslands with low-medium shrub density (15-35% shrub cover)	Ground or in woody vegetation generally < 1m	Ground or in shrubs
Golden-winged Warbler (Confer 1992)	Shrubby grassland, early successional forest, wet sites	Ground or low shrub	Ground or shrubs
Blue-winged Warbler (Ehrlich et al. 1988)	Shrubby grassland, early successional forest	Ground or low shrub	Ground or shrubs
Willow Flycatcher (Sedgwick 2000)	Willow swamps and thickets	Deciduous shrub 0-2m	Trees and shrubs
Brown Thrasher (Cavitt and Haas 2000)	Moderate-to-dense shrub cover	Woody vegetation, usually within 1-3m of ground	Woody vegetation, usually within 3m of ground

Species (Source)	General habitat	Nesting substrate	Foraging substrate
Black-billed Cuckoo (Spencer 1943)	Shrub and early successional forests. Populations fluctuate in response to caterpillar outbreaks.	Woodland edges, thickets. Prefers shrub or low tree, dense cover	Trees and shrubs
American Woodcock (Keppie 1994)	Young forests and old fields	Ground	Ground – primarily earthworms

Population objectives and habitat strategies

Golden-winged Warbler (-1.4%/yr; $P < 0.06$), Brown Thrasher (-1.8%/yr; $P < 0.001$), Field Sparrow (-3.0%/yr; $P < 0.001$), and Black-billed Cuckoo (-1.3%/yr; $P < 0.07$) populations have declined significantly in USFWS Region 3 from 1966-2000 (Sauer et al. 2001). Populations of American Tree Sparrows have experienced significant declines across their winter range (Sauer et al. 1996). Loggerhead Shrike populations have declined 8.4%/yr ($P < 0.001$) in USFWS Region 3 from 1966-2000 (Sauer et al. 2001). Bewick's Wren populations have declined 2.8%/yr ($P < 0.32$) in USFWS Region 3 from 1966-2000 (Sauer et al. 2001).

1. Increase Golden-winged Warbler, Brown Thrasher, Field Sparrow, Black-billed Cuckoo, and Bell's Vireo populations by 3%/yr in USFWS Region 3 from 1980-2010, based on BBS data. Increase wintering populations of American Tree Sparrows in PIF16 based on Christmas Bird Count data.
2. Every effort should be made to restore populations of Loggerhead Shrike and Bewick's Wren (eastern subspecies) in PIF16.
3. Monitor populations of other shrub species (Northern Bobwhite, American Woodcock, Willow Flycatcher, Yellow-breasted Chat, Blue-winged Warbler, Yellow-billed Cuckoo, and White-eyed Vireo) to ensure that population trends are stable or increasing through 2010.
4. Restore shrub plant communities in locations where large GBCAs are not economically feasible.

Shrub conservation opportunities

Conservation opportunities exist on abandoned agricultural land or land being restored to forest. Shrubs, as mid-successional communities, do not have long-term stability in one location; the location of shrub communities is dynamic within a landscape mosaic. It is difficult to manage directly for shrub communities as they tend to have little economic value to landowners, unlike grasslands or forests. Shrub communities are heavily dependent upon large-scale land use patterns and economic forces affecting other land use types (agriculture and forestry). Powerline rights-of-way should be managed to support populations of shrub-nesting birds. Conservation efforts for the Northern Bobwhite provide an

opportunity for cooperative efforts with upland gamebird biologists.

Evaluation of assumptions - research and monitoring

1. Research is needed to better define the bird community associated with different shrub habitats and the factors supporting viable populations in these habitats. Predation and cowbird parasitism patterns should be better described. Issues of edge vulnerability should be examined.
2. Additional research is needed on the effects of management practices to sustain shrub communities within a landscape matrix. Agricultural and forest practices (hedgerows, silvicultural practices) should be studied to determine which practices favor shrub nesting species.
3. More information is needed about the value of shrublands for migrating passerines. Anecdotal observations suggest shrublands provide high nutritional value during migration, especially shrubs that leaf out or flower early in spring or carry fruits in the fall.
4. Determine winter population trends for American Tree Sparrow using Christmas Bird Count data.

Outreach

1. Educate the public about the importance of shrubs to nesting and migrating birds.
2. Educate land managers about habitat requirements for high priority shrub-nesting species. Work with landowners to better understand the effects of agricultural and silvicultural management practices and their implications for shrubland bird conservation.
3. Work to build public-private partnerships to conserve and restore habitats for shrub species. Partner with the USDA Natural Resources Conservation Service to maximize wildlife benefits of agricultural practices focusing on shrub habitats, such as riparian buffers and living snowfences.
4. Work to educate utility companies regarding appropriate management of rights-of-ways for shrub-nesting birds.

Forests

Ecology and conservation status

Mesic forests in PIF16 have suffered major losses of area (20-90%) since pre-European settlement (Noss et al. 1995) and now occupy about 14% of the landscape. An exception is the Driftless Area, where forest cover ranges from 30-50% of the landscape (Knutson et al. In prep.). Forests in PIF16 historically were disturbed by fire, ice, and windstorms (McNab and Avers 1994). Because of the abundance of water in PIF16, riparian forests are an important component of the forested landscape and the riparian zones of some of the largest river systems (Mississippi and Wisconsin Rivers) are under federal or state

management. Management issues surrounding forests in PIF16 include: (1) sustainable timber harvest aimed at maintaining appropriate wildlife habitat for sensitive species and (2) effects on the riparian plant community stemming from hydrologic changes induced by locks and dams, channelization, and levees. Tree species diversity in large river floodplain forests tends to be lower than it was historically, possibly due to hydrologic changes (Yin et al. 1997, Knutson and Klaas 1998).

Bird habitat requirements

Broadleaved forest: Cerulean Warbler, Acadian Flycatcher, Kentucky Warbler, Canada Warbler, Whip-poor-will, Hooded Warbler, Mourning Warbler, Wood Thrush, Yellow-throated Warbler, Northern Goshawk (winter), Ruffed Grouse (year-round, priority in winter), Eastern Screech-Owl (year-round, priority in winter)

The Cerulean Warbler is a high priority forest-nesting species with exceptional habitat requirements. It represents an umbrella forest-nesting species in PIF16 because it requires large forest tracts of mature or old-growth forest (Hamel 1992, Hamel 2000b, a, Rosenberg et al. 2000), a resource relatively rare within PIF16. In some physiographic areas a minimum tract size of 1600-1700 ha (4,000-4,200 acres) is needed for occupancy (Hamel 2000b, Rosenberg et al. 2000). Cerulean Warblers may be present in tracts <100 ha (250 acres) (Rosenberg et al. 2000), but many studies indicate that mature, unfragmented forests ranging from hundreds to thousands of hectares are needed to support stable populations.

Little is known about factors affecting reproductive success in this species, including the relationship between tract size and reproductive success. Although the historic center of the Cerulean Warbler range is the upper Ohio River valley, the species has recently expanded its range to occupy (or reoccupy) regions, including PIF16, where appropriate habitat conditions exist (Hamel 2000b). The species is found breeding in bottomland and riverine forests and also in dry ridge-top forests (Rosenberg et al. 2000). Large, mature trees, a multilayered canopy, and canopy gaps from small-scale disturbances also seem to be important habitat features. Therefore, existing large forested tracts within PIF16 should be identified and their habitat value for Cerulean Warblers assessed. Forest restoration efforts for Cerulean Warblers would also benefit a number of other area-sensitive forest-nesting birds, including the Wood Thrush (Roth et al. 1996), Acadian Flycatcher (Bielefeldt and Rosenfield 1997), Kentucky Warbler (McDonald 1998), Canada Warbler (Conway 1999), Hooded Warbler (Evans Ogden and Stutchbury 1994), Mourning Warbler (Pitocchelli 1993), Nashville Warbler (Williams 1996), and Yellow-throated Vireo (Rodewald and James 1996) in upland habitats and Prothonotary Warbler (Petit 1999) and Louisiana Waterthrush (Robinson 1995) in bottomland habitats (Robbins et al. 1989). The Whip-poor-will is not known to be area-sensitive, but its ground nests are vulnerable to predators (Ehrlich et al. 1988).

In addition to the area and spatial arrangement of forest tracts, the size, species composition, and density of trees may be important. Silvicultural practices may play an important role in the value of managed forests for Cerulean Warblers and other forest-dependent species (Rodewald and Smith 1998, Thompson et al. 2000). Recent studies on silvicultural practices such as group-cut vs. clear-cut indicate neither practice supports populations of interior forest birds (King et al. 1998). Selective harvest creates the least amount of edge, but converts a stand from older age classes to younger age classes. Modeling is a useful tool for planning sustainable harvest rates across the landscape to support populations of forest-interior or savanna birds (Axelsson and Ostlund 2001).

Many private woodlands in PIF16 are grazed by domestic livestock, principally cattle. This practice may be detrimental to the reproductive success of forest-nesting birds for several reasons. Heavy grazing reduces understory cover, changes the plant species composition of the forest understory, retards tree regeneration, and causes soil compaction (Popotnik and Giuliano 2000). The effects of these changes primarily affect ground and understory-nesting species (Ammon and Stacey 1997). Cowbird parasitism increases for all vulnerable species when grazing is practiced, as cattle attract cowbirds (Gates and Evans 1998, Goguen and Mathews 1998, Morris and Thompson 1998, Goguen and Mathews 2000).

Cerulean Warbler populations continue to decline precipitously, even though little is known about the specific habitat requirements that support populations. We propose a Cerulean Warbler Conservation Area (CWCA) model, similar to the GBCA for grassland birds, based on existing syntheses of the literature (Hamel 2000b, a). The following guidelines will focus conservation efforts in PIF16 until new research refines our understanding of habitat requirements for Cerulean Warblers and other high priority forest-nesting birds. Overbrowsing by deer can have similar negative impacts on forest-dwelling birds that require dense understory vegetation (Alverson et al. 1988, Alverson et al. 1994).

Cerulean Warbler Conservation Area (CWCA) Model

We estimate that sustainable breeding populations of Cerulean Warblers in PIF16 require >700 ha (1730 acres) core blocks of mature, mesic hardwood forest, with low edge-to-area ratio (Robbins et al. 1989, Hamel 2000b) within an approximately 4,000 ha (10,000 acre) matrix. The surrounding matrix should be >50% forested, with >25% mature forests and <15% hostile habitat (cowbird feeding sites such as short-grass, intensive animal grazing or feed lots) (Thompson 1994). Within the core block, at least 25% of the canopy trees should be mature trees >20 m in height and 25-55 cm diameter at breast height (dbh) with canopy cover from 65-85% (Hamel 1992, Robbins et al. 1992, Oliarnyk and Robertson 1996, Robbins et al. 1998). Management should emphasize long rotations, and strategies that produce a varied 3-dimensional stand with extensive development of vertical diversity and canopy gaps (Hamel 2000b). In addition, observers note that Cerulean Warblers have better nesting success with an open forest understory (Oliarnyk and Robertson 1996). Uneven-aged management and old-growth or wilderness management are most likely to achieve these goals. An alternative, higher quality prescription, from the perspective of the Cerulean

Warbler, may be achievable in some heavily forested subsections of PIF16. This alternative model calls for a landscape matrix of 8,000 ha (20,000 acres) where >70% of the land is forested and managed according the principles outlined above (Hamel 2000b). Woodlots within CWCAs should not be grazed by domestic livestock, and deer populations should be kept at a minimum .

Restoration of CWCAs will also benefit a number of other area-sensitive forest and riparian associated bird species. Therefore, additional considerations for these species are appropriate. For example, sufficient numbers of large canopy trees should remain to create large snags for woodpecker populations. Maintain >20 cavity trees X rotation age per 40 ha (100 acres) within stands, with a mean minimum size of 30 cm dbh to provide adequate habitat for cavity-nesters (Green 1995). The rotation age factor is necessary because woodpeckers excavate new sites each year. Disturbance to forests should focus on units in the 10-15 ha (25-40 acre) range, to accommodate the spatial preference of the Golden-winged Warbler (Confer 1992).

Restored streams and rivers should retain a high quality vegetated riparian zone five times the width of the normal stream channel to restore meanders, oxbows, and the full range of native riparian vegetation, including tree species richness (Large and Petts 1994, Knutson et al. 1996). This width would also meet the habitat needs of a diverse suite of riparian forest-nesting birds.

Riparian forest: Prothonotary Warbler, Louisiana Waterthrush

Wide, diverse, riparian forests are globally rare, have high bird species richness, and provide habitat for forest-savanna species of concern in PIF16, such as the Cerulean Warbler and Red-headed Woodpecker (Stauffer and Best 1980, Knutson et al. 1996, Hamel 2000a). Floodplain forests host more bird species than do other habitat types (Best et al. 1995), and songbird abundances in floodplain forests can be twice as high as upland forests (Stauffer and Best 1980, Knutson et al. 1996). Even though wide floodplains support more species than narrow floodplains (Stauffer and Best 1980, Knutson et al. 1996), even small patches of floodplain forest in large river systems can provide valuable habitat for forest-nesting songbirds (Stauffer and Best 1980, Knutson et al. 1996, Knutson et al. 1999). Therefore, conservation efforts should emphasize restoration of diverse riparian forests along small, headwater streams (needed by the Louisiana Waterthrush) as well as large, continental riparian systems like the Mississippi River (needed by the Prothonotary Warbler and Cerulean Warbler).

Table 7. Habitat requirements for selected riparian forest species in PIF16.

Species (Source)	General habitat	Nesting substrate	Foraging substrate
Prothonotary Warbler (Petit 1999)	Floodplain and swamp forests with dead standing snags	Cavity	Trees
Louisiana Waterthrush (Robinson 1995)	Gravel-bottom streams flowing through hilly, deciduous forest	Ground cavities in tree roots or logs along streams	Ground, water edges

Coniferous forest: Blackburnian Warbler

PIF16 falls on the southern edge of summer range for the Blackburnian Warbler (Morse 1994, Patten and Burger 1998). The species prefers hemlock forests and threats to the species in PIF16 are primarily from deforestation.

Population objectives and habitat strategies

Forest bird species populations have generally increased in Region 3 of the USFWS from 1966–2000 (Sauer et al. 2001). However, total population levels are presumably well below pre-European settlement levels because of extensive forest losses to agriculture and urban development prior to the beginning of the Breeding Bird Survey in 1966. Nest success of forest birds in the Driftless Area was found to be relatively high and cowbird parasitism low (Knutson et al. In prep., Gustafson et al. In press). Based on population trends, present habitat conditions seem to be sustaining populations of many forest-nesting birds within PIF16, despite forest fragmentation.

PIF16 comprises the NW portion of the Cerulean Warbler range in the US. Populations of the Cerulean Warbler have been declining at 5.7%/yr ($P < 0.01$) from 1966-2000 within USFWS Region 3 (Sauer et al. 2001).

1. Increase Cerulean Warbler populations by 3%/yr in USFWS Region 3 from 1980-2010, based on BBS data.
2. Monitor populations of forest-nesting species (Acadian Flycatcher, Kentucky Warbler, Canada Warbler, Whip-poor-will, Hooded Warbler, Mourning Warbler, Wood Thrush, Yellow-throated Warbler, Blackburnian Warbler) to ensure that population trends are stable or increasing through 2010. Night monitoring is required for the Whip-poor-will.
3. Restore > 10 CWCA's within the current distribution of the Cerulean Warbler in PIF16 by 2010.
4. Restore forests to >0% of the landscape in 3 ecoregional subsections (17 total in PIF16) (Albert 1995) within the current distribution of the Cerulean Warbler in PIF16 by 2020. Within these subsections, implement the CWCA described above. (Allow trees to attain maturity and remain standing after death. Conserve cavity-producing trees within harvested stands.)
5. Restore 2,000 km of riparian zones along streams and rivers within PIF16 by 2010. Restored streams and rivers should retain a high quality vegetated riparian zone 5 times as wide as the normal stream channel. Forested riparian buffers should strive for a diverse native tree community. Restoration should focus on a continuum of stream size, from small, headwater streams to large, continental riparian systems like the Mississippi River.
6. Discourage domestic livestock grazing in woodlands targeted for songbird

- conservation.
7. Minimize deer population levels in woodlands targeted for songbird conservation.

Forest conservation opportunities

1. The best opportunities for large, contiguous forest conservation for Cerulean Warblers and other interior forest-nesting species exist in association with current public land managed for wilderness, recreation, or wildlife conservation. The specific breeding habitat requirements for the Cerulean Warbler put its needs in conflict with short-rotation and even-aged timber production, but are consistent with selection cuts that leave some mature trees. Large blocks of forest habitat, potentially meeting the above criteria, should be identified in PIF16 and CWCAs established wherever feasible. Parts of the Driftless Area (the Yellow River State Forest in Iowa, Wyalusing State Park, and South Kettle Moraine in Wisconsin, and the Whitewater Wildlife Management Area, Minnesota), and Alleghen State Game Area, Fort Custer, and Waterloo Recreation Area in southwestern Michigan should be considered for restoration as CWCAs.
2. In the water-rich PIF16, the potential for restoration of wide riparian forest corridors presents major opportunities to benefit forest songbirds because of multiple bird habitat values and because riparian restoration also addresses wider societal concerns regarding flooding and water quality.
3. Opportunities for forest restoration on private land exist within many state forest management programs and within the USDA Natural Resources Conservation Service (NRCS) riparian buffer program and other federal cost-share programs administered by the NRCS. Many state forestry initiatives focus on improving woodlot quality and regeneration through discouraging woodlot cattle grazing. Removing domestic grazers from woodlots has the potential to improve forest habitat for songbirds as well as supporting forest regeneration.

Evaluation of assumptions- research and monitoring

1. Little is known about the breeding biology and species-specific responses to management of forest-nesting species within PIF16. More information is needed about habitat associations, densities, and reproductive success in oak hickory forests like those of PIF16, especially for the Cerulean Warbler, Acadian Flycatcher, Kentucky Warbler, Canada Warbler, Whip-poor-will, Hooded Warbler, Mourning Warbler, Wood Thrush, and Yellow-throated Warbler.
2. Habitat factors limiting reproductive success, such as thresholds of forest size, landscape context, and forest plant community characteristics should be identified to avoid population declines in the future. Changes in timber management, economics, and the demographics of private landowners

- may also influence habitat quality in the future. Identifying and monitoring the large-scale factors that limit regional populations of forest-nesting birds is necessary, even for species with currently stable populations.
3. Model forest habitat quality using GIS to enhance science-based management of bird habitats in PIF16. Identify large tracts of forest habitats in PIF16 as a basis for conservation planning, including all forest tracts >4000 ha (10,000 acres), all ecoregional subsections with >50% forest cover, and high quality riparian corridors.
 4. Research factors contributing to forest and riparian bird population stability, including associations between landscape factors and indices of reproductive success and the effectiveness of the CWCA model in sustaining populations of high priority species.
 5. Identify cost-effective methods for identifying bird population sources in forested habitats.

Outreach

1. Develop policy recommendations that address economic incentives for private landowners to manage their land to benefit forest-nesting birds.
2. Educate the public about the importance of large tracts of deciduous forest and wide riparian zones to forest bird conservation.
3. Educate silviculturists and land managers about habitat requirements for high priority species.
4. Work to build public/private partnerships to conserve and restore habitats for high priority species. Work to revise timber management practices to benefit wildlife.
5. Recognize outstanding efforts to educate and to conserve habitat.
6. Partner with international groups to ensure adequate winter and migration habitat for neotropical migrants, especially the Cerulean Warbler.

Wetlands

Ecology and conservation status

Many wetlands in PIF16 formed as a result of the Wisconsin glaciation approximately 14,000 years ago (McNab and Avers 1994). Poorly drained soils, holding basins, and kettles resulted in the formation of wetland types including wet meadows, shallow water, and permanent deep-water. The types of wetlands found across the region can vary with soil type and differences in hydrology. Both vegetation composition and hydrology will affect which species of birds use a particular wetland for breeding, feeding, and migratory stopover.

Wetlands across the lower 48 states have decreased by 53% from the 1780s to 1980s (Dahl 1990). In Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, and Iowa, the wetland loss has ranged from 42% to 90%. Wetland losses have been attributed to agriculture (87%) and urban development (8%) (Steiner et al. 1994). Government incentive programs such as the Swampbuster provision of 1990, Food Security Act, Section 404 of the Clean Water Act, and the Wetland

Reserve Program have helped restore and preserve wetlands (Steiner et al. 1994).

Loss and degradation of wetlands are limiting factors for many wetland birds (Brown and Dinsmore 1986, 1991, Fairbairn and Dinsmore 2001). Wetlands >10 ha (25 acres) in size accommodate most wetland-dependent bird species. Because preferred vegetation type and water levels vary by species, incorporating both shallow and deep-water emergent habitats into the overall land management plan is often an appropriate management strategy (Naugle et al. 2001). Complexes of wetlands support more species than isolated wetlands, making them a high priority for conservation (Fairbairn and Dinsmore 2001, Naugle et al. 2001). Water level management can be used to accommodate the needs of species requiring different types of wetlands. Wetland restorations have been successful in providing more breeding and migration habitat for wetland species.

Wetland habitats important to birds in PIF16 include:

1. Wet meadows, often dominated by sedges, whose soils tend to remain saturated or are very shallowly flooded.
2. Emergent wetlands, characterized by perennial rooted herbaceous vegetation. The term hemi-marsh is used to describe emergent wetlands with approximately 50% of the area in open water and 50% wetland vegetation. Dominant vegetation in emergent wetlands includes cattails (*Typha*), bulrushes (*Scirpus*), and sedges (*Carex*).
3. Shrub wetlands, dominated by woody vegetation < 6 m in height, including bogs, early-successional forested wetlands, and shrub-swamps (Cowardin et al. 1979).
4. Sandy beaches associated with lakes and rivers.
5. Bottomland hardwood forests.

Bird habitat requirements

Grass-wetlands: Sedge Wren, Black Rail, Sandhill Crane, Whooping Crane

Black Rails nest in wet meadows and shallow areas of emergent marshes (Eddleman 1994). Breeding habitat consists of areas with short dense vegetation and saturated or shallowly flooded soils (Hands et al. 1989, Legare and Eddleman 2001). PIF16 represents the northern portion of the breeding range for this species. Unfortunately, little is known about Black Rail distribution, abundance, or breeding biology, especially in the Midwest. The major threat to Black Rail populations is believed to be habitat loss. Shallow wetland habitats are most vulnerable to conversion to agriculture or urban development. Sandhill Cranes are attracted to similar habitats, but they are much more common than Black Rails (Tacha et al. 1992). Sedge Wrens usually nest in wet meadows, but are also found in drier upland grasses (Ehrlich et al. 1988).

The federally endangered Whooping Crane is also associated with shallow

wetland habitats (Timoney 1999). The Whooping Crane is the target of federal and state agency efforts to establish a second continental migratory population at Necedah National Wildlife Refuge (La Crosse Tribune, 23 September 2001, pg. C1). In 2000, ultralight aircraft were successfully used to induce migratory behavior in Sandhill Cranes as a test species. The Sandhill Cranes returned to Necedah NWR on their own in the spring of 2001. In 2001, Whooping Cranes, raised by USGS Patuxent Wildlife Research Center and Necedah National Wildlife Refuge are being trained to migrate from Wisconsin to Florida using ultralight aircraft (Wisconsin Department of Natural Resources Press Release, October 17, 2001; <http://www.dnr.state.wi.us/org/caer/ce/news/rbnews/2001/011017co.htm>).

Marshes: Wilson's Phalarope, Black Tern, Forster's Tern, King Rail, Marsh Wren, Northern Rough-winged Swallow, Redhead, Trumpeter Swan, American White Pelican

Nest sites for King Rails range from moist soil to water depths <22 cm (8.6 in.) (Meanley 1992). Improved nest success occurs in large vegetated beds within impounded units. Borrow units and dikes provide travel lanes for predators. Densely vegetated sites are also important for migration as well as nesting (Meanley 1992). Marsh Wrens nest primarily in large expanses of cattails and frequently nest over water (Kroodsma and Verner 1997). Populations in Michigan declined dramatically during the twentieth century, presumably due to marsh destruction (Brewer et al. 1991).

Forster's Tern, Black Tern, and Trumpeter Swan need large wetlands >20 ha (50 acres) for foraging (Bergman et al. 1970, McNicholl 1982, Dunn and Agro 1995, Shuford 1999, Naugle et al. 2001). The Black Tern requires a water depth of 0.5-1.2 m (1.5-4 feet) for nesting (Novak 1992). Reduction of mammalian and avian predators promotes successful nesting of Forster's Terns. Trumpeter Swans were extirpated as breeders in PIF16, but are being reintroduced by several states in the region (Mitchell 1994). Trumpeter Swans and American White Pelicans need large wetlands to take off and land.

Wilson's Phalarope is near the eastern edge of its range in PIF16. It prefers shallow marshes and ponds where it can twirl for insects while swimming, but it will also feed on mudflats (Colwell 1994).

Shrub-wetlands: Golden-winged Warbler, Black-billed Cuckoo, Swamp Sparrow

Bogs and other shallow wetlands dominated by an herbaceous-shrub component may provide suitable habitat for the high priority Golden-winged Warbler. (See the shrub section of this document). The Black-billed Cuckoo also utilizes shrubby riparian areas (see the shrub section of this document). Swamp Sparrow is one of the most frequently occurring species in this habitat in PIF16; nonetheless, it is a priority species due to widespread population declines (Mowbray 1997).

Riparian: Peregrine Falcon, Bald Eagle (winter)

Peregrine Falcon and Bald Eagle populations are recovering from the effects of DDT poisoning that occurred during the 1950s and 1960s (Ehrlich et al. 1988, Kirk and Hyslop 1998, Buehler 2000). Sources of DDT and DDE have largely been eliminated or reduced so that they are not affecting reproductive success for these species (but see Henny et al. 1982). Bald eagle populations along the Mississippi River have experienced steady increases, as evidenced by nest counts (E. Nelson, pers. comm.). Bald Eagles congregate in large numbers around open water with adequate fish prey during winter (Buehler 2000). The locks and dams of the Mississippi River and other large rivers provide open water throughout the winter in PIF16. Peregrine Falcons are successfully nesting on buildings in urban areas in many parts of PIF16. In 2000 the first nesting attempt in several decades was made on a historic cliff nesting site along the Mississippi River near La Crosse, Wisconsin (M. Knutson, pers. obs.).

Swamp (forested) wetlands: American Black Duck, Hooded Merganser

American Black Ducks breed in a wide range of forested wetlands (Longcore 2000). Black Duck populations have been affected by intense hunting pressure, interactions with Mallard populations, and habitat loss. Hunting restrictions and habitat restoration are believed to be the most effective management actions. Hooded Mergansers nest in tree cavities in forested wetlands (Dugger et al. 1994). This species is vulnerable to habitat loss through river channelization and deforestation and possibly the effects of acid rain.

Sand beaches: Piping Plover, American White Pelican

Preservation of existing beaches along the Great Lakes is important for the federally endangered Piping Plover, currently absent as a nester in this region (Haig 1992). Protecting large areas of sandy, undisturbed habitat is required if the plover is to return as a nester. Mudflats are needed as migration feeding areas during April–May and August–September. Suitable undisturbed breeding habitat seems to be the limiting factor for this endangered species (Buehler et al. 1991).

Table 8. Habitat requirements for selected priority wetland bird species in PIF16.

Species (Source)	Nesting Habitat	Foraging Areas	Migration Habitat
Trumpeter Swan (Mitchell 1994)	Hemi-marsh with muskrat or beaver houses, area > 5 ha (12 acres).	Hemi-marsh, area > 5 ha (12 acres).	Emergent marshes and area croplands, February–May, September–November. Needs large areas to take off.

Species (Source)	Nesting Habitat	Foraging Areas	Migration Habitat
Black Tern (Novak 1992, Shuford 1999)	Hemi-marsh situation - cattail, bulrush, water lilies selected; water depth at nest 0.5 - 1.2 m; > 10 ha (25 acres) requirement	Over open water in wetlands >20 cm deep	Open water foraging areas >3 ha (7 acres) and undisturbed roosting sandbars/beaches; May–June; August–September
King Rail (Meanley 1992)	Heavily vegetated interior marshes; water depth moist soil up to 22 cm water depth.	Usually found in heavy cover	Wetlands; April–May; August–September.
Black Rail (Eddleman 1994)	Shallow freshwater marshes and salt marshes	Wet grasslands	Little known. March–May; September–October.
Piping Plover (Haig 1992)	Undisturbed sandy beaches; vary in amount from 4,000 m - 30,547 m	In Lake Michigan forage in splash zone; others use sandflats, mudflats, beaches, and dredge islands.	Undisturbed foraging areas of mudflats and sandflats important April–September.
Bald Eagle (Livingston et al. 1990)	Hemi-marsh or river or lakes with large trees	Clean rivers and lakes	Wetlands >15 ha (40 acres) for foraging in migration and breeding March–September

Population objectives and habitat strategies

Populations of Black Terns have been declining at 4.4%/yr ($P < 0.04$) from 1966-2000 within USFWS Region 3 (Sauer et al. 2001). Declines should be halted by protection of existing wetlands and management of those wetlands for conditions that support both Black and Forster's Terns. Goals for restoration of Black Tern population levels should be developed in conjunction with those of other wetland-dependent species covered under the North American Waterfowl Management Plan, U. S. Shorebird Conservation Plan, and North American Waterbird Plan.

Black and King Rails are secretive in nature and their status within the region is poorly understood. The objective for these species is to develop and implement region-wide monitoring programs using protocols similar to the Marsh Monitoring Program (Weeber and Vallianatos 2000), to better understand their distribution, abundance, and breeding and stopover biology. Remaining wet meadow habitat should be protected from degradation or conversion to other kinds of land use. In contrast, Sandhill Crane populations have dramatically increased 11.5% ($P < 0.001$) from 1966-2000 within USFWS Region 3 (Sauer et al. 2001).

The Whooping Crane, Piping Plover, and Trumpeter Swan are the focus of state and federal recovery programs within PIF16. We support these plans and objectives.

1. Establish a migratory population of Whooping Cranes in PIF16 by

- 2002; consistently add to the flock in subsequent years.
2. Establish a nesting population of Piping Plovers in PIF16 by 2005. Maintain and protect remaining lakeshore beaches as Piping Plover nesting areas.
 3. Increase Trumpeter Swan by 3%/yr in USFWS Region 3 from 1980-2010.
 4. Search for Black Rail populations in PIF16 and enhance and protect habitat if found.
 5. Monitor populations of other wetland species (Wilson's Phalarope, Forster's Tern, Sedge Wren, Marsh Wren, Northern Rough-winged Swallow, Redhead, Swamp Sparrow, American Black Duck, Hooded Merganser, Golden-winged Warbler, Black-billed Cuckoo, American White Pelican) to ensure that population trends are stable or increasing through 2010.
 6. Increase wetland area by 10% in all states in PIF16 by 2010.
 7. Identify and maintain shallow wetlands as rail migration habitat during April-May and August-September.
 8. Identify and maintain deepwater wetlands >20 ha (50 acres) in size for migrating American White Pelican, Trumpeter Swans, and Bald Eagles during March to May and August to November.

Wetland conservation opportunities

Private-public partnerships should be employed to increase the area of existing wetland complexes. The North American Waterfowl Management Plan (NAWMP) and Ducks Unlimited (DU) have been successful in protecting and restoring wetland habitats, primarily for waterfowl; however, many other wetland birds also benefit from these efforts. NAWMP and DU efforts in PIF16 are coordinated through the Upper Mississippi River and Great Lakes Region Joint Venture, with headquarters in U.S. Fish and Wildlife Service's Region 3 office in Minneapolis, Minnesota.

The U.S. Shorebird Conservation Plan (www.manomet.org/USSCP) has international, national, and regional goals focusing on stabilizing populations of all shorebird species. The North American Waterbird Conservation Plan (www.nacwcp.org) is dedicated to planning for sustainable populations, distributions, and habitats of waterbirds throughout North America, including breeding, migratory, and wintering ranges. The Partners in Flight community will be working with these other initiatives under the auspices of the North American Bird Conservation Initiative (NABCI). The purpose of NABCI is to integrate habitat conservation efforts to support sustainable populations of all priority wetland avifauna in PIF16.

Evaluation of assumptions - research and monitoring

1. Adequately assess the status and distribution of Black and King Rails

- throughout PIF16.
2. Research factors contributing to wetland bird population viability, including basic biology and life history requirements of secretive marsh birds, especially rails, and associations between landscape factors and indices of density and reproductive success.
 3. Identify large wetland complexes in PIF16 as a basis for conservation planning (all ecoregional subsections with >20% wetland cover). Identify stop-over migration habitats for wetland birds to ensure that key links in the migration chain are not broken.
 4. Model wetland habitat use and migration stop-over habitats using GIS to enhance science-based management of bird habitats in PIF16.
 5. Monitor populations to determine whether population objectives are being met. Adopt protocols similar to those used in the Marsh Monitoring Program (Weeber and Vallianatos 2000) for monitoring secretive wetland birds. Increase monitoring efforts for species whose trends are unknown.
 6. Identify cost-effective methods for identifying population sources in wetlands.
 7. Develop policy recommendations that address economic incentives for private landowners to manage wetlands in accordance with bird conservation plans.

Outreach

1. Educate the public about the importance of wetlands to waterfowl and other wetland species.
2. Educate land managers about habitat requirements for waterfowl and other wetland species.
3. Work to build public-private partnerships to conserve and restore habitats for high priority species. Partner with the USDA Natural Resources Conservation Service to maximize wildlife benefits of federal incentive programs like the Wetland Reserve Program (WRP). Work with the Upper Mississippi River and Great Lakes Region Joint Venture (UMRGLR JV) of the North American Waterfowl Management Plan (NAWMP) to restore wetland habitats.
4. Recognize outstanding efforts to educate and to conserve habitat.
5. Partner with international groups to ensure adequate winter and migration habitat for waterfowl and other wetland species.

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Appendix A. Important Bird Areas^a in the Upper Great Lakes Plain (PIF16).

Name	State	Designation ^b	Justification
Illinois Beach State Park	IL	N	Ducks and Geese (>10,000)
Dugger Wildlife Area/Minnehaha State Fish and Wildlife Area	IN	G	>320 nesting Henslow's Sparrows (> 1% of population), example of reclaimed mine land
Gibson Lake	IN	G	>1% Interior Least Terns
Jasper-Pulaski Fish and Wildlife Area	IN	G	> 32,000 Greater Sandhill Cranes in migration
Jefferson Proving Ground	IN	G	> 942 nesting Henslow's Sparrows, 55,264 acres
Indiana Shoreline of Lake Michigan	IN	G	Waterfowl, migration stopover for Piping Plover
Muscatuck National Wildlife Refuge	IN	C	Canada Geese (St. James Bay pop.) migration and wintering habitat
Erie Marsh	MI	G	Forster's Tern and Black-bellied Plover migration stopover
Fish Point Wildlife Area	MI	G	>5,000 Tundra Swans, >30,000 other waterfowl
Muskegon Wastewater System	MI	G	>50,000 waterfowl
Nananquing Point Wildlife Area	MI	C	Diving ducks (Lesser Scaup, Canvasback) during migration
Shiawassee National Wildlife Refuge	MI	G	> 48,000 waterfowl, 8,984 acres
Walkinshaw Wetlands	MI	G	>3% of Greater Sandhill Crane population
Bernard W. Baker Sanctuary	MI	G	>1,000 Sandhill Cranes during fall migration
Karn Plant	MI	G	>20,000 Common Mergansers
Lake Erie Metropark	MI	G	Hawk migration
Metrobeach Metropark	MI	G	>19,000 Canvasback in winter
Pt. Mouillee	MI	G	Migrating ducks, terns, shorebirds
St. Clair River and Lake St. Clair	MI	G	>10,000 wintering Redheads, >14,000 Canvasback in migration
Cedar Point National Wildlife Refuge	OH	GNL	>25,000 waterfowl
Killibuck Marsh Wildlife Area	OH	G	>26,000 waterfowl
Magee Marsh State Wildlife Area	OH	GNL	Migrants, adjoins Ottawa National Wildlife Refuge
Metzger Marsh Wildlife Area	OH	GNL	>50,000 shorebirds, >50,000 ducks
Ottawa National Wildlife Refuge	OH	G	>100,000 waterfowl, 8,316 acres of marsh, shorebird fall migration
West Sister Island	OH	CNL	Heron/egret rookery said to be largest in Great Lakes
East Lake (Lake Erie)	OH	G	>20,000 Bonaparte's Gulls, > 50,000 Red-breasted Mergansers
Headlands Beach State Park and Fairport Harbor	OH	G	>10,000 Bonaparte's Gulls, 700-1,600 Common Terns, >75,000 Red-breasted Mergansers
Mouth of Huron River	OH	G	>40,000 Bonaparte's Gulls
Lakeshore Metropark (Cleveland)	OH	G	>9,500 Bonaparte's Gulls, >5,000 Common Goldeneyes, > 4,000 Common Mergansers, >15,000 Herring Gulls, >40,000 Red-breasted Mergansers

Name	State	Designation ^b	Justification
Lorain (lake off Lorain)	OH	G	>17,000 Red-breasted Mergansers, >600 Caspian Terns, >600 Common Terns, >50,000 Ring-billed Gulls, >5,000 Bonaparte's Gulls
Medusa Marsh	OH	G	>2500 Pectoral Sandpiper
Horicon National Wildlife Refuge	WI	G	>100,000 waterfowl, shorebird migration, RAMSAR site (globally important wetland), 12,911 acres
Menominee County Northern Kettle Moraine State Forest	WI	SNL	Breeding warblers Large concentrations of passerines
Upper Mississippi River National Wildlife and Fish Refuge and Trempealeau National Wildlife Refuge	WI, MN, IA, IL	G	> 16,900 Tundra Swan, > 136,000 Canvasbacks, >96,700 Lesser Scaup, >270,000 waterfowl during migration, >5,700 pairs Great Blue Heron, concentrations of nesting Neotropical migrants, 78,500 ha (200,000 acres) of wetlands

^aDesignated by the American Bird Conservancy (C. Chipley, pers. comm.).

^bG=Global, C=Continental, N=National, and L=Local significance.

Appendix B. Bird species listed as threatened, endangered, or special concern by states in the Upper Great Lakes Plain (PIF16) during 2001^a.

Common Name	# of States	IA	IL	IN	MI	MN	OH	WI	16 B Score ^b	16 W Score ^c
Piping Plover	7	E	E	E	E	E	E	E	29	-
Henslow's Sparrow	7	T	E	E	T	E	SC	T	28	-
Short-eared Owl	7	E	E	E	E	SC	SC	SC	19	23
King Rail	7	E	E	E	E	E	E	SC	19	-
Bald Eagle	7	E	T	E	T	SC	E	SC/FL	17	19
Peregrine Falcon	7	E	E	E	E	T	E	E	18	17
Northern Harrier	6	E	E	E	SC		E	SC	19	19
Barn Owl	6	E	E	E	E		E	E	18	18
Red-shouldered Hawk	6	E	T	SC	T	SC		T	16	15
Cerulean Warbler	5			SC	SC	SC	SC	T	25	-
Trumpeter Swan	5			E	T	T	E	E	24	24
Black Tern	5	SC	E	E	SC		E		20	-
Forster's Tern	5	SC	E		SC	SC		E	19	-
Loggerhead Shrike	5		T	E		T	E	E	17	19
Black-crowned Night-Heron	5		E	E	SC		T	SC	16	13
Osprey	5		E	E	T		E	T	15	-
Common Tern	5		E		T	T	E	E	13	-
Upland Sandpiper	4		E	E			T	SC	22	-
Wilson's Phalarope	4		E		SC	T		SC	22	-
Long-eared Owl	4	T			T		SC	SC	17	21
Hooded Warbler	4			SC	SC	SC		T	20	-
American Bittern	4		E	E	SC		E		18	-
Bewick's Wren	4		E	E			E	E	18	-
Least Bittern	4		T	E	T		E		18	-
Yellow-crowned Nt-Heron	4		E	E			E	T	17	-
Common Moorhen	4		T		SC	SC	SC		15	-
Greater Prairie-Chicken	3		E			SC		T	26	26
Louisiana Waterthrush	3				SC	SC		SC	21	-
Sandhill Crane	3		T	E			E		20	-
Marsh Wren	3			E	SC		SC		19	17
Northern Goshawk	3				SC		SC	SC	18	19
Least Tern	3	E	E	E					17	-
Yellow-headed Blackbird	3		E	E	SC				17	-
Snowy Egret	3		E				E	E	13	-
Kirtland's Warbler	3			E	E		E		-	m
Yellow Rail	3				T	SC		T	-	m
American Black Duck	2						SC	SC	21	26
Golden-winged Warbler	2			E			E		25	-
Dickcissel	2				SC				23	-
Acadian Flycatcher	2					SC		T	22	-
Worm-eating Warbler	2			SC				E	22	-
Sedge Wren	2			E			E		21	-
American White Pelican	2					SC		SC	20	-
Black-backed Woodpecker	2				SC			SC	-	20
Yellow-throated Warbler	2				T			E	19	-
Virginia Rail	2			E			SC		18	15

Common Name	# of States	IA	IL	IN	MI	MN	OH	WI	16 B Score ^b	16 W Score ^c
Sharp-shinned Hawk	2			SC			SC		17	14
Western Meadowlark	2			SC	SC				17	-
Cooper's Hawk	2				SC			SC	16	15
Lark Sparrow	2						E	SC	16	-
Merlin	2				T			SC	-	16
Great Egret	2			SC				T	14	-
Cattle Egret	2						T	SC	9	-
Caspian Tern	2				T			E	-	m
Little Blue Heron	2		E				E		-	m
Nelson's Sharp-t Sparrow	2					SC		SC	-	m
Bachman's Sparrow	2			E			SC		-	-
Mississippi Kite	2		E	SC					-	-
Sharp-tailed Grouse	2				SC			SC	-	-
Spruce Grouse	2				SC			T	-	-
Black Rail	1		E						26	-
Bell's Vireo	1							T	23	-
Kentucky Warbler	1							T	22	-
Prothonotary Warbler	1				SC				22	-
Redhead	1							SC	19	21
Canada Warbler	1						E		21	-
Swainson's Hawk	1		E						20	-
Grasshopper Sparrow	1				SC				19	-
Prairie Warbler	1				E				19	-
Canvasback	1							SC	-	19
Brown Creeper	1		T						15	18
Red-necked Grebe	1							E	18	-
Yellow-breasted Chat	1							SC	18	-
Lesser Scaup	1							SC	-	18
Common Snipe	1						SC		14	17
Purple Martin	1						SC		17	-
Horned Grebe	1					T			-	17
Northern Saw-whet Owl	1						SC		16	16
Pied-billed Grebe	1		T						16	13
Yellow-bellied Sapsucker	1						E		16	-
Common Goldeneye	1							SC	-	16
Dark-eyed Junco	1						E		-	16
Black-and-white Warbler	1			SC					15	-
Broad-winged Hawk	1			SC					14	-
Northern Waterthrush	1						E		14	-
Winter Wren	1						E		14	-
Evening Grosbeak	1							SC	-	14
Hermit Thrush	1						E		-	13
Double-crested Cormorant	1						SC		13	-
Sora	1						SC		12	-
Pine Siskin	1							SC	11	10
Common Loon	1				T				-	M
Swainson's Thrush	1							SC	-	M
Tennessee Warbler	1							SC	-	M
Franklin's Gull	1					SC			-	m
Le Conte's Sparrow	1							SC	-	m
Little Gull	1							SC	-	m
Marbled Godwit	1					SC			-	m

Common Name	# of States	IA	IL	IN	MI	MN	OH	WI	16 B Score ^b	16 W Score ^c
Yellow-bellied Flycatcher	1							SC	-	m
Baird's Sparrow	1					E			-	-
Black Vulture	1						SC		-	-
Burrowing Owl	1					E			-	-
Chestnut-coll. Longspur	1					E			-	-
Chuck-Will's-Widow	1						SC		-	-
Great Gray Owl	1							SC	-	-
Magnolia Warbler	1						E		-	-
Sprague's Pipit	1					E			-	-
Swainson's Warbler	1		E						-	-

^a E = Endangered; T = Threatened; SC = Special Concern; SC/FL = Special Concern in the state because it is federally listed.

^b PIF16 total score (breeding).

^c PIF16 total score (wintering), M = regularly migrates through PIF16 but not present for breeding or wintering, m = rarely or irregularly observed in PIF16 but not present for breeding or wintering.

Appendix C: Partners in Flight species assessment and criteria for priority ranking.

The Partners in Flight species assessment was first developed in 1991 and has been continually reviewed and refined in the years following its inception (Beissinger et al. 2000, Carter et al. 2000). The system ranks each species of North American breeding bird based upon six measures of conservation vulnerability and one measure of conservation responsibility (importance of area). These vulnerability factors include (1) relative abundance, (2) size of breeding range, (3) size of nonbreeding range, (4) threats to the species in breeding areas, (5) threats to the species in nonbreeding areas, and (6) population trend. Each species is given a score of 1-5 in each category, with 1 indicating the least amount of vulnerability and 5 the most. Scores in each category are then summed to produce a composite score with a potential range from 7-35. Species with high overall scores are considered most vulnerable to extinction (though many are not listed as threatened or endangered) and need careful monitoring across their ranges.

One of the most influential factors for determining species of conservation priority is the species' population trend. It is important to focus active management in those areas where declines can be stabilized or reversed. Species whose populations are declining range-wide may or may not be declining in a given planning unit. Area Importance scores identify areas where a high proportion of the population is found. Relative abundance scores in the PIF prioritization scheme are independent of the size of the planning unit, but percentage of population is not. Thus, relative abundance 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.

After calculating a total composite score within the planning unit for each species, the following criteria identify priority species. Species are listed according to the first criteria they meet, although they may qualify under several criteria:

- I. The species' total score is ≥ 22 and it occurs in the region in manageable numbers (i.e., $AI > 1$).
- Ila. The species' total score is 19-21, with the sum of Area Importance (AI) and Population Trend (PT) ≥ 8 . Thus, species with moderate total scores and moderate relative abundances in the planning unit are included only if their population trends are declining significantly. A species with high relative abundance in the area is included if its population trend is unknown or declining.
- Ilb. The species' total score is 19-21, and the percentage of its total population breeding in the planning unit is $> 8\%$. Planning units with large proportions of the population have more influence on a species' global population than do areas with smaller numbers of individuals.

- IIc. The species' total score is 19-21, and threats during the breeding and nonbreeding seasons (TB + TN)>5, or the local TB or TN=5.
- III. The species is a PIF "Watch List" species with an AI \geq 2. (The Watch List includes species with the highest PIF priority rankings across their entire range. Most Watch List species also qualify under criteria I or II.)
- IV. A species is federally listed as threatened or endangered. Most of these are included in one of the above categories.
- V. A species is of local management interest because it is hunted, has other socioeconomic or cultural values, is state listed, or is listed in another conservation plan.

Partners in Flight species priority lists for all species and conservation areas are available on the Rocky Mountain Bird Observatory's home page:
<http://www.rmbo.org>.