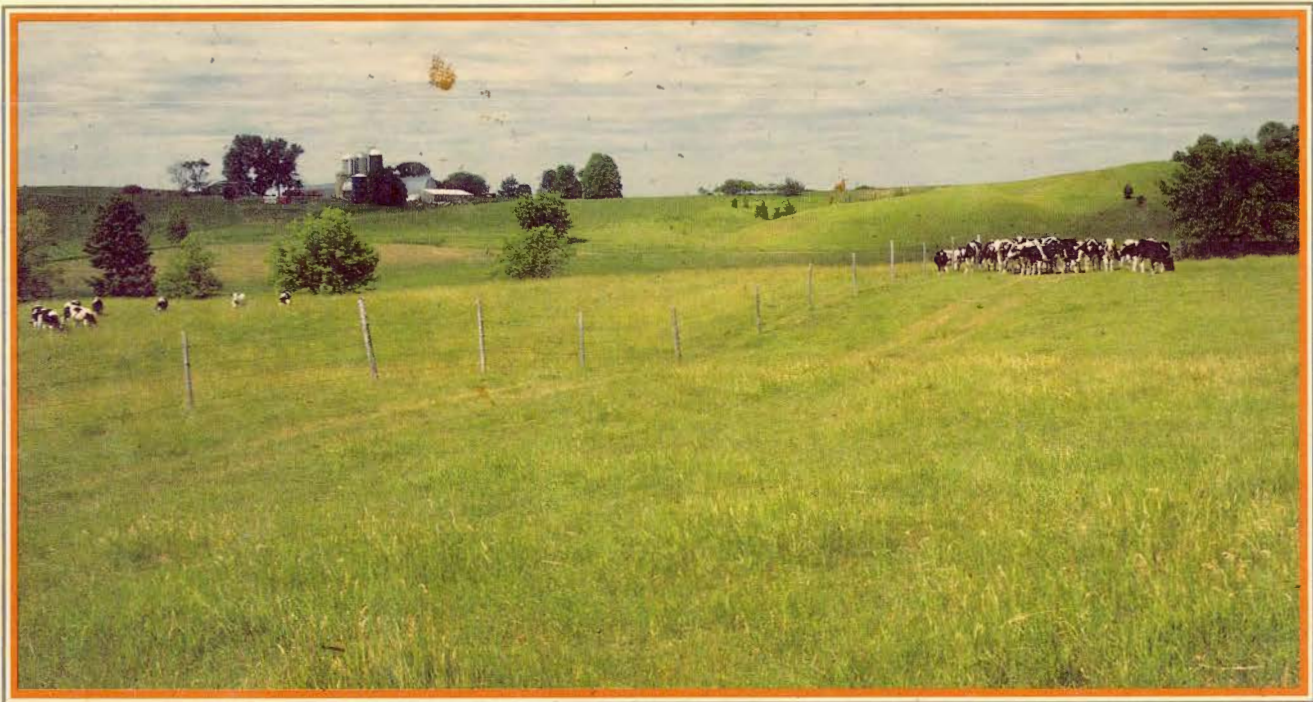


MANAGING HABITAT FOR GRASSLAND BIRDS

A GUIDE FOR WISCONSIN





MANAGING HABITAT FOR GRASSLAND BIRDS
A GUIDE FOR WISCONSIN



MANAGING HABITAT FOR GRASSLAND BIRDS

A GUIDE FOR WISCONSIN

David W. Sample and Michael J. Mossman
Bureau of Integrated Science Services
Department of Natural Resources
P.O. Box 7921, Madison, WI 53707

1997

Wendy M. McCown, Editor
Michelle E. Jesko, Design

CONTENTS

To the Reader	1
Introduction	3
Purpose and Use of This Guide	6
Overview of Grassland and Grassland Birds Management Issues . .	8
Definitions of Grasslands and Grassland Birds	8
Grassland Bird Habitat	10
Grassland Bird Communities	10
Grassland Bird Distribution and Abundance in Wisconsin	11
Management Philosophy	11
Managing for Statewide Diversity	11
Managing for Population Viability	16
Managing for Communities	17
Scale Issues and Regional Differences	17
Long-Term Monitoring	18
Public and Agency Education	19
Identifying Bird Species of Management Concern and Priority Habitats for Wisconsin	21
Species	21
Habitats	31
Guidelines and Recommendations for Habitat Management . .	45
Amount of Habitat	46
Habitat Size and Shape	47
Large-Scale Landscapes	47
Medium-Scale Landscapes	48
Small Blocks	48
Habitat Distribution	49
Surrounding Land Use	50
Effective Habitat Size	50
Suitable vs. Unsuitable Adjacent Habitats	51
Woody Cover and Edge Issues	53
Habitat Structure and Other Features	55
Disturbance Patterns	57
Land Management Practices	60
Mowing	60
Burning	62
Grazing	63
Herbicide	65
Planting and Restoration	65
Water-Level Manipulations	66
Conventional Cropping Practices	67



Alternative Cropping Practices	69
Set-Asides	70
Forestry Practices	71
Management Priorities for Birds, Habitats, Landscapes, and Sites . .	73
Statewide	73
Birds	73
Habitats, Landscapes, and Sites	74
Southwestern Upland	81
Birds	82
Habitats, Landscapes, and Sites	83
Southeastern Ridges and Lowlands	91
Birds	92
Habitats, Landscapes, and Sites	92
Central Plains	99
Birds	100
Habitats, Landscapes, and Sites	101
Lake Michigan Shoreland	107
Birds	108
Habitats, Landscapes, and Sites	108
Northern Highland/Lake Superior Lowland	113
Birds	114
Habitats, Landscapes, and Sites	114
Conclusion	120
Appendices	121
A. Complete List of Grassland Birds and Other Birds that Use Grassland Habitats in Wisconsin	121
B. List of Plants Mentioned in the Text	123
C. U.S. Forest Service National Hierarchical Framework of Ecological Units for Wisconsin	124
D. Wisconsin DNR Geographic Management Units and Regions	125
E. Definitions of Wisconsin Grassland Habitats and Lists of Associated Non-Grassland Bird Species	126
F. General and Special Habitat Features Required or Preferred by Grassland Bird Species	132
G. Statewide Ranking and Descriptions of Priority Landscapes for Grassland Bird Management	136
Glossary	142
Literature Cited	144
Suggested Reading	148



TO THE READER



The information in this guidebook derives from the Wisconsin grassland bird study, which was conducted from 1985-1997. This study included research into grassland bird distribution, abundance, community composition, habitat preferences, habitat requirements, population trends, and response to land use changes. Extensive field work for this study was conducted statewide, with particular focus on southern and central Wisconsin.

This guidebook is written primarily for natural resources managers who are familiar with many of the technical terms and concepts that are discussed here regarding grassland bird management. In the hope and expectation that many others beyond this primary audience—such as planners and private landowners—will also use this publication, we have included a glossary of terms and have placed a shaded box around those terms within the text. Some terms not in the glossary are defined where they first occur in the text.

Grassland bird management in Wisconsin is complex. It is therefore not easy to distill all of the necessary information into several simple steps—a short “recipe”—that will ensure successful management for all grassland birds in need of conservation attention in the state. It is our sincere hope that this guidebook will, while conveying some of the complexity of the issue, arm land managers with some of the knowledge and tools necessary to begin the process of implementing management for grassland birds throughout the state. It is also our hope that this management will make a positive difference for our grassland bird communities—communities that, along with grassland ecosystems as a whole, deserve our attention to ensure their presence and health in the future.



Western Meadowlark

INTRODUCTION

The immense weed, grass, and fern grown marsh or low-land prairie, which has been the breeding grounds for Henslow's sparrows and short-billed marsh wrens since long, long before my time, is being slowly reclaimed. The cornfields and pastures are eating into it on all sides, and will, before many years, meet in its very center. What will become of ... [these birds], as well as the borders of bobolinks, the marsh hawks, the prairie hens, and other characteristic nesting birds, when the last acre of virgin sod is ploughed for corn?

—Ned Hollister, *Some Changes in the Summer Bird Life of Delavan, Wisconsin* (Hollister 1919)



So wrote the co-author of *Birds of Wisconsin* (Kumlien and Hollister 1903) in reaction to the changes in land use and bird populations he had witnessed since 1888 in southeastern Wisconsin. Yet his comments have meaning for us today, over 75 years later. Many an older farmer in Wisconsin can remember times when farmland birds such as meadowlarks, bobolinks, and upland sandpipers¹ were much more common than they are today. These same people wonder what has happened to the cheerful avian denizens of their farmland “backyards.”

¹ Scientific names for birds and plants mentioned in the text are found in Appendices A and B, respectively.



Big bluestem

JIM McEWAT © '87

Between 1966 and 1994 the populations of ten grassland bird species declined significantly on Wisconsin's Breeding Bird Survey routes, a higher proportion of species than in any other habitat group.



Wilson's Phalarope

In the 1970s and early 1980s professional and amateur ornithologists again voiced concerns over declines in grassland bird populations in Wisconsin (Hine 1973, Robbins 1982). The declines were confirmed by data from the U.S. Department of the Interior's Breeding Bird Survey (BBS). Between 1966 and 1994 the populations of ten grassland bird species declined significantly on Wisconsin's BBS routes, a higher proportion of species than in any other habitat guild² (Robbins et al. 1996). These declines were not only evident in Wisconsin but were widespread throughout the Midwest (Herkert 1995) and the continent as a whole (Knopf 1994). In addition, the Partners in Flight Watch List includes 13 Wisconsin grassland bird species considered to be of high conservation concern (Carter et al. 1996).³ Sixteen grassland bird species occurring in Wisconsin were also recently identified as species of management concern in Region 3 by the U.S. Fish and Wildlife Service (USFWS; Office of Migratory Bird Management 1995).⁴

The causes for these population declines are especially difficult to determine for grassland birds, whose populations are known to naturally fluctuate both geographically and over time (Emlen and Wiens 1965, Cody 1985). However, the alteration and loss of breeding habitat are suspected causes (Robbins et al. 1996). Native grasslands have been almost completely lost since European settlement, and agricultural land has undergone many changes, from the era of wheat farming in the late 1800s, to the dominance of dairy farming in the mid-1900s, to the growth of row cropping in recent decades (Sample 1989). Some bird species adapted well to agricultural land use in the early to mid-1900s, but since the late 1950s large acreages of pasture and small grain crops have been converted to row crops, which decreased useable agricultural habitat for grassland bird species (Graber and Graber 1963). Also, much late-harvested grass hay has been converted to alfalfa, which is harvested early and frequently, causing significant mortality of nesting birds (Frawley 1989, Bollinger et al. 1990, Igl 1991). The loss of hay and pasture acreage is strongly correlated with declines in grassland bird populations in the Midwest (Herkert et al. 1996).

² Terms that are shaded in the text are found in the glossary on page 142.

³ Partners In Flight is a multinational interagency program for the conservation of neotropical migratory birds in the western hemisphere. These 13 species are identified in Table 3, page 22.

⁴ The Midwest region of the USFWS (Region 3) includes Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Ohio, Michigan. These 16 species can be found in Table 3, page 22.

Other factors that may play a role in population declines are inadequate reproduction due to nest predation, brood parasitism, exposure to toxic chemicals, and excessive overwinter mortality caused by factors including changes or loss of habitat on migration routes or wintering grounds (Temple 1988). Changes in breeding distribution, such as shifting or contracting ranges, are also potentially related to population declines. We can detect these range changes for species that are at the edge of their breeding ranges in Wisconsin, such as Brewer's blackbird. However, these changes may stem from many different causes that are difficult to determine and may be related to conditions nearer the center of the species' breeding range.

Reproduction problems such as predation and parasitism are often related to habitat changes, although this is a topic that is poorly understood. When agricultural development fragmented the original grassland and grassland/savanna landscapes, it increased the amount of linear edge (Addis et al. 1995) and woody vegetation, which directly influences predator populations and movements. The number of buildings and farmsteads in

a landscape may also influence predator population size and movements.

Ideally, management strategies should be based on an understanding of where and how a given declining bird population is limited at any time or place in its annual cycle, including geographically remote factors such as problems on the wintering grounds in the southern U.S. and Central and South America, which have received increasing attention in recent years (Lymn and Temple 1991, Basili and Temple 1995). However, information on most species is woefully inadequate for such a task, and decisions must often be based on educated judgment. Given the magnitude of changes in breeding habitats, habitat management on breeding grounds is generally a prudent course of action. It is likely to benefit at least some bird species that are limited by the availability or quality of breeding habitat, and is not likely to have negative impacts on species that are limited elsewhere.

Although grassland birds face challenges to their survival that are different and perhaps more numerous than at the end of the last century, we can through habitat management, help improve their chances in the century before us.

A typical cattle feedlot, on a farm in Columbia County. This situation is common in modern dairy farms, where most of the cows are kept in confinement instead of being pastured. Feed (forage crops and grains) raised elsewhere on the farm is brought to the cows in the barn and feedlot.



MICHAEL MOSSMAN

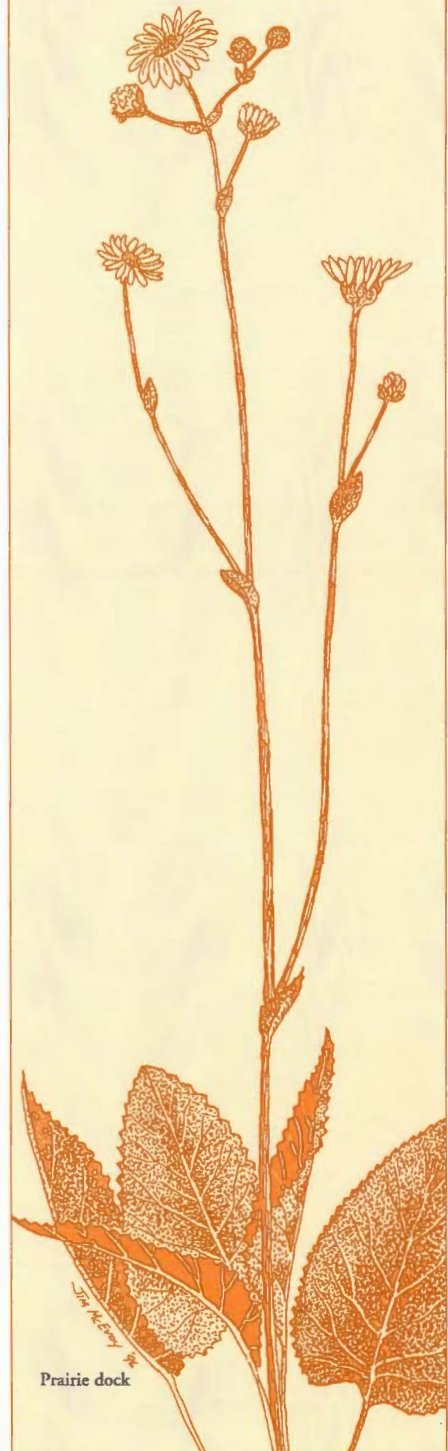
PURPOSE AND USE OF THIS GUIDE



This publication is designed to help managers plan and implement habitat management for grassland birds in Wisconsin. We describe the goals and organizing principles of grassland bird management in the state, beginning with some definitions and a discussion of bird-habitat relationships and bird distribution. We then discuss overall management philosophy, and proceed to identify management priorities for both grassland birds and habitats statewide. General habitat management guidelines are then discussed, as are management recommendations based on species' responses to general and specific management practices. Lastly, we address management issues and priorities for birds and habitats within each natural division in Wisconsin (Figure 1).⁵

This guide should help land owners, land managers, and planners identify the grassland bird species, communities, and habitats of management concern both in their local areas and statewide, and it should also help them determine what management practices will support specific habitats, bird species, or communities. We also identify specific landscapes, sites, and properties worthy of special management attention in Wisconsin.

⁵ We are using natural divisions as defined by Hole and Germain (1994) in this guidebook. These divisions are familiar to most Wisconsin natural resources managers. The Wisconsin Department of Natural Resources (DNR) has recently signed the Forest Accord, which is an agreement to use new ecoregions developed by U.S. Forest Service (Appendix C, page 124) which show some similarities to those used by Hole and Germain. Further, the DNR is now basing planning and management efforts within newly defined Geographic Management Units (GMU's) (Appendix D, page 125).



Prairie dock

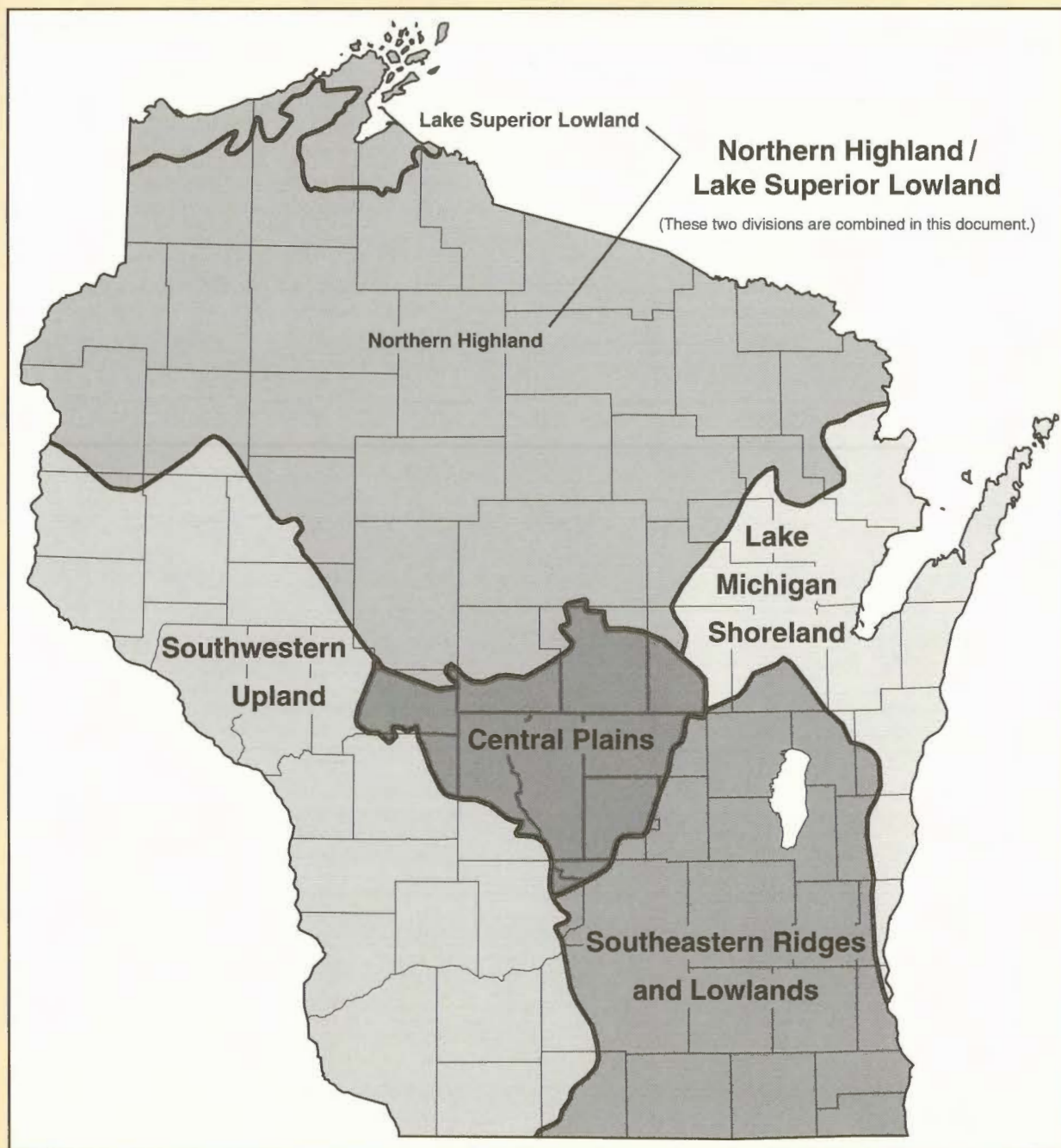


FIGURE 1. *Natural Divisions of Wisconsin, as described by Hole and Germain (1994).*

OVERVIEW OF GRASSLAND AND GRASSLAND BIRDS MANAGEMENT ISSUES

Definitions of Grasslands and Grassland Birds

We define Wisconsin grasslands broadly to include all native grasslands, from sedge meadows and open bogs to prairies, savannas, and barrens communities. We also include surrogate prairie grasslands (hereafter “surrogate grasslands”), which represent the vast majority of grassland habitat in the state. Surrogate grasslands are habitats that are similar to and replace the former prairie grasslands that historically occurred in Wisconsin. Surrogate grasslands include agricultural habitats such as hayfields, small grains (oats, wheat, and barley), row crops (corn, soybeans, and potatoes), fallow fields, old fields, pastures, and set-aside fields. Examples of other surrogate grasslands include young conifer plantations, orchards, parks, golf courses, airports, cut-over or burned-over forests, and mossed bogs (bogs from which sphagnum moss has been removed commercially). Surrogate grasslands also include other idle grasslands, such as those on public lands managed for wildlife. Usually, idle grasslands are composed of non-native grasses and forbs, but they also can be plantings of one or several native species.

Some of the habitats we consider are on the wet (e.g., sedge marshes and open bogs) and woody (e.g., upland shrub and brush prairie barrens) ends of the grassland habitat continuum. They are included because they are used by grassland birds, because they include at least some elements of grassland vegetation structure, and because they represent communities that are not usually covered in management plans for other habitats, such as wetlands or forests.

We consider grassland birds to be those species that use these grassland habitats during the breeding season for courtship, nesting, foraging, rearing young, and roosting or resting. During the breeding season, 105 species regularly or occasionally use Wisconsin grasslands for at least one of these functions, representing 45% of the 233 confirmed breeding species in the state (Robbins 1991; Appendix A, page 121). Of these 105 species, 40 require grasslands or a grassland habitat setting for part of their breeding cycle, including nesting or foraging (see sidebar). These

We define Wisconsin grasslands broadly to include all native grasslands; we also include surrogate prairie grasslands, which represent the vast majority of grassland habitats in the state, including agricultural habitats. Surrogate grasslands are similar to and replace the former prairie grasslands that historically occurred in Wisconsin.



Upland Sandpiper

The 40 species that require grasslands during their breeding cycle.

Cattle egret
 Green-winged teal
 Northern pintail
 Blue-winged teal
 Northern shoveler
 Gadwall
 American wigeon
Northern harrier^a
 Red-tailed hawk
 American kestrel
 Gray partridge
 Ring-necked pheasant
Greater prairie-chicken
 Sharp-tailed grouse
 Northern bobwhite
Yellow rail
Upland sandpiper
 Wilson's phalarope
 Barn owl
Short-eared owl
Horned lark
Sedge wren
 Eastern bluebird
 Loggerhead shrike
 Bell's vireo
Dickcissel
 Clay-colored sparrow
 Field sparrow
Vesper sparrow
 Lark sparrow
Savannah sparrow
Grasshopper sparrow
Henslow's sparrow
Le Conte's sparrow
Sharp-tailed sparrow
Bobolink
Eastern meadowlark
Western meadowlark
 Brewer's blackbird
 Brown-headed cowbird

^a Obligate grassland species are in **bold**. These are species that require relatively treeless grasslands for most or all parts of their breeding cycles, including nesting and foraging. They may use non-grassland habitats but do not require them for their survival.

The 16 additional, generalist species that commonly occur in grasslands.

Mallard
 Killdeer
 Mourning dove
 Common nighthawk
 Red-headed woodpecker
 Alder flycatcher
 Willow flycatcher
 Eastern kingbird
 Barn swallow
 Common yellowthroat
 Song sparrow
 Swamp sparrow
 Red-winged blackbird
 Common grackle
 Orchard oriole
 American goldfinch

The 49 species that occur less commonly in grasslands.

American bittern
 Canada goose
 American black duck
 Ring-necked duck
 Lesser scaup
 Turkey vulture
 Merlin
 Wild turkey
 King rail
 Virginia rail
 Sora
 Sandhill crane
 Spotted sandpiper
 Common snipe
 American woodcock
 Ring-billed gull
 Herring gull
 Rock dove
 Great horned owl
 Ruby-throated hummingbird
 Downy woodpecker
 Northern flicker
 Eastern phoebe
 Western kingbird
 Purple martin
 Tree swallow
 Northern rough-winged swallow
 Bank swallow
 Cliff swallow
 Blue jay
 American crow
 Common raven
 Black-capped chickadee
 House wren
 American robin
 Gray catbird
 Brown thrasher
 Cedar waxwing
 European starling
 Yellow warbler
 Yellow-breasted chat
 Northern cardinal
 Indigo bunting
 Rufous-sided towhee
 Chipping sparrow
 Lincoln's sparrow
 Yellow-headed blackbird
 Baltimore oriole
 House sparrow

Grassland birds are those species that use grassland habitats during the breeding season for courtship, nesting, foraging, rearing young, and roosting or resting.

High quality grassland bird breeding habitat fulfills the requirements of birds during their nesting cycles, attracts relatively high densities of birds, **and** has high nest productivity.



Eastern Meadowlark

40 species include 17 grassland obligates—species that require grasslands for most or all parts of their breeding cycles and who don't require non-grassland features such as trees. Also included in the list of 40 birds are some species that may not normally be thought of as grassland birds but which occur on either the wet or woody ends of the grassland habitat spectrum, such as shrub-grassland species and birds characteristic of sedge meadows or requiring open water. Sixteen additional species commonly frequent grasslands and may even nest in them but are habitat generalists or are more common in other habitats. These two groups of 40 and 16 species collectively make up the 56 species that are referred to generally in this guidebook as grassland birds. Forty-nine other species occur primarily in other habitats and less regularly in grasslands; these will not be discussed further.

Grassland Bird Habitat

Grassland bird breeding habitat must fulfill the requirements that a bird has during its nesting cycle. These requirements include suitable habitat structure (which is influenced by management history), adequate habitat size and surrounding land use, sufficient food resources, and sometimes other features including access to open water and nest cavities. High quality habitat fulfills these requirements, attracts relatively high densities of birds, **and** has high nest productivity. Some habitats that attract high densities of nesting birds may produce few young and therefore are not considered high quality habitat (Van Horne 1983). A more detailed discussion of grassland bird habitat requirements is found in the section on page 45, "Guidelines and Recommendations for Habitat Management."

Grassland Bird Communities

Birds with similar habitat requirements (e.g., savannah sparrow and bobolink), or whose requirements differ but are fulfilled in the same habitat type (e.g., savannah sparrow and red-headed woodpecker in open oak savannas), tend to occur together as bird communities. The composition of bird communities varies from site to site, region to region, and year to year because of differences in management history, site conditions, and precipitation patterns and because patterns of bird distribution and abundance vary across the state. As mentioned above, differences in site size, surrounding land use, and woody cover also affect the bird community composition. However, certain bird-habitat associations are fairly constant. Typical bird communities of Wisconsin grassland habitats are presented in Table 1. Some examples follow:

- Horned lark, killdeer, and vesper sparrow are found in plowed and cultivated agricultural habitats, especially early in the season before the crop canopy has developed.
- Vesper, grasshopper, field and clay-colored sparrows, and sometimes lark sparrow occur together in uncultivated habitats with short, sparse vegetation, lots of bare soil, and some shrub cover, such as dry or sand prairies, barrens, and old fields on poor, sandy soils.
- Upland sandpiper, grasshopper sparrow, and western meadowlark may be found together in habitats characterized by short to medium height vegetation, such as moderately grazed pastures, some idle fields of mixed grasses and forbs, open barrens, dry old fields, and sometimes hayfields.
- Savannah sparrow, bobolink, dickcissel, red-winged blackbird, and eastern meadowlark are common associates in relatively mesic habitats with medium vegetation height, such as hayfields, some idle fields of grasses and forbs, and lightly grazed pastures.
- Sedge wren, common yellowthroat, swamp sparrow, red-winged blackbird, and sometimes Henslow's sparrow are commonly found in habitats characterized by tall, dense vegetation, such as southern sedge meadows and idle fields of grasses and forbs (e.g., switchgrass).

Grassland Bird Distribution and Abundance in Wisconsin

Grassland birds have variable patterns of distribution and abundance in Wisconsin (Table 2). Some species' breeding ranges include the entire state, while others are mainly restricted to certain natural divisions. Even for statewide species, abundance patterns typically vary from one part

of the state to another. We record abundance by natural divisions, but it is important to note that species often have highly localized distributions within a natural division. For example, while Brewer's blackbird and clay-colored sparrow are listed as uncommon and rare, respectively, in the Southwestern Upland, they are largely absent from the southern three-quarters of this natural division but are locally common in the northwestern part. For further information on ranges, see the sections on natural divisions starting on page 73; see also Robbins (1991), Price et al. (1995), or Temple and Cary (1987).

Management Philosophy

To organize our thinking and approach to grassland bird habitat management in Wisconsin we developed a management philosophy. This philosophy provides the principles that help guide the processes of developing a statewide management plan, determining management priorities, and planning and implementing management actions. The components of this philosophy include emphasizing statewide diversity of grassland birds, promoting management of viable bird populations, managing for bird communities as well as species, creating management plans that are responsive to differences in geographic scales and natural divisions, gauging the effects of management through monitoring, and encouraging public and agency education of grassland conservation issues.

Managing for Statewide Diversity

The overall goal of grassland bird management in Wisconsin should be to maximize statewide diversity of grassland birds rather than just focusing on local diversity. This means providing sufficient habitat for all grassland birds. Managing for local diversity alone tends to promote habitats suitable for the same limited suite or suites of species at the expense of other species and communities with different or unique habitat needs in diverse parts of the state. There are, however, instances when strictly local management is

Table 1. The species composition of Wisconsin's grassland bird communities.^{a, b}

	Cattle egret	Am. green-winged teal	Mallard	Northern pintail	Blue-winged teal	Northern shoveler	Gadwall	American wigeon	Northern harrier	Red-tailed hawk	American kestrel	Gray partridge	Ring-necked pheasant	Greater prairie-chicken	Sharp-tailed grouse	Northern bobwhite	Yellow rail	Killdeer	Upland sandpiper	Wilson's phalarope	Mourning dove	Barn owl	Short-eared owl
Habitat Types ^c																							
Row crops					F			f			F	F	f	f	F		S	f		O			
Small grains								F	F	F	O	O	f	f	F		O			F	f	f	
Fallow fields			O					o	F	F	O	O	f	f	O		O	o		O	f	f	
Alfalfa or legume hay	f	o	O		O		o	o	F	F	O	O	f	f	O		O	o		O	f	f	
Grass or grass/legume hay	f	o	O		O		o	o	O	F	F	O	O	o	f	O		O	o		O	f	o
Pastures ^d	f	o	O	o	O		o	o	O	W	W	O	L	l	O		H	S		O	f	l	
Idle cool season/grass/forb-short	f	o	O	o	O	o	o	o	F	W	W	o		o	o	O		O	o		W	f	f
Idle cool season/grass/forb-med.	f	o	O	o	O	o	o	o	O	W	W	O	O	o	o	O			o	o	W	f	o
Idle cool season/grass/forb-tall			O		o	o	o	o	O	W	W	O	O	o		o				o		f	o
Idle warm season/grass/forb-med.	f	o	O		O	o	o	o	O	W	W	O	O	o	o	O			o		W	f	o
Idle warm season/grass/forb-tall			O				o		O	W	W		O	o		O						f	o
Dry old field	f	o	o	o	O	o	o	o	O	W	W	O	O	o	o	O			o		O	f	o
Upland shrub			O					o	o	W	W	O	O		o	O			o		O	f	o
Wet old field	f	o	O		O	o	o	o	O	W	W		O	o	o	O			O	o	o	f	o
Shrubby wet old field	o	o	O		O		o	o	O	W	W	O	O		o	O			o		O	f	o
Dry or sand prairie									W	W			o	o	o						O	f	f
Dry-mesic prairie ^e	f	o	O	o	O	o	o	o	O	W	W	o	O	o		O			o		W	f	o
Wet-mesic or wet prairie	f	o	O	o	O	o	o	o	O	W	W		O	o					o	o		f	o
Oak savanna			o	o	o	o	o	o	O	O	O	O	o	o	w	O			o		O	o	o
Southern sedge meadow	f	o	O	o	O	o	o	o	O	W	W		O			o			o	o		f	o
Northern sedge meadow			O	o	O	o	o	o	O	W	W			o		S			o	S			o
Southern sedge marsh			D	o	O	o	o	o	O												S		
Northern sedge marsh			O	o	D	o	o	o	O							o	O			S			
Shrub swamp	o	o	O		O		o		O	W			O		o	o		O			O	f	o
Open bog			O					o	O						o								o
Mossed bog			o						O														f
Open barrens								O	O	O			o			O	S		o		o		
Diverse barrens			o					S	O	O			o			O	S		O		o		
Brush prairie barrens			o					O					S			O	O		O		o		
Oak or river barrens									O	O				o		O				D			
Conifer barrens									O	O				o		O				O			
Cut- or burned-over									W	W			o					o		O			
Young conifer plantation								o	F	F				o					O	f	f		
Orchard														o						D			
Park or golf course	f		O						O	O				o		O				O			

^a Species are shown in taxonomic order. Includes 40 species that require grasslands and 16 other species that commonly occur in grasslands (see text). See Appendix E for non-grassland bird species typically associated with these communities. Bolded names are species of management concern, which are the focus of this report; discussion of our selection of these species begins on page 21.

^b **D**=dominant breeding species; **S**=specialist (species with relatively limited distributions that occur more commonly in this habitat than in most others); **O**=occurs as a breeding species; **F**=forages, but does not typically breed; **W**=woody vegetation of appropriate type is required for nesting (otherwise forages only); **L**=occurs with very light grazing (often lowland sites with tall vegetation); **H**=occurs with heavy grazing.

^b True mesic prairies are too rare and small to receive significant use from grassland birds and are thus excluded from the list of habitats.

Abundance: r = rare

u = uncommon

fc = fairly common

a = abundant

SGCN = species of
greatest conserv.
need

MANAGING HABITAT FOR GRASSLAND BIRDS

Table 2. Breeding season abundance of Wisconsin's grassland birds.

Bird Species ^b	Abundance ^a by Natural Division				
	Southwestern Upland	Southeastern Ridges and Lowlands	Central Plains	Lake Michigan Shoreland	Northern Highland/Lake Superior Lowland
Cattle egret	rare	uncommon	n.p.	uncommon	n.p.
Green-winged teal	rare	uncommon	uncommon	uncommon	rare
Mallard	common	abundant	abundant	common	common
Northern pintail	rare	rare	rare	rare	rare
Blue-winged teal	fairly common	common	common	common	fairly common
Northern shoveler	rare	rare	rare	rare	rare
Gadwall	rare	rare	rare	rare	rare
American wigeon	rare	rare	rare	rare	rare
Northern harrier	uncommon	uncommon	fairly common	uncommon	fairly common
Red-tailed hawk	common	common	common	common	fairly common
American kestrel	common	common	common	common	common
Gray partridge	uncommon	fairly common	uncommon	fairly common	n.p.
Ring-necked pheasant	fairly common	common	fairly common	fairly common	uncommon
Greater prairie-chicken	n.p.	n.p.	uncommon	n.p.	uncommon
Sharp-tailed grouse	n.p.	n.p.	uncommon	n.p.	uncommon
Northern bobwhite	fairly common	uncommon	uncommon	uncommon	n.p.
Yellow rail	n.p.	rare	rare	rare	rare
Killdeer	common	common	common	common	fairly common
Upland sandpiper	fairly common	uncommon	uncommon	fairly common	uncommon
Wilson's phalarope	rare	rare	uncommon	uncommon	uncommon
Mourning dove	common	common	common	common	uncommon
Barn owl	rare	rare	rare	rare	casual
Short-eared owl	rare	casual	rare	casual	rare
Common nighthawk	fairly common	fairly common	fairly common	fairly common	fairly common
Red-headed woodpecker	common	fairly common	common	fairly common	rare
Alder flycatcher	uncommon	uncommon	fairly common	uncommon	fairly common
Willow flycatcher	fairly common	fairly common	fairly common	uncommon	uncommon
Eastern kingbird	common	common	common	common	common
Horned lark	common	common	common	common	fairly common
Barn swallow	common	common	common	common	common
Sedge wren	fairly common	common	common	common	common

Table 2. *Continued.*

Bird Species ^b	Abundance ^a by Natural Division				
	Southwestern Upland	Southeastern Ridges and Lowlands	Central Plains	Lake Michigan Shoreland	Northern Highland/Lake Superior Lowland
Eastern bluebird	fairly common	uncommon	fairly common	uncommon	fairly common
Loggerhead shrike	uncommon	uncommon	uncommon	uncommon	rare
Bell's vireo	uncommon	rare	rare	rare	n.p.
Common yellowthroat	common	common	common	common	common
Dickcissel	fairly common	fairly common	uncommon	uncommon	rare
Clay-colored sparrow	uncommon	rare	fairly common	uncommon	fairly common
Field sparrow	common	fairly common	common	fairly common	uncommon
Vesper sparrow	common	common	common	common	fairly common
Lark sparrow	uncommon	rare	uncommon	rare	n.p.
Savannah sparrow	common	abundant	common	abundant	common
Grasshopper sparrow	fairly common	uncommon	fairly common	uncommon	uncommon
Henslow's sparrow	uncommon	uncommon	uncommon	uncommon	rare
Le Conte's sparrow	n.p.	rare	uncommon	rare	uncommon
Nelson's sharp-tailed sparrow	n.p.	casual	casual	n.p.	rare
Song sparrow	abundant	abundant	abundant	abundant	abundant
Swamp sparrow	fairly common	common	common	common	fairly common
Bobolink	common	common	common	common	common
Red-winged blackbird	abundant	abundant	abundant	abundant	abundant
Eastern meadowlark	common	common	common	common	fairly common
Western meadowlark	fairly common	uncommon	fairly common	uncommon	uncommon
Brewer's blackbird	uncommon	rare	fairly common	uncommon	fairly common
Common grackle	abundant	abundant	abundant	abundant	common
Brown-headed cowbird	common	common	common	common	common
Orchard oriole	uncommon	uncommon	rare	uncommon	rare
American goldfinch	common	common	common	common	common

^a Abundance categories can be arranged in order of decreasing abundance: abundant, common, fairly common, uncommon, rare, casual, or typically not present (n.p.). These categories are not meant to be exact, but are designed to give an indication of the "average" abundance of species within natural divisions. There is usually variation in abundance within a natural division.

^b The species list is the same as in Table 1. Bolded names are species of management concern, which are the main focus of this report. Discussion of our selection of these species begins on page 21.

The overall goal of grassland bird management in Wisconsin should be to maximize statewide diversity of grassland birds rather than just focusing on local diversity. This means providing sufficient habitat for all grassland birds.

We should make every effort to maximize the viability of grassland bird populations; managing for large tracts of grassland habitat is the best strategy for reaching this goal.



Red-winged blackbird

appropriate (such as for the private landowner who wants to increase the number of bird species on his or her property).

The best way to accomplish the goal of statewide diversity is to provide a broad spectrum of habitats and habitat structures in appropriate geographic locations (Ryan 1986). This includes managing for habitats that are not especially diverse either in vegetation structure or bird species richness—for example, tracts of tall grasses and sedges with homogeneous structure, which benefit habitat specialists such as Le Conte's sparrow and yellow rail—or other habitats required by species that are uncommon, locally distributed, or in danger of statewide extirpation.

Diversity across the entire Midwest deserves special attention as well from both planners and managers. The conservation of some species of management concern that occur here may depend less on management in Wisconsin than management elsewhere in their ranges. At the same time, management in Wisconsin is important to species that are relatively common or secure here but are rare or declining elsewhere. Our bird-ranking scheme includes consideration of the Midwest as a whole (see "Identifying Bird Species of Management Concern and Priority Habitats for Wisconsin," page 20). Also, the Partners in Flight program identifies priority species and habitat objectives for the Midwest and other regions (Thompson et al. 1993, Herkert et al. 1996).

Managing for Population Viability

While pursuing the goal of statewide diversity, we should make every effort to maximize the viability of grassland bird populations. Although we lack adequate knowledge of several key issues—including minimum viable population size for nearly all species, habitat characteristics required to maintain a viable population, and habitat or landscape characteristics that enable a population to be a source supplying individuals to other populations that are not maintaining themselves—we must use available data and educated judgment to increase the likelihood that populations are viable. We know that large populations are more likely than small ones to be viable and sustain themselves over time (Herkert et al. 1996). Therefore, managing for large tracts of grassland habitat is the best strategy for supporting viable populations. The larger the habitat block, the more individuals of a given species will likely colonize and establish territories there. Large sites have the advantage of accommodating the needs of species requiring large areas (area-sensitive species) as well as the needs of species that do not. Large tracts of grassland also have a high ratio of interior to edge, thus minimizing the negative edge effects of increased brood parasitism and predation rates, which can reduce nest productivity on small habitat blocks (Johnson and Temple 1990). In addition, large tracts are generally easier to manage than a larger number of small sites. We

should not, however, rely on a few large management areas alone, because they may experience local catastrophes or uncontrollable long-term habitat changes. The establishment of multiple large areas, especially within and among different natural divisions, is wise.

Managing for Communities

Statewide management should focus on bird communities as well as on species whenever possible. Community management emphasizes habitats, recognizing that habitats support bird communities, not single species in isolation. Community management is especially important when working with large habitat blocks or landscapes where a large number of species are at risk. However, single-species management can be appropriate when the community management approach will not work for certain species or when specific limiting factors can be identified. For example, single-species management may involve high priority species such as endangered or pest species.

It is almost always appropriate to focus not only on the needs of birds but also on the entire grassland ecosystem, especially including communities of plants, vertebrates, and invertebrates. Management that benefits both grassland birds and other elements of our native grassland biota should receive higher priority than activities that benefit birds alone, except perhaps certain endangered birds. For example, consider two landscapes with potential for grassland management, one of which includes a series of prairie remnants and one with no prairie remnants. The former has the greatest benefits for overall biodiversity (Henderson and Sample 1995).

Scale Issues and Regional Differences

Grassland bird management should be based on a hierarchy of objectives at different levels—statewide, natural divisions, landscapes or areas, and local sites—to achieve the overall goal of maintaining the state's grassland bird diversity. Management should therefore be sensitive to differences among and within the state's natural divisions. Management objectives for each division should be based on:

- Abundance and distribution of priority bird species within the division
- Potential for maintaining, creating, or restoring particular priority habitat types⁶
- Prevalence of competing or complementary land uses and management goals
- Patterns of land ownership

⁶ Based on soil type and moisture, topography, current land uses, amount and interspersed of woody cover on the landscape, and successional trends. Priority habitats are discussed in detail starting on page 31.

Statewide management should focus on bird communities as well as on species whenever possible.

•

It is almost always appropriate to focus not only on the needs of birds but also on the entire grassland ecosystem, especially including communities of plants, vertebrates, and invertebrates.



Ring-necked pheasant

Include private lands in grassland management whenever possible, because there is not enough publicly owned land to achieve statewide management goals.

Because grassland birds are suffering severe population declines, they are a good vehicle for raising public and agency interest in grassland conservation issues as a whole.



American goldfinch

Local management objectives should be based on similar considerations as well as on how local objectives can contribute to achieving natural division and statewide objectives. Objectives vary markedly among local areas. For example, some local areas in the Northern Highland/Lake Superior Lowland have special opportunities for maintaining extensive sedge meadows, which are required by Nelson's sharp-tailed sparrow, yellow rail, and Wilson's phalarope, while some local areas in the Southwestern Upland possess the well-drained, sandy soils needed to provide the barrens habitat suitable for lark sparrows and associated species.

Areas within natural divisions that have relatively low human populations, low land values, or large tracts owned by public or private conservation agencies may be especially appropriate for large-scale projects that benefit species requiring large areas, whereas areas with high human use and high property values may be better managed for other bird species. Some areas with very little potential for grassland bird habitat are best managed for other goals altogether. For example, it is inappropriate to manage for grassland communities in largely forested landscapes or in highly productive row crop land where any habitat created would be isolated. However, large (500 acres⁷ and greater) grassland restorations may be justifiable in some agricultural areas. Statewide management goals can only be attained with the cooperation and coordination of both large landowners (such as the Wisconsin DNR, U.S. Forest Service, USFWS, The Nature Conservancy, northern county forests, and forest products corporations) and smaller landowners (such as southern county forests and other county lands, other corporations, farmers, and other private landowners).

At all scales, grassland bird management should, whenever possible, consider and include private lands to ensure the success of statewide management goals, because there is not enough publicly owned land to do so.

Long-Term Monitoring

Monitoring allows us to assess the response of bird populations to management activities. Long-term monitoring is especially important because surveys that monitor trends over decades lessen the impact of temporary population highs and lows on assessments of trends. Although not commonly practiced, long-term monitoring should ideally include some assessment of reproductive success and habitat conditions, in addition to bird abundance.

⁷ There is a metric conversion table on page 151 of this guidebook.

There are some long-term monitoring programs already active in Wisconsin, of which the U.S. Department of the Interior's Breeding Bird Survey (BBS), the Wisconsin Checklist Project (Rolley 1994), and several DNR surveys (Robbins et al. 1996) are particularly useful. However, for a variety of reasons, these programs do not adequately monitor the populations of some grassland species (Robbins et al. 1996).

In addition to monitoring within Wisconsin, we need to look at trends elsewhere for species that are at the edge of their ranges in Wisconsin. For these species, long-term monitoring should also consider the status and trends of the population in the center of the range, to help distinguish range shifts and contractions in Wisconsin from overall population changes. Later in this

guidebook, we provide more detail on species that are not currently adequately monitored in the state (see Table 3).

Public and Agency Education

Habitat conservation involves partnerships between private landowners, conservation organizations, and public management agencies. Therefore, ongoing public and agency education are essential to fulfill the goals of grassland bird management. Grasslands need to gain equal footing with forests and wetlands in the public's perception of important natural habitats. Because grassland birds are suffering severe population declines, they are a good vehicle for raising public and agency interest in grassland conservation issues as a whole.

Typical sand prairie habitat, showing short vegetation and exposed areas of sand ("sand blows") at Spring Green Preserve in Sauk County. This is one of the preferred habitats of lark sparrows in Wisconsin.



MICHAEL MOSSMAN



Prairie smoke

IDENTIFYING BIRD SPECIES OF MANAGEMENT CONCERN AND PRIORITY HABITATS FOR WISCONSIN



To properly focus management resources, it is necessary to identify species and habitats in greatest need of management attention. For this purpose, we developed criteria to establish need and then ranked both birds and habitats accordingly.

Species

Of the 40 bird species that require grasslands or a grassland habitat setting for some part of their breeding cycles, not all species are equally deserving of management concern. The following criteria take into account the species' status at a variety of scales, ranging from the species' entire range (global), the Upper Midwest (regional), Wisconsin, Wisconsin's natural divisions, and local sites.

Criteria:

- Global abundance⁸
- 🐦 Abundance in Wisconsin relative to other states and regions in the species' range
- Population trend
 - 🐦 Wisconsin
 - 🐦 USFWS Region 3
 - Eastern U.S.
 - Continent
- Breeding and winter range size⁸
- Breeding range trend
- 🐦 Relationship of Wisconsin to center of the range
 - Winter season threats⁸
- 🐦 Breeding season threats
- 🐦 Habitat specificity
- 🐦 Minimum area requirements
 - Benefits from current management activities
 - Current knowledge level of species' ecology and limiting factors.

We ranked all 56 grassland bird species (40 species requiring grasslands, plus 16 generalists that commonly occur in grasslands) using these criteria. We allowed a possible "score" of 1-5 for each criterion, with 5 indicating the highest management need. Criteria marked with a bird icon above were weighted more heavily than the others because we felt they were the most important for establishing management need in Wisconsin. We arrived at a final score for each species by summing the individual scores. Table 3 lists the 56 grassland bird species in ranked order, indicating the score, state status, and long-term monitoring needs for each species.

Species scored high in the ranking process for different reasons. For example, Henslow's sparrow scored high for almost all criteria, while bobolink scored high primarily because of consistent range-wide population declines and because it has a large population in Wisconsin compared with many other states. Sedge wren ranked high because it is a habitat specialist, it is relatively abundant in Wisconsin, and Wisconsin is in the center of its range. Brewer's blackbird scored low for most criteria except for a significant population decline across the entire continent and also because we lack knowledge about its ecology and management.

⁸ Scores taken from Partners in Flight (1996).

Our species of management concern use the full range of grassland bird habitat structure, and they demonstrate the need to maintain a diversity of habitat types.



Henslow's sparrow

Table 3. Management priority of grassland birds in Wisconsin, ranked in order from highest management concern to lowest. Species of management concern are in **bold**.

Score ^a	Species ^b	Wisconsin Status	Partners in Flight Watch List Species ^c	USFWS Region 3 Species of Management Concern ^d	Adequately Monitored ^e
81	Henslow's sparrow	state-threatened	♦	♦	no
78.5	Bobolink	special concern ^f	♦	♦	yes
71	Nelson's sharp-tailed sparrow	special concern	♦		no
71	Yellow rail	state-threatened		♦	no
71	Loggerhead shrike	state-endangered	♦	♦	no
70	Lark sparrow	special concern	♦	♦	no
69.5	Grasshopper sparrow	special concern	♦	♦	yes
69.5	Red-headed woodpecker	special concern	♦	♦	yes
69	Field sparrow	special concern	♦	♦	yes
68	Eastern meadowlark	special concern		♦	yes
67.5	Savannah sparrow				yes
67	Sedge wren			♦	no
67	Vesper sparrow	special concern			yes
66.5	Western meadowlark	special concern			yes
66	Upland sandpiper	special concern		♦	yes
66	Wilson's phalarope	special concern			no
65.5	Bell's vireo	state-threatened	♦	♦	no
64.5	Dickcissel	special concern	♦	♦	no
64	Greater prairie-chicken	state-threatened			yes
64	Short-eared owl	special concern	♦	♦	no
64	Orchard oriole	special concern	♦		yes
63	Blue-winged teal	special concern			yes
62.5	Le Conte's sparrow	special concern			no
61.5	Clay-colored sparrow		♦		no
61	Sharp-tailed grouse	special concern			no
60.5	Common nighthawk				no
60	Northern harrier	special concern		♦	yes
59.5	Swamp sparrow				no
59.5	Willow flycatcher				yes
57.5	Ring-necked pheasant				yes
57.5	Eastern kingbird				yes
57	Gray partridge				yes
56	Northern bobwhite				yes
55	Brown-headed cowbird				yes
54	Brewer's blackbird				yes
54	Barn owl	state-endangered		♦	no
53	Green-winged teal				no
52	Northern pintail	special concern			no
52	Common grackle				yes
51.5	Common yellowthroat				yes
51	American goldfinch				yes
50.5	Eastern bluebird				no
50.5	Red-winged blackbird				yes
49.5	American wigeon	special concern			no
49	Alder flycatcher				yes
48.5	Horned lark				yes
48.5	Northern shoveler				no
47	Killdeer				yes
47	Song sparrow				yes
46.5	Gadwall				no
45.5	American kestrel				yes
45.5	Cattle egret	special concern			no
45.5	Barn swallow				yes
37	Red-tailed hawk				yes
33	Mourning dove				yes
32	Mallard				yes

^a Scores are based on criteria on page 21; the maximum score possible is 102.5. See Sample (1995) for a description of how scores were calculated.

^b Same species as in Table 1.

^c See Carter et al. (1996).

^d See Office of Migratory Bird Management (1995).

^e i.e., is species currently adequately monitored by existing programs such as BBS, Wisconsin Checklist Project, and DNR surveys. See Robbins et al. (1996) for a discussion of adequate monitoring.

^f Special concern status denotes species about which some problem with abundance or distribution is suspected. This category is intended to focus attention on certain species **before** they become threatened or endangered.

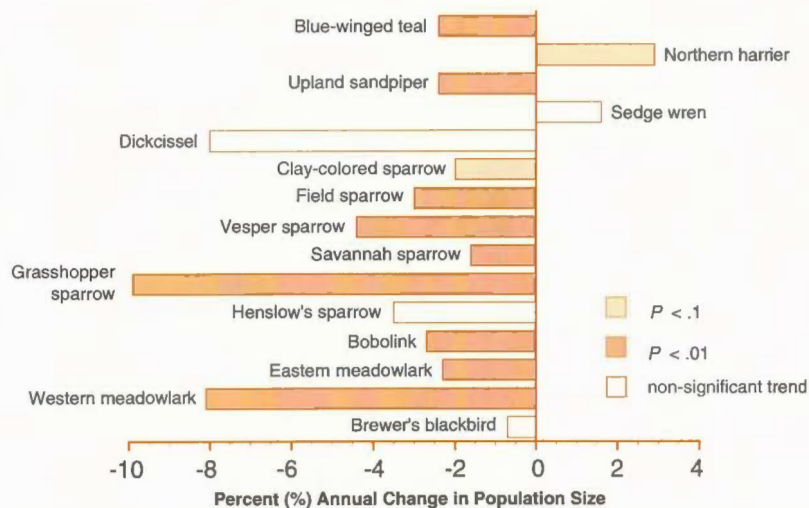
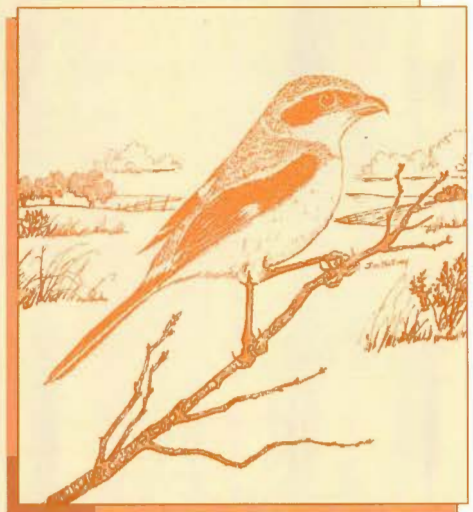


FIGURE 2. Population trends of grassland bird species of management concern in Wisconsin. Species are listed in taxonomic order. Data are from federal Breeding Bird Survey (BBS) routes in Wisconsin, 1966-1994 (U.S. Department of the Interior 1995). This figure includes only the 15 species for which Wisconsin BBS data are adequate. See Robbins et al. (1996) for a definition of adequate BBS data.

Of the top 25 species, we initially identified 23 as “species of management concern” (Table 3). They are all native grassland birds and all require grasslands during the breeding season. The remaining two species in the top 25—red-headed woodpecker and orchard oriole—are clearly deserving of conservation attention, but they are not species that **require** grassland habitats. They are species that were historically characteristic of savannas but that are now generalists found in a variety of habitats. In addition to the initial 23 species of management concern, we included three more—northern harrier, Brewer’s blackbird, and barn owl—for a total of 26 species. Northern harrier is an area-sensitive species that has generated concern among field ornithologists, in spite of its increasing trend on BBS routes. We know little about Brewer’s blackbird, which expanded its range into Wisconsin relatively recently, but it appears to be area-sensitive and is dependent upon grasslands in this state. Barn owl is one of two state-endangered grassland birds in Wisconsin (along with loggerhead shrike). It is a rare, area-sensitive species whose status is poorly known in the state (Matteson and Petersen 1988). These three species, in addition to the top-ranking 23 species that require grasslands, are shown in bold in Table 3. Figure 2 shows population trends for species of management concern for which adequate BBS survey data exists.

The lower-ranked species are also important for management focus and should not be allowed to “fall through the cracks.”



Loggerhead Shrike

The species of management concern reflect the full continuum of habitat structure required by grassland birds in Wisconsin, and they demonstrate the need to maintain a diversity of habitat types for the conservation of grassland bird populations in the state; no one or two habitats will accommodate the needs of all species of management concern. Even the top ten species of management concern in our ranked list encompass a wide variety of habitat preferences, such as:

- Dense wet meadow grasses and sedges (Nelson's sharp-tailed sparrow and yellow rail).
- Tall and dense grasses and forbs (Henslow's sparrow).
- Lush medium-height habitats (bobolink and savannah sparrow).
- Mesic or dry grasslands of moderate to low height (eastern meadowlark).

- Short and sparse herbaceous vegetation with exposed soil (grasshopper and lark sparrow).
- Habitats with scattered shrubs (loggerhead shrike and field and lark sparrows).
- Habitats with homogeneous structures (yellow rail).
- Habitats with diverse structures (lark and grasshopper sparrow).

Although the 26 species of management concern are listed in ranked order in Table 3, we do not suggest that management effort should focus only on the highest-ranked species. The lower-ranked species are also important for management focus and should not be allowed to "fall through the cracks" while we implement grassland management across the state. This list should be viewed as one of several tools for helping to focus conservation activities (Herkert et al. 1996).



DAVID SAMPLE

An example of diverse or heterogeneous vegetation structure in a fallow field, characterized by a mix of short and tall plants with uneven coverage and exposed soil. Other habitats that can have a similar structure include dry or sand prairie, some barrens, and dry oldfields on sandy sites.

GRASSLAND BIRD SPECIES OF MANAGEMENT CONCERN IN WISCONSIN

Measurements represent length from tip of bill to tip of tail, taken from Peterson (1980).

Blue-winged teal
male (15-16")



SCOTT NIELSEN

Northern harrier
female (17.5-24")



GREGORY K. SCOTT

Greater prairie chicken
male (17-18")



JAMES D. YOUNG

SCOTT NIELSEN



**Sharp-tailed
grouse**
male (15-20")

MICHEL ROBERTVIREO



Yellow rail
sexes similar (7")

WILLIAM GLASS



Upland sandpiper
*sexes similar
(11.5")*

**Wilson's
phalarope**
sexes similar
male (9")



CORNELL LAB OF ORNITHOLOGY/ISIDOR JEKIN

Short-eared owl
sexes similar
(13-17")
center right



LEROY R. PETERSEN



CORNELL LAB OF ORNITHOLOGY/JAMES WEAVER

Barn-owl
sexes similar
(14-20")
lower left



GREGORY K. SCOTT

Sedge wren
sexes similar
(4-4.5")
lower right



CORNELL LAB OF ORNITHOLOGY S. PETTINGILL



KATHRYN KIRK

Loggerhead shrike
sexes similar (9")

left

Bell's vireo
sexes similar (4.5-5")

right



STEPHEN KIRKPATRICK



CORNELL LAB OF ORNITHOLOGY M. & B. SCHWARZSCHILD

Dickcissel
male (6-7")

left

Clay-colored sparrow
sexes similar (5.25")

right



STEPHEN J. LANG



CORNELL LAB OF ORNITHOLOGY S. PETTINGILL

Field sparrow
sexes similar (5")

left

Vesper sparrow
sexes similar (6")

right

Lark sparrow
sexes similar
 (5.5-6.5")

left



CORNELL LAB OF ORNITHOLOGY/A. PAFF

Savannah sparrow
sexes similar
 (4.5-5.75")

right



GREGORY K. SCOTT

Grasshopper sparrow
sexes similar
 (4.5-5.25")

left



STEPHEN J. LANG

Henslow's sparrow
sexes similar
 (4.75-5.25")

right



CORNELL LAB OF ORNITHOLOGY/B. D. COTTRILL

Le Conte's sparrow
sexes similar
 (4.5-5.25")

left



G. LASLEY/WIREO

Nelson's sharp-tailed sparrow
sexes similar
 (5-6")

right



R. CURTIS/WIREO



STEPHEN J. LANG



GREGORY K. SCOTT

Bobolink
male (6-8")
 left

Eastern meadowlark
sexes similar (9")
 right



CORNELL LAB OF ORNITHOLOGY/MARY TREMAINE



A. & E. MORRIS/WIREO

Western meadowlark
sexes similar (9")
 left

Brewer's blackbird
male (9")
 right

Habitats

We ranked grassland bird habitats based on three major criteria:

- Current and potential importance to breeding grassland birds (and secondarily to other biota)—current value to grassland birds received more weight than potential value, which can only be realized through future management
- Rarity
- Vulnerability to threats

Combinations of these three criteria resulted in 12 ranked habitat categories (Table 4), ranging from habitats that are “important to birds, uncommon, and vulnerable” to habitats that are “not important to birds, common, and secure.”

By managing for high priority habitats, managers can provide for the habitat needs of all high priority grassland bird species. Note that there are no habitats in categories 3 (important to birds, uncommon, and secure) or 5 (important to birds, common, and secure), revealing that no habitats that are important to grassland birds are secure, whether uncommon or common. The habitats of greatest value to birds are all in the vulnerable categories, and all native habitats are in the uncommon category.

Because habitats are ranked based on their importance to grassland birds, the rankings do not accurately reflect the value of those habitats to other bird species and communities. For example, while sedge marshes rank lower than sedge meadows and other habitats in their importance to grassland birds, they may be of great importance to some wetland species of conservation concern, including black terns.

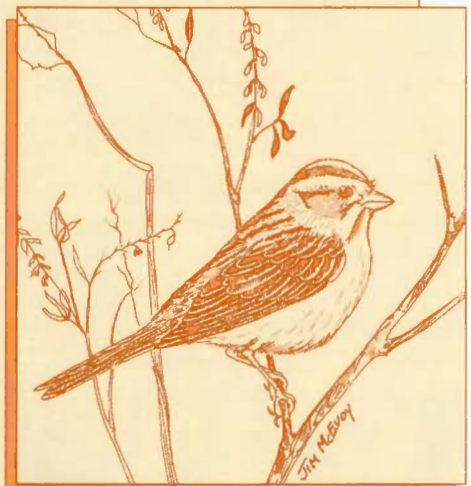
High ranking habitats include both native and surrogate grasslands. A variety of factors contribute to their value:

- Diverse and open barrens, dry or sand prairie, short idle fields of mixed grasses and forbs, medium-height idle fields of mixed grasses and forbs, lightly to moderately grazed pastures, and dry old fields typically attract diverse grassland bird communities.
- Southern sedge meadows and tall idle fields of grasses and forbs attract less diverse grassland bird communities but are important to some habitat specialists.
- Open, diverse, and brush prairie barrens, northern sedge meadows, and open bogs are native habitats often occurring on large tracts or in large open landscapes. They attract species requiring large areas,

The habitats of greatest value to grassland birds are all vulnerable, and all native habitats are uncommon.

•

To promote overall biodiversity we should expand, improve, and buffer remnants of native grassland vegetation, and encourage large-scale restorations.



Clay-colored sparrow

Table 4. *Ranking of all grassland communities according to management priority.^a*

Rank	Category	Habitat Type^b
1	Important to birds^c, uncommon, vulnerable	Open barrens Diverse barrens Northern sedge meadow Southern sedge meadow Dry or sand prairie (most sites are small and will benefit from expansion, restoration, and buffering by idle grassland) Idle warm season grass/forb - medium Idle warm season grass/forb - tall Idle cool season grass/forb - short Idle cool season grass/forb - medium Upland shrub See comments under Rank #9
2	Important to birds, common, vulnerable	Pastures (light to moderately grazed) Dry old field
3	Important to birds, uncommon, secure	No habitats in this category
4	Somewhat important to birds, uncommon, vulnerable	Wet-mesic or wet prairie (large sites only; many sites are too small and isolated to be of high value unless buffered by idle grasslands or established in large restorations) Brush prairie barrens Open bog Oak or river barrens Northern sedge marsh Southern sedge marsh Oak savanna Wet old field Mossed bog (see text) See comments under Rank #9
5	Important to birds, common, secure	No habitats in this category. See comments under rank #12
6	Somewhat important to birds, common, vulnerable	Fallow fields Shrubby wet old field Shrub swamp Small grains
7	Somewhat important to birds, uncommon, secure	No habitats in this category
8	Somewhat important to birds, common, secure	Cut- or burned-over Young conifer plantation Idle cool season grass/forb - tall
9	Not important to birds, uncommon, vulnerable	Dry-mesic prairie (most sites are too small and isolated; could move to rank #1 when buffered by idle grassland habitats, embedded in large open grassland landscapes, or established in large restorations) Conifer barrens (typically small sites; management for large sites through expansion and restoration would move this to rank #4)
10	Not important to birds, common, vulnerable	No habitats in this category
11	Not important to birds, uncommon, secure	Orchard Park or golf course
12	Not important to birds, common, secure	Alfalfa or legume hay Grass or grass/legume hay Row crops

] move to rank #5 if haying is delayed past 15 July.

^a Priority ranking system based on the rarity matrix developed by Rabinowitz (1981).

^b Habitats are not ranked within each category. Habitat types are the same as in Table 1 and Appendix E.

^c "Birds" refers to grassland species only, particularly species of management concern.

have high current value to birds, and require relatively little effort to be maintained or restored, compared with other native grassland habitats.

- All types of prairies, as well as oak or river barrens and savannas have high potential value to birds through expansion and restoration of presently degraded or small habitat patches or through buffering with other suitable grassland habitats. Although potentially important habitats for birds, relatively few of these habitats currently exist.

Short and medium-height idle cool season grasses and forbs, which are typically composed of non-native species, rank very high. Fields of this habitat type are usually less expensive to establish than native warm-season grasses and forbs. However, to promote overall biodiversity we should expand, improve, and buffer remnants of native grassland vegetation, including native cool-season and warm-season grasses, or encourage large-scale restorations when feasible.

Most prairie remnants (shown here is Westport Drumlin Prairie State Natural Area in Dane County) occur as small islands in agricultural landscapes. Buffering such remnants with idle grasslands, restored prairie, and other suitable grassland habitats will increase the value of such sites for grassland birds.



MICHAEL MOSSMAN

WISCONSIN GRASSLAND BIRD HABITATS

These photographs show examples of some of the grassland habitats we discuss in this guidebook. Bird communities associated with these habitats are shown in Table 1. Appendix E contains more detail about the characteristics of these habitats.



DAVID SAMPLE

Fallow fields have been plowed within the last three years. These habitats have some bare soil and lots of weeds (both grasses and forbs). Photo from Rock County.



MICHELLE JESKO

Alfalfa or legume hay are fairly young hay fields where the planted legumes make up more than half of the vegetation cover and where grass cover is low. This photo from Dane County shows alfalfa; other legumes in this habitat type include red clover and birdsfoot trefoil.



LEPOV PETERSEN

Grass or grass/legume hay fields have a larger proportion of grass and forbs that are not legumes, such as the dandelions shown in this photo. Timothy, smooth brome, and orchard grass are the most common grasses. Photo from Dane County.

Pastures (heavily grazed) have very short vegetation due to a high density of livestock. This photo shows heavily grazed grass sod in the foreground and lower right, with thistles that the cattle have avoided, grading into a heavily grazed lowland, with sedge hummocks visible in the center of the photo.



ROBERT READ

Pastures (moderately grazed) have vegetation of medium height and density. Photo from Oconto County.



MICHAEL MOSSMAN

Pastures (lightly grazed) have relatively tall grasses and forbs. This photo from Columbia County show thistles and other forbs in bloom.



MICHAEL MOSSMAN



MICHELLE JESKO

Pastures with shrubs and trees typically show this diversity of structure. This field in Iowa County is heavily grazed, with the variation in height at ground level resulting from lush growth of grasses on cow pies. Shrub-dependent birds such as loggerhead shrikes like this habitat.



DAVID SAMPLE

Idle cool season grass fields have a high proportion of typically non-native grasses (such as Kentucky bluegrass, timothy, and quack grass) and always some forbs. These fields are usually retired hay fields or pastures or planted for wildlife habitat. This photo, from Pine Island Wildlife Area in Columbia County, shows a medium-height field.



LISA DLUTKOWSKI

Idle warm season grass fields are like idle cool season grass fields but are composed of typically native grasses (such as big and little bluestem, Indian grass, and switchgrass) and forbs. They are usually medium to tall height. This field is in Swan lake Wildlife Area in Columbia County.

Dry old fields are former cropland (out of production for more than three years) on upland soils, now dominated by perennial grasses and lots of forbs. This field, in Mud Lake Wildlife Area in Columbia County, grades into upland shrubs in the background.



DAVID SAMPLE

Upland shrub fields are grass-dominated with a light cover of scattered shrubs. They can succeed from many different histories, usually agricultural. This retired pasture is part of the Nature Conservancy's Thomson Prairie in Iowa County.



SCOTT SAUER, THE NATURE CONSERVANCY

Shrubby wet old fields are fields of grasses and forbs mixed with a light cover of lowland shrubs. This example in Dane County shows more shrub cover than is useful for grassland birds.



DNR ARCHIVES



LISA DUTKOWSKI

Dry sand prairies are remnant communities of native grasses and forbs on sandy or droughty soils, possibly with some scattered shrubs. Fields of most value to grassland birds are not on steep slopes. This photo shows Butenhoff Prairie in Green County.



DNF ARCHIVES

Dry-mesic prairies have slightly taller vegetation than dry sand prairies. This site has dry-mesic prairie with a few invading shrubs and saplings.



RICHARD HENDERSON

Wet-mesic prairies, along with wet prairies, typically have the tallest vegetation of prairie types. This example is Faville Prairie State Natural Area in Jefferson County.

Southern sedge meadow has dense, homogeneous vegetation, mostly broad-leaved sedges. While sedge meadows have the hydrologic characteristics of a wetland, their vegetation structure supports grassland birds. This example is in Swan Lake Wildlife Area in Columbia County.



LISA DUTKOWSKI

Northern sedge meadow is typically dominated by wiregrass sedges. Many extensive tracts of northern sedge meadow still exist, such as this site, Reeds Lake Sedge Meadow, at Crex Meadows Wildlife Area in Burnett County.



MICHAEL MOSSMAN

Southern sedge marsh is similar to sedge meadow, but with some open water and emergent plants. Sedge marsh supports both wetland birds and grassland birds that are habitat specialists. This example is in St. Croix County.



MICHAEL MOSSMAN



MICHAEL MOSSMAN

Northern sedge marsh, like northern sedge meadow, is often found in large landscapes, such as this one in Crex Meadows Wildlife Area in Burnett County.



WILLIAM VANDER ZOUWEN

Shrub swamps are not former cropland. They are sedge meadows with shrubs typically covering less than half of the area. This site in Dodge County has somewhat more shrub cover than is ideal for grassland birds.



MICHAEL MOSSMAN

Open bogs are floating mats of vegetation with few trees. This is another wetland habitat that supports grassland birds because of its vegetation structure, which includes sedges, sphagnum moss, and low shrubs. This bog is in the Sylvania Wilderness Area, just across the border in Michigan's Upper Peninsula.

Oak savannas can have a wide variety of herbaceous understory vegetation associated with scattered, mature, open-grown oaks. Almost all of the remaining oak savanna has non-native understory, like this site in Iowa County.



MICHAEL MOSSMAN

Oak savanna with shrubs have fewer of the open grassland bird species than those without shrubs, but they include some additional species. Both types of savannas attract some grassland birds and other species that require mature trees for nesting. This example is in Dane County.



RICHARD HENDERSON

Open barrens are large expanses of prairie-like vegetation on sandy soils that have been recently burned. They are most common in northern Wisconsin and typically have only very short woody vegetation. This site is in Bayfield County.



LISA HARTMAN



ERIC EPSTEIN

Diverse barrens are large landscapes in northern Wisconsin that consist of mixed patches of open areas, woods, and shrubs. Like all barrens, this habitat is maintained through prescribed burning. This is the Solon Springs Sharptail Barrens State Natural Area in Douglas County.



ERIC EPSTEIN

Brush prairie barrens are prairie-like areas in northern Wisconsin with oak grubs and other shrubs stunted by regular burning. This is Namekagon Barrens in Burnett County.



MICHAEL MOSSMAN

Oak/River barrens are primarily found on the sandy terraces along the Wisconsin and Chippewa rivers and parts of Glacial Lake Wisconsin. They are like oak savannas, but typically with Hill's and bur oaks, red cedar, and jack pine. This site is in the Tiffany State Wildlife Area in Buffalo County.

Conifer barrens are savanna-like areas on sandy soils, typically with scattered jack pine and some hard woods. This is Moquah Barrens in Bayfield County.



MICHAEL MOSSMAN

Cut/burned-over areas are former forests where the regrowth is less than 10 ft tall. This example is in Adams County.



MICHAEL MOSSMAN

Young conifer plantations are fields planted in conifers less than 10 ft tall.



DNR ARCHIVES

*There he sits;
his whole being says it's your next move to absent
yourself from his domain. The county records
may allege that you own this pasture, but the
plover airily rules out such trivial legalities...
The upland plover fits easily into the agricultural
country-side. He follows the black-and-white
buffalo, which now pasture his prairies, and finds
them an acceptable substitute for brown ones.*

—Aldo Leopold, *A Sand County
Almanac and Sketches Here and
There* (Leopold 1949)

GUIDELINES AND RECOMMENDATIONS FOR HABITAT MANAGEMENT



To effectively manage grassland bird habitats in Wisconsin we should know as much as possible about habitat requirements for individual species and communities as well as the factors that influence habitat selection and the ability of populations to sustain themselves.

Each grassland bird species has a particular range of habitat conditions to which it is well suited (Wiens 1969, Sample 1989). Because grassland bird habitat requirements are diverse, management designed to benefit one or a few species will not adequately accommodate the needs of all other species. Effective management produces a diverse spectrum of habitats across the state and takes into account amount of habitat, habitat size and shape, habitat distribution, surrounding land use, woody cover and edge issues, habitat structure, disturbance patterns, and the impacts of land management practices. The following sections provide guidelines and recommendations for all of these topics.



Yellow Coneflower

Because grassland bird habitat requirements are diverse, management designed to benefit one or a few species will not necessarily benefit all other species.

Grassland bird habitat should be managed at three different scales: large landscapes of more than 10,000 acres, medium landscapes of intermediate size, and small blocks of 40-1,000 acres.



Yellow rail

Amount of Habitat

We estimate that a total of roughly 3 million acres of potentially suitable agricultural grassland habitat now exists in the state, excluding roadsides. This figure undoubtedly varies from year to year, as it includes an annual average of approximately 620,000 acres of lightly to moderately grazed pasture (one-third of the total pasture acreage in the state), 630,000 acres of small grains, 940,000 acres of old fields, fallow fields, unharvested cover crops, and idle cover crops (U.S. Department of Commerce 1994), 200,000 acres of late-cut hay (cut after early July—mostly grass hay), and approximately 620,000 acres of grassland in the Conservation Reserve Program (CRP). Since we do not know much about the quality of this habitat for birds (i.e., what proportion of fields are of adequate size and shape, how much of the surrounding habitat is suitable for birds), we conservatively estimate that roughly one-half of this total acreage of agricultural habitat, or 1.5 million acres, is currently suitable—and potentially high quality—habitat for grassland birds.

In addition to this agricultural habitat, a recent inquiry to land managers in Wisconsin indicates that we currently have approximately 120,000 acres of permanent, publicly owned and leased grassland habitat in blocks of 100 acres or greater in the state (D. Sample, unpublished data). The amount of grassland in blocks smaller than 100 acres is unknown but may equal or exceed another 120,000 acres, which would bring the total amount of permanent, non-agricultural grassland in the state to 240,000 acres. As with agricultural lands, the acreage that is high-quality for grassland birds may be less than this total.

By combining the information above, the total amount of potential agricultural and permanent habitat for grassland birds in Wisconsin is conservatively estimated to be approximately 1.7 million acres. We suggest, based on professional judgement, maintaining these suitable agricultural and permanent grassland habitats along with an additional 250,000 to 750,000 acres of managed grassland bird habitat in permanent cover. These additional acres should fit the recommendations for grassland habitat established in this guidebook and would include improvements to and expansions on current public properties managed as grasslands (such as DNR Wildlife Areas and State Natural Areas), some additional land acquisition and leases, and significant amounts of privately owned grasslands—such as those with permanent conservation easements.

As a general guideline, additional habitat managed for grassland birds should be distributed throughout the state as follows: Southwestern Upland 25%, Southeastern Ridges and Lowlands 20%, Central Plains 15%, Lake Michigan Shoreland 10%, and Northern Highland/Lake Superior Lowland 30%.

Habitat Size and Shape

Most of the agricultural and grassland landscapes in Wisconsin are highly fragmented, characterized by a patchwork of fields, woodlots, hedgerows, farmsteads, and other habitats and land uses. Large open expanses of grasslands are the exception and not the rule. Because of the fragmented nature of these landscapes, habitat size becomes a management issue for grassland birds.

There are a number of grassland species that require large tracts of habitat; these are the area-sensitive species. Species requiring areas more than 250 acres—or in some cases even 500 acres—in size throughout their breeding ranges include greater prairie-chicken, sharp-tailed grouse, northern harrier, possibly upland sandpiper, and barn owl. Our observations indicate that yellow rail, Wilson's phalarope, short-eared owl, and Nelson's sharp-tailed sparrow are also restricted to large sites in Wisconsin. Other research in Wisconsin indicates that Brewer's blackbird is area-sensitive as well (Niemuth 1995). Additional species described as area-sensitive in other midwestern and eastern states are sedge wren, vesper, savannah, grasshopper, and Henslow's sparrow, bobolink, eastern meadowlark, and western meadowlark (Samson 1980, Johnson and Temple 1986, Bollinger and Gavin 1992, Herkert 1994, Vickery et al. 1994). However, in Wisconsin we found all these species in a wide range of field sizes. Area requirements of species may vary geographically (Herkert et al. 1996), and methods used to determine habitat size have differed among studies.

The area required for a healthy, viable grassland bird population is not well known, but it is surely larger than the field size required for a particular grassland bird species to select and occupy a site, which is the focus of most research on minimum area requirements. In one of the few population viability analyses for a grassland bird species, Temple (1992) estimated that an isolated population of sharp-tailed grouse in Wisconsin would require a patch of suitable habitat at least 10,000 acres in size. While this species occurs on much smaller sites in the state, those populations

may not be viable. Therefore, minimum area requirements can not be used alone to determine adequate habitat size for a viable population.

Grassland bird habitat should be managed at three different scales: large landscapes of more than 10,000 acres, medium landscapes of 1,000 to typically around 5,000 acres but potentially up to 9,000+ acres (Sample et al. 1994, Henderson and Sample 1995), and small blocks of 40-1,000 acres.

Large-scale and medium-scale management areas foster the health of grassland bird communities and bird species that have varying degrees of area sensitivity. Large areas also typically contain greater natural variation in habitat structure, soil type, and topography than small areas. Some existing large landscapes are mostly publicly owned, but most new large landscapes will likely be a combination of private and public land. Most should be located in areas that were historically native grasslands to take advantage of the land formations, climate, and ecological features that naturally support management of open grassland habitat. However, some areas of cleared forest or former wetlands that are currently important to grassland birds, such as the Buena Vista/Leola Grasslands and the Clark/Marathon/Taylor county area, should also be considered.

Large-Scale Landscapes

Large-scale management areas should be at least 10,000-50,000 acres in size. Overall, large landscapes should incorporate extensive areas of open treeless grasslands. However, landscapes larger than 10,000 acres can also accommodate both open grasslands and some areas of upland shrub and savanna habitats that are consistent with pre-settlement conditions or do not conflict with grassland management goals. Large-scale landscapes can thus provide habitat for a more diverse bird community than most smaller landscapes.

Most of the land in these large areas can remain in private ownership, with compatible agricultural uses, but the core of the project should be an area of permanent grassland at least 2,000 acres in size. Securing this core grassland

for new areas may involve some acquisition and permanent conservation easements. At least 35% of the land within the rest of the management area should be in permanent or long-term grass cover including pasture, long-term set-aside such as CRP land, conservation easements, prairie remnants, and other idle grasslands—75% of which should be in blocks of 40 acres or more scattered throughout the area. The remainder (52% of the total project area) could stay in active crop production, ideally in small grains and hay (cut after 15 July or adjacent to idle grass cover). Removal of most linear tree and shrub cover, especially in fencelines and roadsides, should be encouraged throughout the management area, especially around the core grassland area, which will reduce the amount of potential nest parasite and predator habitat (Henderson and Sample 1995, Fitzgerald 1996).

Medium-Scale Landscapes

Medium-scale management areas should be at least 1,000-5,000 acres in size. These areas should have a 250-1,000 acre core of permanent grassland, with 35% of the remaining land in permanent grass cover and the rest in productive agriculture—roughly the same proportions as for large-scale areas. In medium-scale landscapes that encompass local concentrations of prairie remnants and pastures on unplowed, original prairie sod,

a management goal should be to restore as much of the intervening land to prairie as feasible. Medium-scale grassland areas are best suited to landscapes where large-scale areas are not feasible, or where the extent of suitable landscape is limited.

Small Blocks

The general rule of thumb for grassland management units—at all scales—is the larger the better, even for small blocks of land. **Blocks of grassland habitat should be at least 40 acres in size.** Blocks of 80-250 acres are preferable to smaller blocks, and blocks of 250-1,000 acres are the most desirable in this size category. Small blocks should not be isolated on the landscape, but concentrated as closely together as possible, preferably adjacent to or connected by other suitable grassland habitat such as idle grassland or pasture. Blocks less than 40 acres in size may be valuable if located directly adjacent to suitable idle grassland habitat similar to the managed block so that the total amount of grassland is more than 40 acres.

Habitat blocks should approximate circle or square shapes to minimize the edge-to-interior ratio as much as possible. **Habitat strips should be at least 220 yards wide for the same reason** (Figure 3). The aim here is to reduce the negative effects of increased nest predation, parasitism, and possibly competition near edges.



MICHELLE JESKO

Extensive landscapes of idle grassland, such as this Dane County farmland enrolled in the CRP, are used by a number of grassland birds of management concern. Many of these landscapes are large enough to attract area-sensitive species such as northern harrier, upland sandpiper, and short-eared owl. Idle grasslands play an important role in large- and medium-scale landscapes.

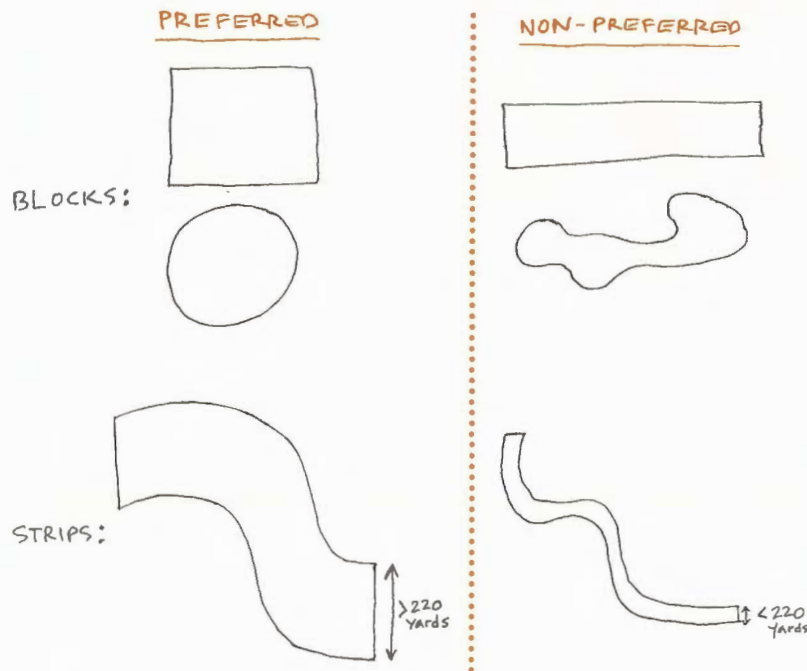


FIGURE 3. When planning small blocks or strips of grassland habitat, keep in mind that some shapes and proportions are better for grassland birds than others.

Habitat Distribution

When planning the distribution of blocks of grassland habitat in large areas or landscapes, it is important to consider the predominant land uses and development patterns of the area, as well as other ecological factors. This will maximize the benefits to grassland birds and will wisely use limited time and money available to resource managers.

There are two major ways to distribute habitat across landscapes: consolidated (clumped) and scattered. The aim of both is to maximize the amount of grassland bird habitat in large blocks. We suggest that managed grassland habitat blocks should be scattered in landscapes where the predominant surrounding land uses already are dominated by suitable grassland habitats. Buena Vista/Leola Grasslands is a good example of such a landscape, although increasing acreage devoted to irrigated row crops and

The general rule of thumb for grassland management units—at all scales—is the larger the better, even for small blocks of land.



Short-eared owl

Because grassland birds are influenced by land uses adjacent to blocks of managed habitat, effective habitat size is really the management block plus the amount of suitable grassland habitat adjacent to or very near the managed block.



Le Conte's sparrow

cranberry bogs are changing the landscape make-up there. In this scenario, there is a good likelihood that any managed grassland parcel will be close to and complement the existing suitable habitat. Siting decisions should maximize the use of adjacent suitable habitat whenever possible.

Habitat blocks can be consolidated in two different kinds of landscapes:

- Landscapes that are intensely agricultural or primarily urban and suburban, such as much of the intensively agricultural southeast.
- Landscapes that offer special opportunities for the preservation of large areas of existing idle grasslands, such as open, diverse, and brush prairie barrens and sedge meadows in the Crex Meadows/Fish Lake area.

In the case of intensively agricultural areas, little suitable habitat already exists in the landscape. It may be necessary to initiate several large-scale plantings or native grassland restorations (at least 500-1,500 acres) to create enough quality grassland habitat in one landscape. However, as we suggested above, many of these landscapes are inappropriate for grassland management for social or economic reasons. Some of the existing large landscapes with lots of suitable, idle grasslands will be appropriate for either scattered or consolidated habitat distribution.

Surrounding Land Use

Effective Habitat Size

Habitat size can be defined in various ways in grasslands, and the way in which it is defined affects conclusions about bird habitat size requirements. For example, consider two prairie remnants, both of the same size: one is in a landscape of pastures, old fields, small grains, some row crops, and disturbed wet meadows with little or no woody cover; the other is in a landscape of farmsteads, woodlots, and hedgerows surrounding small crop fields. While it is easy to establish the actual size of each prairie remnant it is difficult to define the "effective" habitat size—that is, the habitat size as it is used by birds that occupy the remnant. In the case of the prairie surrounded by hedgerows, woodlots, and farmsteads, the effective size of the suitable grassland bird habitat may be the size of the remnant itself. In the other case, the entire landscape—including the remnant, small grains, pastures, old fields, and row crops—may be the effective habitat size. Therefore the character of the surrounding land use may affect bird occupancy of a habitat patch. In some

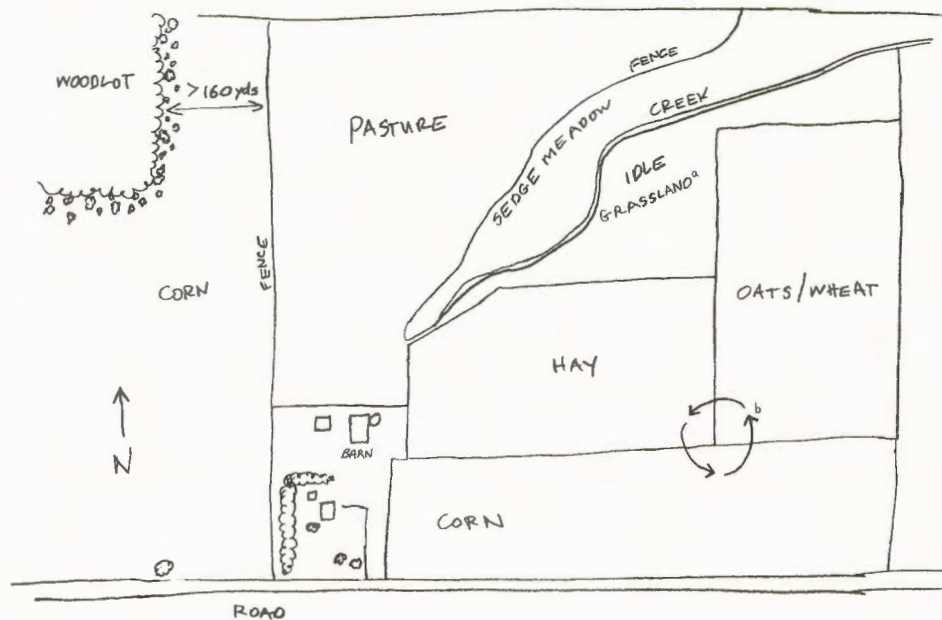


FIGURE 4. An example of an idealized arrangement of habitats on a Wisconsin farm.

^a Grassland habitat that is not disturbed during the breeding season (e.g., old field, set-aside, conservation easement).

^b Arrows symbolize rotation of crops.

cases the nature of the habitat around a site may be more important than the field or patch size. Our preliminary research confirms this (Sample 1995).

Because grassland birds are influenced by land uses adjacent to blocks of managed habitat, effective habitat size is really the management block plus the amount of suitable grassland habitat adjacent to or very near the managed block. The placement and configuration of habitat blocks in relation to other habitat types becomes an important determinant of effective habitat size and of the species composition, species richness, and density of grassland birds that use the site. Examples of idealized arrangements of grassland habitats on a typical farm or Wildlife Area are presented in Figures 4 and 5. Note that managers should consider the degree of management control over—and the permanence of—suitable surrounding land uses. Some types such as CRP land may be less secure over the long term than others, such as grassland with a conservation easement.

Buffers of grassland vegetation between managed grassland habitat and either farmsteads

or woody vegetation can increase effective size. In particular, row crops, although not quality grassland bird habitat, can be used to buffer managed grassland habitat from woody edges and may therefore buffer against nest predation and parasitism. The presence of some row crops may be used in other cases to contribute to the overall size of a treeless landscape.

Suitable vs. Unsuitable Adjacent Habitats

The habitats listed in Table 1, page 12 are suitable grassland habitats for at least some grassland birds, with some general exceptions (discussed below). Idle grassland habitats are almost always of higher value as suitable habitat than those that are disturbed during the breeding season. The degree of suitability for any given grassland habitat depends in part on the targeted bird community or species. For example, the degree of acceptable woody cover depends on whether we are managing for bobolink or for field sparrow. Also, it would be less effective to manage a 25 acre parcel of idle, tall grassland with no woody cover next to a 30 acre oak or river barrens remnant than it would be to manage the idle grassland

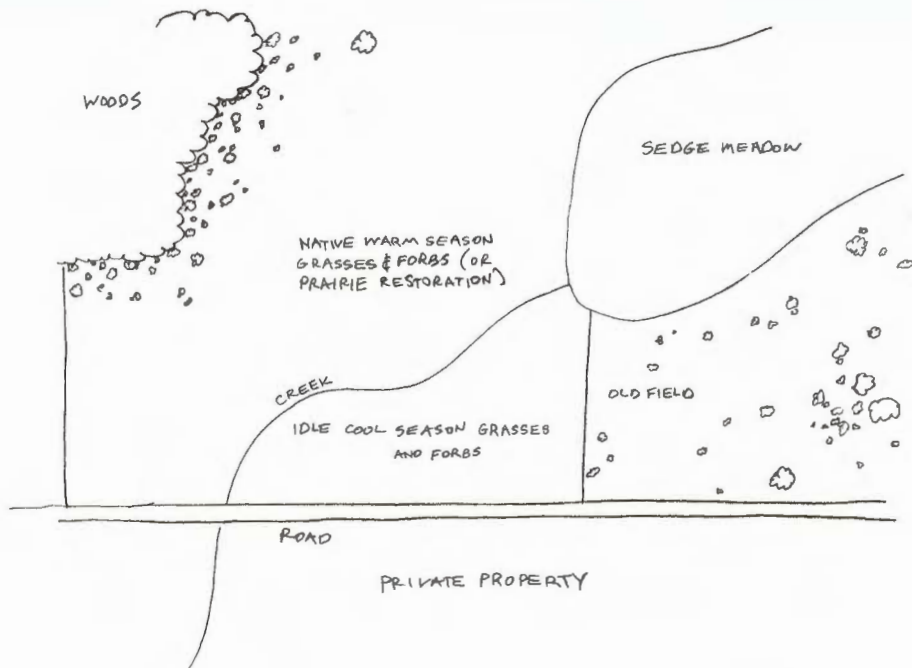


FIGURE 5. Idealized arrangement of habitats on part of a Wildlife Area managed for grassland birds.

Farmland with large expanses of grass-dominated hay, such as this farm in Buffalo County, are valuable for a number of bird species of management concern—especially because such fields are often mowed late enough in the breeding season for successful nesting to occur.



MICHAEL MOSSMAN

next to a large pasture, because the former two habitat types attract different kinds of bird species and do not function as well as a single large block of habitat.

Unsuitable habitats for grassland birds include grasslands with too much woody cover (i.e., generally more than 30% cover), habitats with abundant linear woody cover, farmsteads, and suburban developments. Row crops (although providing foraging habitat for some species), most parks, and golf courses are also unsuitable habitats; while they are used by some grassland birds they typically are not productive habitats. Since most hay is cut well before 15 July, hay should be avoided in general, especially in southern Wisconsin, unless mowing can be delayed. Grass-dominated hayfields that are typically cut late in the season are an exception to this rule. Concentrations of such fields exist in the northern half of the state, including Clark, Taylor, Marathon, Douglas, Bayfield, Ashland, St. Croix, and Door counties. The presence of idle grassland cover near hayfields may provide re-nesting habitat for birds displaced from a mowed field after cutting.

Woody Cover and Edge Issues

Blocks of open grassland habitat should be structurally open and relatively free of farmsteads and major linear woody edges such as woodlots, hedgerows, and woody fencelines that fragment the habitat and create edges for nest parasites, predator habitat, and corridors for predator movement. In most cases woody cover should be kept to a maximum of 5% of grassland habitat. This is especially true when management is focusing on obligate grassland species that do not require much if any woody vegetation. In such cases it is desirable to have the edge of any managed grassland habitat greater than 110 yards from any major woody edges or developments such as farmsteads and homes that are present in the area. In general, woody cover below 3.25 ft (1 m) high can exceed the suggested 5% maximum but should not exceed 20%.

However, the amount and type of woody vegetation depends largely on the targeted bird species or community as well as on the size of the management block. Scattered shrubs, shrubby patches, and small trees (less than 30% total cover and less than 10 ft tall) may be beneficial to shrub-grassland species, such as loggerhead shrike, Bell's vireo, and field and clay-colored sparrow. Oak savanna species such as American kestrel, red-headed woodpecker, eastern kingbird, and orchard oriole benefit from scattered mature, open-grown trees. Most other grassland species readily use small shrubs and trees as perches, even if they don't require them. For species that do require woody vegetation, irregular patterns of scattered woody plants and irregular, shrubby edges to woodlots are preferred over hard, linear edges (Ratti and Reese 1988) (Figure 6).

Idle grassland cover near hayfields may provide re-nesting habitat for birds displaced from a mowed field after cutting.



Bell's vireo

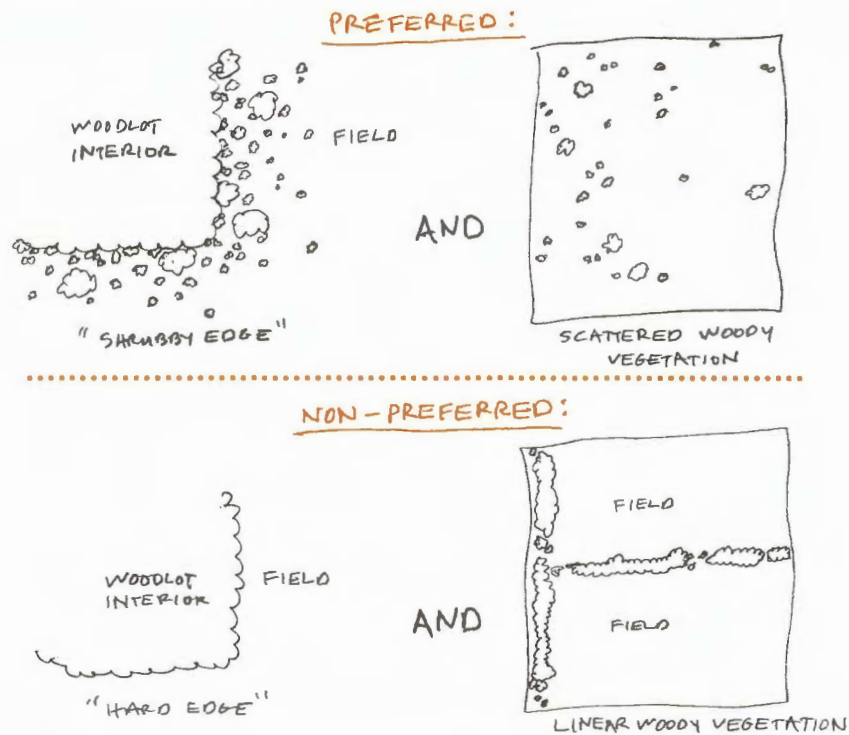


FIGURE 6. Some patterns of woody vegetation are better for grassland birds than others because they reduce negative effects of edges.

A typical fragmented agricultural landscape, in Waukesha County. Hedgerows provide abundant habitat and movement corridors for nest predators and perches for brown-headed cowbirds.



Habitat Structure and Other Features

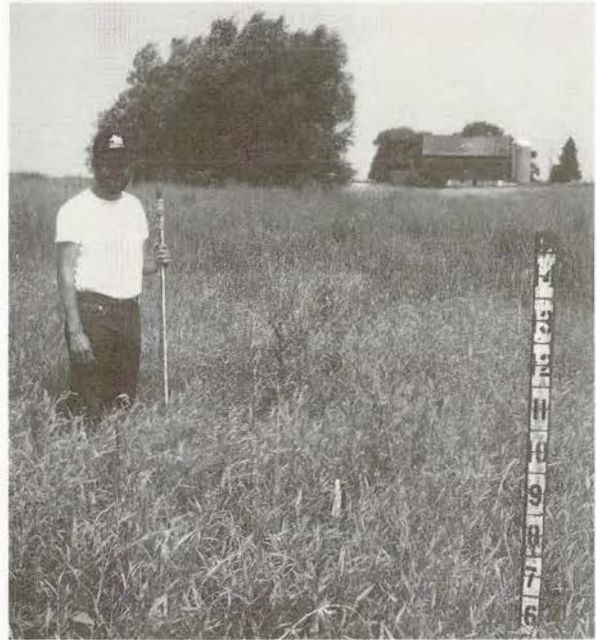
Differences in bird communities among habitats are largely determined by differences in habitat structure rather than by differences in plant species composition, although the two are certainly related. The following features of habitat structure are particularly important to grassland birds.⁹

- Vegetation height-density
- Height and cover of woody vegetation
- Litter depth and cover
- Cover of standing residual (dead) vegetation, cover of exposed soil, and cover of live herbaceous vegetation.
- Ratio of grass vs. forb cover

One of the most common ways to categorize grassland species is into three groups based on general vegetation height-density preference—shortgrass, midgrass, and tallgrass. However, while vegetation height-density is an important and easily measured structural feature of vegetation for grassland birds, for some species it may not be the most important feature affecting whether or not they occur in a given habitat or field. For example,

- For many of the species requiring woody vegetation, the type and quantity of woody cover and how it is arranged in a habitat is more important in determining habitat occupancy than the height-density of herbaceous vegetation (e.g., clay-colored and field sparrows readily use scattered shrubs, while Bell's vireo tends to prefer clumps or patches of shrubs).

⁹ See Table 5, page 58, and Appendix F, page 132, for detailed notes on habitat structural requirements for grassland bird species; see also Sample (1989) and Sample (1995) for a detailed description of structural variables and how they were measured.



MICHAEL MOSSMAN

Height-density of vegetation is measured with a Robel Pole, which is marked in 5 centimeter increments. An observer views the marked pole from a distance of four meters and from the top of a second pole 1.5 meters tall and records the lowest visible part of the marked pole, rounded to the nearest 5 centimeters.



LISA DLUTKOWSKI

A field of relatively homogeneous grass cover, with a Robel pole showing a height-density of 55 centimeters.

Diversity of vegetation structure and cover types should be promoted at a variety of scales.

•

The goal is a mix of habitats and landscapes, many diverse, some more homogeneous, with the result that the overall character of grassland habitat in the state is diverse.



Orchard oriole

- For some species requiring large areas, such as greater prairie-chicken, northern harrier, and short-eared and barn owl, the landscape's size, openness, and the existing combination and configuration of habitats within it are more important in determining habitat suitability than the height-density or other structural features of specific fields.
- For species requiring open water, such as waterfowl, the presence and type of wetlands in a favorable relationship to nearby grasslands may be the most important factor in habitat selection (see Appendix F, page 132).

Accordingly, grassland bird species of management concern are ultimately placed into one of six categories in Table 5 (shortgrass, midgrass, tallgrass, species requiring woody vegetation or nest structures, species requiring open water, and species requiring large areas), which includes brief descriptions of both the general and specific habitat features required by grassland birds. All grassland bird species (including those not of management concern) are placed in to one of the six categories in Appendix F, page 132.

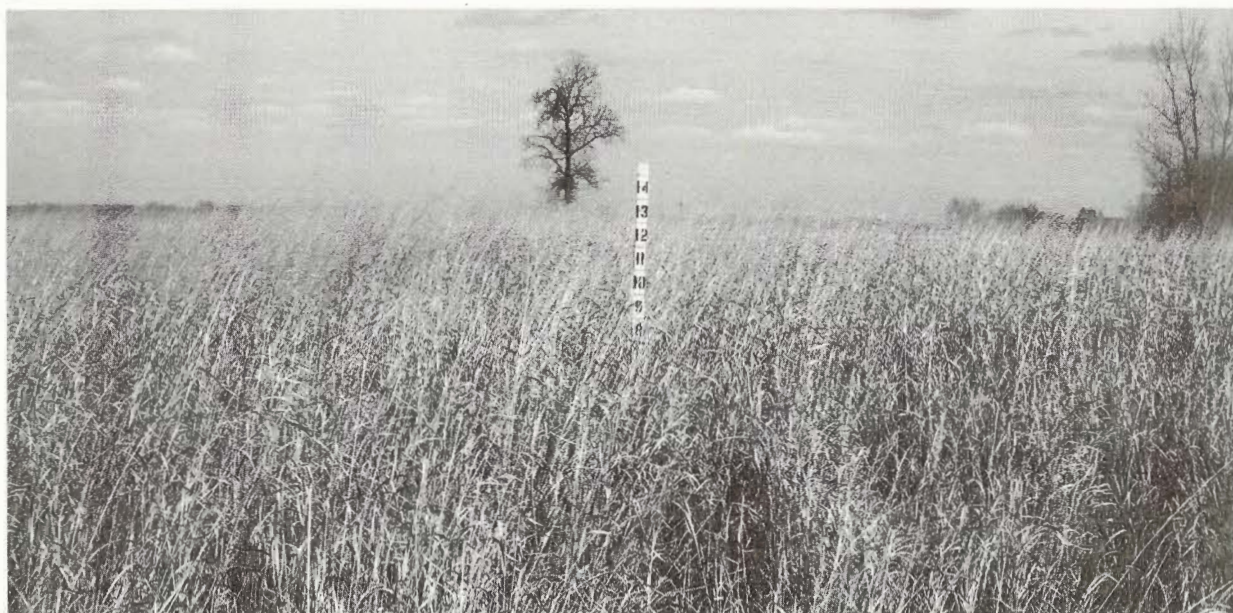
Grassland birds also may occupy suitable micro-sites within a larger, less suitable habitat patch, which complicates habitat description and ultimately species management. For example, a field of dense switchgrass—a tallgrass habitat that normally harbors such species as sedge wren; common yellowthroat; song, swamp, and Henslow's sparrow; and red-winged blackbird—may have small patches that are poorly established or weedy. These areas may be occupied by typical shortgrass species such as grasshopper or vesper sparrows. Most fields, particularly large ones, have variations in topography or soil type that affect vegetation structure, and these differences in structure are often reflected by subtle differences in bird community composition in a given habitat. Therefore, managing a field as a particular habitat type is no guarantee that only certain species or bird communities will occur there.

Diversity of vegetation structure and cover types should be promoted at a variety of scales: within most fields or blocks of habitat, among fields or blocks of habitats, within a landscape, within natural divisions, and within the entire state. Structural diversity can be reflected by differences in vegetation height and density, woody cover, amount of exposed soil, grass to forb ratio, litter depth and cover, and other variables. Natural factors such as soil type, hydrology, topography, and climate should be used to best advantage in producing diversity at all scales. Managers should maintain a spectrum of different field ages (for example fallow fields, old fields, and old and young plantings of grasses and forbs) by varying the length of disturbance cycles; this also encourages structural diversity among fields.

Much of the habitat managed as grassland in the state, especially in areas where soils are not dry, thin, or sandy, contains relatively tall and dense vegetation. Overall, there is a great shortage of grassland vegetation in the short and medium height-density categories.

Within a field less than 80 acres, only one cover type should typically be represented. Within that field, however, structural diversity can vary and should be achieved by planting diverse plant species, including roughly 10% forb cover. Fields or blocks of habitat greater than 80 acres may consist of either more than one cover type or a single cover type. The degree of diversity also varies depending on the target species or communities, some of which require large expanses of habitat with homogeneous structure. We end up with a mix of habitats and landscapes, many diverse, some more homogeneous, with the result that the overall character of grassland habitat in the state is diverse.

Standing residual vegetation, such as the switchgrass depicted in this photo at the Pieper WPA in Dodge County, is important in the spring for species such as Henslow's sparrow and sedge wren.



LEROY PETERSEN

Disturbance Patterns

Most grassland habitats in Wisconsin are in agricultural landscapes. During the breeding season, many of these habitats are subject to farming-related disturbances that may severely lower the reproductive performance of nesting grassland birds (Rodenhouse and Best 1983, Frawley 1989).

Even among bird species that nest early—such as meadowlarks and horned lark—or species that nest late—such as dickcissel and American goldfinch—there is substantial overlap between the peak nesting season and agricultural field operations, such as planting, cultivating, fertilizing, and harvesting (Best 1986, Frawley 1989). The conservation of undisturbed or idle habitats during the breeding season is therefore important to the conservation of grassland birds. Also, since most species prefer at least some residual vegetation in the spring, it is important that some sites are not harvested or burned following the previous fall or late summer. Species that require significant standing residual vegetation or litter layer in the spring—such as Henslow's sparrow or eastern meadowlark, respectively—prefer habitats that have not been disturbed since the previous spring.

Table 5. Habitat feature preferences of the 26 grassland bird species of management concern.^a

Grassland Species Groups ^b	Height-density of Herbaceous Vegetation ^c			Litter Layer ^d	Cover of Standing Residual Vegetation ^e	Grass:forb ratio ^f
	short (<15 cm)	medium (15-35 cm)	tall (>35 cm)			
SHORTGRASS SPECIES						
Vesper sparrow	x	(x)		low	low	medium
Grasshopper sparrow	x	(x)		medium	medium	medium
Upland sandpiper	x	(x)		medium	medium	medium
Western meadowlark	x	(x)		medium	low	medium
MIDGRASS SPECIES						
Savannah sparrow	(x)	x	(x)	medium	low	medium
Eastern meadowlark	(x)	x	(x)	high	medium	medium
Bobolink	(x)	x	(x)	medium	medium	medium
Dickcissel	(x)	x	(x)	medium	medium	low
TALLGRASS SPECIES						
Le Conte's sparrow		(x)	x	high	high?	high?
Yellow rail			x	high	high	high?
Nelson's sharp-tailed sparrow			x	high	high	high?
Henslow's sparrow		(x)	x	high	high	high
Sedge wren		(x)	x	high	high	high
SPECIES REQUIRING WOODY VEGETATION OR OTHER NESTING STRUCTURE						
Loggerhead shrike	x	(x)		medium?	low?	medium?
Bell's vireo	(x)	x?	(x)	medium	medium?	?
Clay-colored sparrow	(x)	x		high	medium	medium
Field sparrow	(x)	x	(x)	high	medium	high
Lark sparrow	x			low	low	high
Brewer's blackbird	x	(x)		low	low	high
SPECIES REQUIRING OPEN WATER						
Blue-winged teal	(x)	x	(x)	medium	low	high?
Wilson's phalarope		x	(x)	high	medium	high?
SPECIES REQUIRING LARGE AREAS (AREA-SENSITIVE)						
Northern harrier	(x) ⁱ	(x)	x	medium	medium	medium?
Greater prairie-chicken	x ⁱ	x	(x)	medium?	high?	high?
Sharp-tailed grouse	x ⁱ	x	x	medium?	high?	medium?
Barn owl	x	x	x	medium?	medium?	?
Short-eared owl	(x) ⁱ	(x)	x	high	high	high?

^a Information based on data and observations from the Wisconsin grassland bird study and from the midwestern grassland bird literature. Where data are lacking, conflicting, or inconclusive, a question mark appears.

^b See Appendix F for additional information on the habitat requirements of grassland bird species, including species not of management concern.

^c See Glossary for definition of height-density. x = most preferred categories; (x) = less preferred categories.

^d See Glossary for definition of litter layer. Categories (high/medium/low) refer to both the depth of litter and percent of ground surface covered.

^e Categories refer to both the height-density and percent of ground surface covered.

^f Cover of grasses (or sedges) in relation to forbs: high = >2.5:1 grass:forb, medium = 1:1 to 2.5:1 grass:forb; low = <1:1 grass:forb.

Cover of Bare Ground	Type	Woody Vegetation			Preferred Wetland Features (* = required)	Minimum Area Requirements ^h		
		% Cover ^g				low (^{<} 25 acres)	medium (25-250 acres)	high (^{>} 250 acres)
		none	low (^{>} 0-5%)	medium (5-30%)				
high	trees/shrubs	(x)	x	(x)		x?	x?	
medium		x	(x)	(x)			x?	
medium		x	(x)				x	x?
medium		x	(x)				x	x?
low		x	(x)					x?
medium	shrubs/trees	(x)	x	(x)		x		
medium		x	(x)				x	
medium		x	(x)			x		
low		x	(x)		wet sedge/grass meadows		x?	
low		x	(x)		*wet sedge/grass meadows			x?
low		x	(x)		*wet sedge/grass meadows			x?
low		x	(x)			x?	x?	
low		x	(x)		wet sedge/grass meadows		x?	
low?	trees/shrubs		x	(x)			x?	
low	shrubs		(x)	x		x?		
medium	shrubs		(x)	x		x		
medium	shrubs		(x)	x		x		
high	shrubs	(x)	x	(x)			x?	
high	trees/shrubs	(x)	x	(x)			x	
low		x	(x)		*open water	x		
low		x	(x)		*standing water; wet sedge/grass meadows			x?
medium		(x)	x	(x)	wet sedge/grass meadows		x?	x
medium?		(x)	x	(x)				x
medium?	shrubs		(x)	x				x
low?		(x)	x	(x)	forages over wetlands			x
low		(x)	x	(x)	forages over wetlands			x?

^g Percent of ground surface covered by woody vegetation canopy.

x = most preferred categories; (x) = less preferred categories.

^h Minimum area required for a species to be likely to occupy a site.

ⁱ Typically foraging habitat only.

^j Used for dancing or booming grounds.

Many agricultural habitats are subject to farming-related disturbances during the breeding season that may lower grassland bird nesting success. The conservation of undisturbed or idle habitats is therefore important.



Horned lark

Land Management Practices

Many management practices can be beneficial to grassland bird habitats. Because of the importance of idle grassland habitat it is generally important to rotate management through a given tract or area so that no more than approximately one-third of the land area is disturbed by any management technique or techniques in a given year (Herkert et al. 1996). Rotation of disturbances—such as mowing, grazing, harvesting, and burning—through subunits within a habitat block helps assure that some residual vegetation is always available for those species that require it. Rotation, especially in native grassland remnants, also provides refugia for potentially fire-vulnerable invertebrates and other fauna. It appears that a management subunit (i.e., the portion of a grassland block disturbed by management) may need to be at least 75 acres in size to maximize benefits for grassland birds (Herkert et al. 1996). In Wisconsin, most blocks of grassland habitat are not currently large enough to allow for subunits this size.

Mowing

Mowing is useful for controlling woody vegetation and weeds and can reduce the litter layer if cuttings are removed. Mowing can also alter plant species composition. For example, mid-summer mowing or burning of native warm-season grasses tends to suppress them and help develop and maintain native forbs, especially spring-flowering species, as well as cool-season grasses. Other native forbs are reduced by mid-summer mowing and benefit most from mowing or burning in the dormant season of early spring or late fall.

On private lands used for production agriculture, there are few recommendations that are currently both feasible to the farmer and beneficial to grassland birds. For example, delaying mowing until after 15 July is not likely to be considered by many dairy farmers—even with compensation—unless they are willing to let some fields go for use as feed for dry cows or other animals that do not require high-quality forage or if they want to let legumes re-seed themselves. One suggestion that has some merit is to cut hayfields from the inside out to allow escape routes for fledglings (Figure 7). In addition, locating idle nesting cover—such as old fields or set-aside lands—adjacent to hayfields provides alternate habitat for species that re-nest after mowing-induced failure of first nest attempts (Warner and Etter 1989).

On public and private lands managed for wildlife conservation purposes, it is advisable to delay mowing until after 15 July. Mowing after this date will allow most species a chance to raise at least one brood. However, in cases where late-nesting species such as dickcissels and sedge wrens are being managed for, mowing should be delayed until early August. If more than one mowing is conducted or if mowing is required after the breeding season for some other

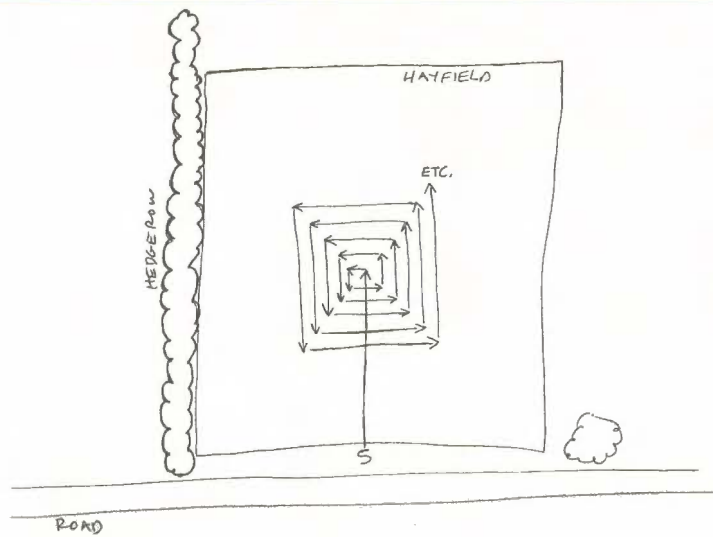


FIGURE 7. Diagram of mowing a hayfield from the inside out. Lines and arrows indicate the path of the tractor; "S" indicates the starting point.

purpose, the last mowing of the year should generally be early enough to promote some fall regrowth, which provides residual vegetation cover the following spring. This means mowing should be done by early September (for cool-season grasses) or early August (for warm-season grasses) in most years.

Grassland birds respond to mowing in various ways:

- Some species abandon fields mowed during breeding activities, including bobolink, red-winged blackbird, dickcissel, sedge wren, ring-necked pheasant, eastern meadowlark, and Henslow's and swamp sparrow.
- Some species remain in cut fields to renest or increase in density after mowing, including upland sandpiper, savannah, grasshopper, and vesper sparrow, western meadowlark, and horned lark.
- Some species colonize recently cut fields or fields prior to spring green-up, primarily to forage. These include mourning dove, killdeer, common grackle, American robin, red-winged blackbird, northern flicker, rock dove, European starling, upland sandpiper, eastern meadowlark, and house sparrow.
- Many species do well in habitats that are mowed in the late summer or fall (annually or every few years). Exceptions include those species that require substantial residual vegetation early in the spring: Henslow's sparrow, sedge wren, ring-necked pheasant, and mallard.

It is generally important to rotate disturbance through a managed field so that no less than two-thirds of the land area remains idle in a given year.



Bobolink

Burning

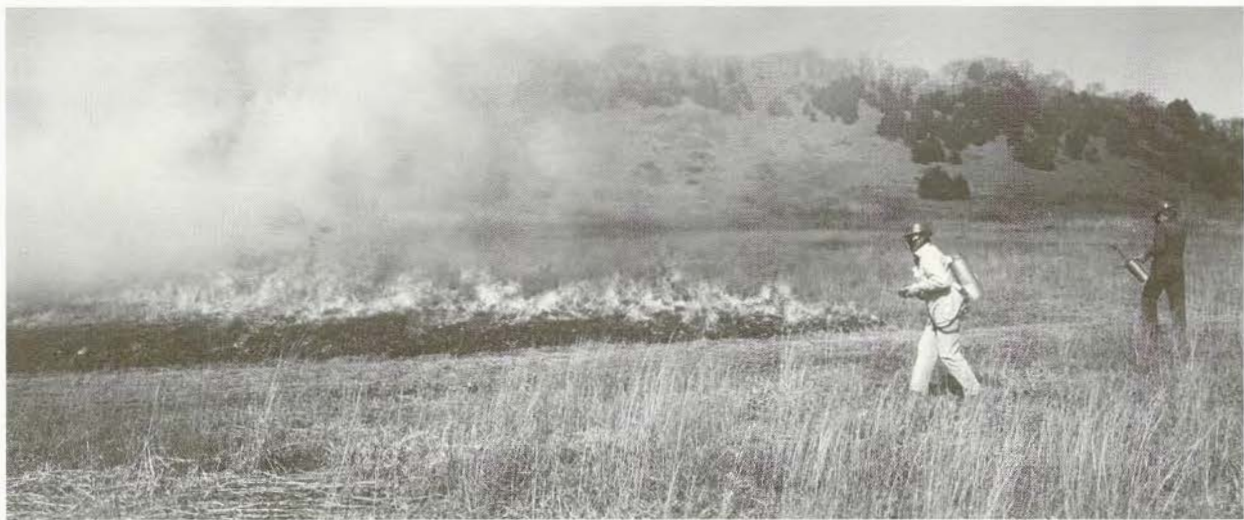
Burning is typically used to control woody vegetation over time, reduce litter build-up, and stimulate grass and forb production. The timing of a burn can also influence plant species composition: spring burns tend to suppress cool-season grasses and promote warm-season grasses, while the opposite is true of mid- to late-summer burns. Again, the effects of burning depend on the bird species or groups targeted and on the intensity and completeness of the burn. Burns scheduled outside the breeding season—in spring from March to late April and in fall from September to November—are generally best for birds. As with mowing, burning cool-season grasses before mid-September or warm-season grasses by early August allows for some regrowth before dormancy. Fall burns generally are less complete than spring burns, leaving more stubble on the ground. As with other disturbances, no more than one-third of large areas (more than 100 acres) or one-half of smaller areas should be burned in a given year. Or, if small areas are in close proximity (i.e., less than one mile apart), some fields can be burned in their entirety, while

leaving other sites unburned (Herkert et al. 1993). This alternative is not recommended for native grassland remnants where potentially fire-sensitive invertebrates may be a concern.

Early spring (March and April) burning affects grassland bird species in different ways. In the breeding season immediately following the burn, some species do very well in burned areas, while others do not:

- Species with a positive response (i.e., species colonize field or increase in density) include killdeer; upland sandpiper; horned lark; vesper, lark, and grasshopper sparrow; eastern meadowlark; and Brewer's blackbird.
- Species with a negative response (i.e., species abandon field, fail to colonize fields, or are reduced in density) include mallard; northern pintail; northern harrier; ring-necked pheasant; mourning dove; sedge wren; common yellowthroat; clay-colored, Henslow's, Le Conte's, song, and swamp sparrow; and red-winged blackbird.

Prescribed burning is a useful management tool for grasslands. Grassland bird species have variable responses to burning, but over the long term many species benefit from 3-5 year burning rotations. Shown here is a burn at Spring Green Reserve in Sauk County.



THOMAS MEYER

- Species reported to respond both negatively and positively include field and savannah sparrow, bobolink, and American goldfinch.

Over time, short spring burning rotations (every 1-2 years) reduce or remove woody vegetation and therefore lower the quality of habitat for species requiring shrubs or small trees. As shown above, one-year rotations also discourage species that require residual vegetation in the spring. Rotations of at least five years and longer tend to favor and maintain a woody component, such as upland shrub communities, and residual vegetation. Bird species that do not have significant requirements for litter or standing residual vegetation in spring will likely do well under short rotations, and most species appear adapted to moderate-length (3-5 year) burning rotations (Herkert et al. 1996).

Grazing

Grazing is used to control some species of woody vegetation, reduce litter build-up, and reduce vegetation height and density. Prickly and thorny shrub species, however, are actually encouraged by grazing (R. Henderson, DNR terrestrial ecologist, personal communication). Grazing results in a more diverse vegetation structure than either mowing or burning because of the uneven grazing patterns of cattle, which is related to factors such as the distribution of preferred and unpalatable plants and dung piles within pastures. Although grazing intensity can be varied, heavy grazing should be avoided. Light to moderate grazing is best. As a general guideline, leave more than 50% of grazed fields with a height of at least 10 inches (25 cm) or height-density measurements of at least 2-8 inches (5-20 cm). Defining grazing intensity and its effect on vegetation height and density in terms of stocking rate (animals per acre) is difficult, because of differences among years in precipitation and temperature and among sites in soil conditions and plant species composition (Skinner et al. 1984). All of these factors affect vegetation growth and therefore the amount of available forage, which in turn determines the appropriate stocking rate. In general, however, grazing at a rate of around 0.4-0.5 head of cattle per acre can be considered light grazing under average precipitation and soil conditions (George et al. 1979; D. Undersander, UWEX-Agronomy, personal communication; Sample 1995).

Native warm-season grass pastures can provide good habitat for a variety of grassland bird species (Skinner et al. 1984) and have the advantage of being left ungrazed until relatively late in the nesting season, when the forage quality of cool-season grass pastures has declined. However, warm-season pastures may require special management to maintain the warm-season grasses over time, such as by limiting the period of intense grazing in

Most grassland bird species seem to be adapted to moderate-length (3-5 year) burning rotations.

Although grazing intensity can be varied, heavy grazing should be avoided. Light to moderate grazing is best.



Vesper sparrow

Large pastures that are lightly or moderately grazed, such as this one in Monroe County, provide good habitat for a number of species of management concern.



MICHAEL MOSSMAN

Large moderately grazed pasture in Marinette County.



MICHAEL MOSSMAN

summer and by burning in late April or early May (R. Henderson, personal communication).

Fall grazing should be stopped by early- to mid-September for cool-season grasses or early August for warm-season grasses, to allow for vegetation regrowth before dormancy sets in. The presence of several scattered shrubs or small trees, especially thorn-bearing species, increases the value of pastures as potential loggerhead shrike habitat.

As a general rule, bird species that prefer short vegetation occur in heavily grazed pastures, just as species preferring moderate and tall vegetation inhabit moderately and lightly grazed pastures, respectively. However, because pastures are often not grazed evenly, there is a likelihood that several ranges of vegetation height-density will be represented in a single pasture, especially large ones. The following are generalizations about species' responses to grazing from research in Wisconsin and the midwest:

- Tallgrass bird species such as sedge wren and Henslow's and Le Conte's sparrow are relatively intolerant of all but very light grazing.
- Light grazing can benefit species such as northern harrier, dickcissel, bobolink, and eastern meadowlark.
- Species that may occur in pastures that are moderately grazed include upland sandpiper, savannah and grasshopper sparrow, western meadowlark, and Brewer's blackbird.
- Heavily grazed pastures do not typically provide nesting habitat for any species of management concern, but are occasionally used for foraging. Nesting birds include horned lark and killdeer.
- Pastures with scattered shrubs can benefit loggerhead shrike, field and clay-colored sparrows, and Brewer's blackbird. Bell's vireo benefits from the presence of several dense patches of shrubs.

Herbicide

Herbicides are typically used in wildlife management for controlling noxious or aggressive weeds and woody vegetation. These chemicals can cause changes in vegetation structure, which, as described above, affect habitat suitability for birds. Chemicals that biodegrade quickly should be used in preference to those that do not. See also "Conventional Cropping Practices," page 67.

Planting and Restoration

Many grasslands managed for wildlife habitat have aimed for a tall and dense nesting cover. This cover was thought to be good for game birds such as ducks and pheasants. Recent research in Wisconsin, however, has shown that traditional **monotypic stands** of dense nesting cover may not be best for game birds (Gatti n.d.). Of the nongame grassland birds, only those species that prefer relatively tall, dense cover are attracted to such stands. More species would benefit from the establishment of shorter grasses, whether native or non-native (see section on long-term set-asides, below). Many wildlife managers are now experimenting with different seedings, especially with a variety of prairie plant species. Some of these restorations have provided excellent grassland bird habitat (Volkert 1992).

It is difficult to describe a seed mixture or seeding rate that guarantees a certain type of vegetation structure, because of variability in soil type and moisture, establishment techniques, and annual variation in precipitation. However, a general approach to lower vegetation height and density and to increase structural diversity is to lower seeding rates:

- Reduce cool-season grass seed to about 4-6 lb per acre, about half the normal rate.
- Make the following reductions for native warm-season grass mixes:
 - Switchgrass, use 2 lb per acre rather than the typical 4 lb;
 - Big and little bluestem, use 1 lb per acre rather than 2 lb;

It is important to establish forbs in managed grasslands because they diversify structure and invertebrate resources.



Northern harrier

- Indiangrass, use 2 lb per acre rather than 3 lb
- Side-oats grama, use 3 lb per acre (well-drained sites only).

In a typical warm-season grass seeding, 3-5 lb of seed per acre are sufficient (R. Henderson, personal communication). With lower seeding rates, noxious or aggressive weeds may have to be monitored more closely than with high seeding rates. However, lower seeding rates are less costly and result in more structural diversity.

It is also important to establish forbs in managed grasslands because they diversify structure and invertebrate resources. Several bird species such as dickcissel and savannah sparrow are most abundant in fields with a strong forb component. Reducing grass seeding rates, along with mowing or burning occasionally in the summer or fall, also helps encourage the forb component of a planting. Moreover, enough forb seed should be added to most mixes to result in at least 10% forb cover. In most cases, 10,000-20,000 forb seeds per acre should result in a noticeable forb component, as long as grass seeding rates do not exceed those recommended above (R. Henderson, personal communication). Forb seeds vary greatly in size and weight; therefore, an average seeding rate cannot be provided. For more detailed information on seed mixes and seeding rates for native grasses and forbs under differing soil moisture conditions, see Henderson (1995).

Planting a mix of grass species is preferable to planting monocultures, and native grasses are generally preferable to non-native cool-season grasses, although birds do not require them. Native grasses and forbs are also better than non-native species for prairie invertebrates (Henderson and Sample 1995). However, there may be specific cases where monocultures can be used, such as targeting habitat for sedge wren or Henslow's sparrow.

Restorations of native grasslands should be targeted for areas in the state that were grasslands in presettlement times (Henderson and Sample 1995).

Water-Level Manipulations

Water-level manipulations can be a critical tool—often used in conjunction with other management practices such as burning—in maintaining wet grasslands and sedge meadows. A lowered water table, caused by on-site or nearby ditching or drainage, can result in dry conditions and encourage succession to shrub carr or tree-dominated communities. Alternatively, deep flooding can replace the sedge meadows or other wet grassland habitats with open water or emergent marshes that are of little value to grassland birds (Mossman and Sample 1990).

Conventional Cropping Practices

The use of traditional agricultural crops—row crops, small grains, and legume hay—by grassland birds can be seen in Table 1, page 12.

- Row crops have the lowest value for grassland birds, although many bird species forage in row-crop fields. Corn is also an important winter food resource for resident species such as pheasant, turkey, bobwhite quail, and sometimes prairie-chicken. Vesper sparrow is the only species of management concern that regularly nests in row crops, and most of its nests are destroyed by farm machinery or predators in those fields (Rodenhouse and Best 1983). Habitat quality is improved by reducing the number of passes that farm machinery makes through crop fields or by increasing the interval between passes to at least 3.5 weeks to allow time for a typical passerine grassland bird nesting cycle (Stallman and Best 1996).

- Small grains receive low to moderate use by grassland birds (nesting species include red-winged blackbird, bobolink, horned lark, and vesper and savannah sparrow), but unlike hayfields they are harvested late enough to avoid the peak nesting season. Also, they appear to be suitable adjacent habitats or buffers in agricultural landscapes.
- Although alfalfa hay attracts many species, it is typically a valuable habitat only for very early nesters such as vesper sparrow and red-winged blackbird unless harvesting is delayed, in which case later nesters such as dickcissel can successfully fledge young. Otherwise it functions largely as an ecological trap.
- Some grass or mixed grass and legume hay is typically harvested late enough in July to allow for successful nesting by grassland birds.



Virtually all of Wisconsin's historical prairie acreage has been converted to cropland. The primary row crop in the state is corn, which has increased in recent decades due to the conversion of pasture and small grains. Vesper sparrow, horned lark, and killdeer are the only species that commonly nest in corn.

MICHAEL MOSSMAN

Contour strip-cropping in Iowa County. Contour strips are a common erosion control practice in the hilly Driftless Area (Southwestern Upland Natural Division).



MICHELLE JESKO

Raking hay in Dane County. Early harvest of alfalfa hay can cause high mortality for grassland birds.



MICHAEL MOSSMAN

- Contour strip-cropping is commonly practiced to reduce soil erosion, especially in the Southwestern Upland. While grassland bird abundance can be higher in strip crops than on normal fields for some species, such as bobolink, eastern meadowlark, and vesper and grasshopper sparrow (Good and Dambach 1943), it may not be higher for other species. Also, nest productivity and predation rates in strip crops compared to conventional fields are not known.

The most valuable agricultural habitats for grassland birds are old fields, lightly to moderately grazed pastures, fallow fields, wet meadows (undisturbed or periodically cropped or grazed fields), and late-cut grass hay and mixed grass and legume hay. None of these habitats is as common as those described above.

Cropping systems that reduce pesticide and inorganic fertilizer use—such as through integrated pest management and measuring soil requirements, respectively—are preferred over systems that depend heavily on these chemicals. Both inorganic fertilizers and pesticides reduce the invertebrate food base and may negatively affect young or adult birds. Pesticides can also simplify the vegetation structure and plant species composition in crop fields (Rodenhouse et al. 1995).

Alternative Cropping Practices

Organic farming. Organic farming has many advantages over conventional farming for grassland birds. It provides better nesting habitat (Ducey and Miller 1980, Gremaud 1983) and may have better food resources due to decreased use of insecticides and increased soil organic matter. However, organic farms tend to have smaller fields than conventional farms (Ducey and Miller 1980) and may thus fail to meet minimum area requirements. Because they have small field sizes, organic farms tend to have more edge habitats than conventional farms, which increases the negative edge effects of nest predation and parasitism. Organic farms may also rely heavily on mechanical cultivation for weed control, which can result in the destruction of nests.

Conservation tillage. Conservation tillage has been shown to provide better nesting habitat for more grassland bird species than conventionally tilled fields (Warburton and Klimstra 1984, Basore et al. 1986). The presence of crop residue on the soil surface also supports higher numbers of invertebrates than conventionally tilled fields, therefore increasing food resources. However, increased mechanical cultivation and possibly pesticide use for weed control in conservation tillage fields may cause them to be ecological traps (Best 1986). Conservation tillage systems that reduce the need for additional pesticide use,

The most valuable agricultural habitats for grassland birds are old fields, lightly to moderately grazed pastures, fallow fields, wet meadows, and late-cut hay.



Killdeer

such as ridge-till or the use of integrated pest management, are preferred for row crop grassland bird habitat.

Intensive rotational grazing. This increasingly popular practice (Undersander et al. 1991) is not beneficial to most grassland bird species because of intensive trampling from cattle and short rest periods between grazing events (Paine et al. 1996a, Temple et al. n.d.). However, when incorporated into farms with adjacent grasslands that are not cut or grazed until after the peak breeding season, rotational grazing may boost overall grassland bird productivity above that of conventional farms (Temple et al. n.d.).

Alternative Crops. At present, few alternative crops have been produced in large enough areas in Wisconsin to assess their value as grassland bird habitat. In Iowa, experimental strip intercropping of corn, soybeans, oats, and legumes produces higher bird abundance than conventional row crops but may function as an ecological trap by attracting birds to settle in a habitat with a low rate of nest success (Stallman and Best 1996). Native warm-season grasses grown as biomass energy crops can improve grassland bird diversity compared to conventional row crops (Paine et al. 1996b). Research on other crops and cropping practices that are both beneficial to farmers and birds is currently being conducted.

Set-Asides

Set-asides are agricultural fields taken out of crop production for some economic or conservation purpose as part of a USDA program. Current agricultural policy is changing the status of set-aside programs.

Annual set-asides. Annual set-asides, such as Acreage Conservation Reserve (ACR) fields enrolled in the now-defunct USDA Feed Grain Program, received moderate use from grassland birds of management concern (Sample 1995) and provided higher quality habitat than row crops. Some set-aside fields such as those

planted to small grains suffered because regulations allowed for late planting during the breeding season, while others such as grass and legume mixtures suffered from early mowing. Although annual set-aside programs are currently being phased out, grassland birds will benefit in the future more from multi-year programs that encourage diverse plantings of grasses and forbs and that do not release such plantings for cutting before 15 July. Bird communities in annual set-asides are similar to those listed in Appendix E, page 126, and Table 1, page 12, under alfalfa hay, small grains, and fallow fields.

Long-term set-asides. Habitat established under programs such as the CRP has proven to be valuable to grassland birds in Wisconsin. In CRP fields in the southern part of the state, several species of management concern, including dickcissel, vesper and grasshopper sparrow, bobolink, and western meadowlark have been found in similar densities to those in other preferred habitats (Sample 1995). Early release of CRP fields for haying due to drought conditions during the bird breeding season and emphasis on seed mixtures aimed at the creation of tall, dense cover, however, have limited the CRP's value for grassland birds. We make the following recommendations for improving habitat quality in long-term set asides such as CRP land:

- Include native forbs in seed mixes, typically enough to provide 10% cover of forbs (see planting and restoration recommendations above).
- Include grasses of varying heights in seed mixes to promote a variety of height and density among fields. For example, be sure to provide some seed mixes featuring short native grasses (e.g., little bluestem, side-oats grama, prairie dropseed, and Scribner's panicum) or short non-native grasses (e.g., Kentucky bluegrass and redtop).

- Reduce grass seeding rates by up to 50% (down to 4-6 lb per acre for cool-season grasses and 3-5 lb per acre for warm-season grasses) to reduce vegetation density and to encourage forbs.
- Allow mowing only after 15 July.
- Allow for management over time to control woody vegetation and rejuvenate the planting (e.g., burning, grazing, late season haying, re-seeding).
- Consider allowing light grazing to reduce vegetation height and density.
- Encourage enrollment of whole fields to avoid linear-shaped fields with high edge:interior ratios.
- Locate other suitable grassland habitat adjacent to set-aside fields when possible.

Forestry Practices

Cut-overs. Recently clearcut or burned-over forest land provides habitat for many grassland species—mainly those that require cover of shrubs or other low woody vegetation (see Appendix E, page 126, and Table 1, page 12).

If blocks of cut-over habitat are big enough, they may provide habitat for sharp-tailed grouse. Cut-overs remain suitable for some grassland and shrub-grassland species until most of the regenerating trees become taller than 10 ft and exceed roughly 50% cover. Large blocks of short-rotation, even-aged forestry can be targeted for stands at the edges of open, diverse, and brush prairie barrens, firebreaks, or other grassland openings to increase the effective size of grassland habitat (Mossman et al. 1991).

Firebreaks. Wide (440 yd), herbaceous (or heath-dominated) firebreaks in the northern forest provide grassland bird habitat and may even serve as important corridors between grassland openings, such as in the barrens area of northwestern Wisconsin. Many grassland species, including sharp-tailed grouse, use such firebreaks (Gregg 1987, Niemuth 1995).

Conifer plantations. Young conifer plantations are most useful to grassland bird populations when the trees are less than 10 ft tall. Avoid locating these plantations in open grassland landscapes. Typical bird communities of young conifer plantations are listed in Table 1, page 12.



Many CRP fields, such as this one in Rock County, have a very dense, homogeneous vegetation structure. While these types of fields are used by some grassland birds, lighter grass seedings with a forb component create a more diverse structure that would benefit more bird species.

DAVID SAMPLE

*I distinctly remember
the large eggs of the "Prairie Snipe" [upland
sandpiper] and the still larger ones of the
"Crooked-bill" or "Big-Snipe" [long-billed curlew]...
These snipes were so numerous... that a bird
student might have been misled to the conclusion
that they were nesting in colonies.*

—Halvor L. Skavlem, *Recollections of
Bird-Life in Pioneer Days* (referring to
an area in Rock County in the 1850's)
(Skavlem 1912)



MANAGEMENT PRIORITIES FOR BIRDS, HABITATS, LANDSCAPES, AND SITES

Statewide

Birds

The statewide list of management concern species (see Table 3, page 22) translates into different priority sub-lists for each natural division in the state, based on the division's potential for management. That potential reflects differences among natural divisions in habitat distribution and in soil types and other factors—such as hydrology and land-use patterns—that affect grassland habitats. It also reflects differences in bird distributions. For example, while some species, such as bobolink and eastern meadowlark, are nearly statewide in distribution, others are found primarily or most abundantly in one natural division:

- Northern Highland/Lake Superior Lowland—sharp-tailed, Le Conte's, and clay-colored sparrows; sharp-tailed grouse; yellow rail; Brewer's blackbird; and northern harrier
- Central Plains—greater prairie-chicken and vesper sparrow
- Southwestern Upland—grasshopper, lark and field sparrow, western meadowlark, loggerhead shrike, and Bell's vireo
- Southeastern Ridges and Lowlands—blue-winged teal and barn owl
- Lake Michigan Shoreland—upland sandpiper

Complete lists and discussion of species of management concern for each natural division are included in the sections of this guidebook starting on page 81.



Habitats, Landscapes, and Sites

In Table 4, page 32, we rank habitat types in terms of their importance to grassland birds, amount and distribution, and degree of stability in Wisconsin. To implement grassland bird management, however, we also need to identify both large-scale landscapes and specific sites that incorporate these priority habitats.

We have identified 26 management priority landscapes, along with their current and potential size, dominant habitat types, and notes on their potential for development, expansion, or restoration (Appendix G, page 136). These priority landscapes vary from predominantly native to primarily surrogate grasslands. We selected these priority landscapes for one or more of the following reasons:

- Current value for grassland bird species of management concern
- Current large size
- Potential for the creation of large sites or linkages of smaller sites with high-quality grassland bird habitat
- Representation of unique grassland habitat types
- Representation of habitat variation within the state

All 26 landscapes listed in Appendix G represent unique opportunities for landscape-scale grassland management that should not be missed. The top ten landscapes are all of the highest management priority; taken together they represent all the habitat types required by high priority grassland bird species and communities. The top ten landscapes include areas that currently have some of the highest amounts of permanent grassland habitat in the state, as well as areas with patchworks of agricultural habitats that are more suitable for grassland birds than the agricultural habitats in some of the lower ranked landscapes. The remaining 16 landscapes are also of high priority for grassland birds but in some cases represent duplication of habitats included in the top 10. These 16 land-

scapes are still highly important landscapes for grassland bird management, however, and have other merits warranting their presence on the priority list—such as representing habitat variation among natural divisions and importance to other related bird communities.

The priority landscapes in Figure 8 contain the best examples of highly ranked grassland habitats and capture some of the differences in bird, as well as habitat distribution statewide. They range from fairly small sites such as the Rush Creek/Battle Bluff Goat Prairies and Savannas (see G in Figure 8; 230 acres of dry prairie and old field and up to 500 acres of potential oak savanna restoration) to large areas such as the Yellowstone/Pecatonica River Valley Landscape (C; up to 200,000 acres, primarily surrogate grasslands) and the Namekagon/Douglas County Barrens (U; currently 9,700 acres composed mainly of native grassland and barrens habitats, with potential for expansion). Some sites are isolated within forests, such as Black Lake/Belden Swamp (Z), or fragmented landscapes, such as Bong Recreation Area (L), while others are embedded in large, relatively open landscapes, such as Yellowstone/Pecatonica River Grasslands and Savannas and Columbia/Dane County Prairie Wetlands (K). Many of these open landscapes are or will be managed with the cooperation of private landowners and other agencies.

If all 26 priority landscapes were developed and managed, they would incorporate over 1.1 million acres of landscape-scale grassland habitat for grassland birds in the state.

Figure 8 includes the location of these priority landscapes along with eight secondary landscapes of lesser priority, key sites within landscapes that serve either as focal points for management or as locations of important, existing managed grasslands, and many other smaller but important sites for grassland bird habitat management outside of the landscapes. Enlarged maps for each natural division, including names of sites and secondary landscapes, are presented along with suggested management priorities in the following sections, starting on page 81.

Seventeen of the 26 priority landscapes are suited for large-scale areas, which is the most important scale for grassland bird management. The Buena Vista Prairie-Chicken Management Area (in landscape P) is an important example of a currently functioning large-scale grassland area (approximately 50,000 acres) that fits our criteria and in fact serves as the model for our concept of an area consisting of a combination of public and private land (Hamerstrom et al. 1957). The Crex Meadows/Fish Lake Complex (T) also qualifies as a current large-scale management area because it already includes well over 20,000 acres of publicly owned grassland habitat, mostly at Crex Meadows Wildlife Area.

In addition to these two areas, three others—Moquah Barrens (W), Namekagon/Douglas County Barrens (U), and Fort McCoy Barrens (B)—are approaching the size required for large-scale areas and currently exceed the required 2,000 acre core of

permanent grassland. Grassland and barrens habitat at Moquah Barrens is planned to exceed 11,000 acres, the Namekagon/Douglas County Landscape currently has around 9,700 acres of open, diverse, and brush prairie barrens, and Fort McCoy Barrens has around 8,800 acres of sand prairie and barrens habitats, although not all of it is open enough for high grassland bird use. In addition to these five landscapes, we will probably need at least five new large-scale grassland landscapes, bringing the total number to at least ten in the state.

Most of the five current large-scale areas consist primarily of large public ownerships, and thus differ from our model of large-scale management areas. Opportunities for future large-scale acquisitions such as the five discussed here are very limited; this is one reason why our recommendations for large-scale areas do not rely entirely on land acquisition but rather incorporate significant amounts of private land.

Dry prairies on bluffs ("goat" prairies) are perhaps best represented at Rush Creek State Natural Area on the Mississippi River in Crawford County, shown here. These habitats receive relatively light use from grassland birds primarily because much of the habitat is restricted to steep slopes. Expansion of grassland habitat at these sites will improve their value for grassland birds.



DICK BAUTZ

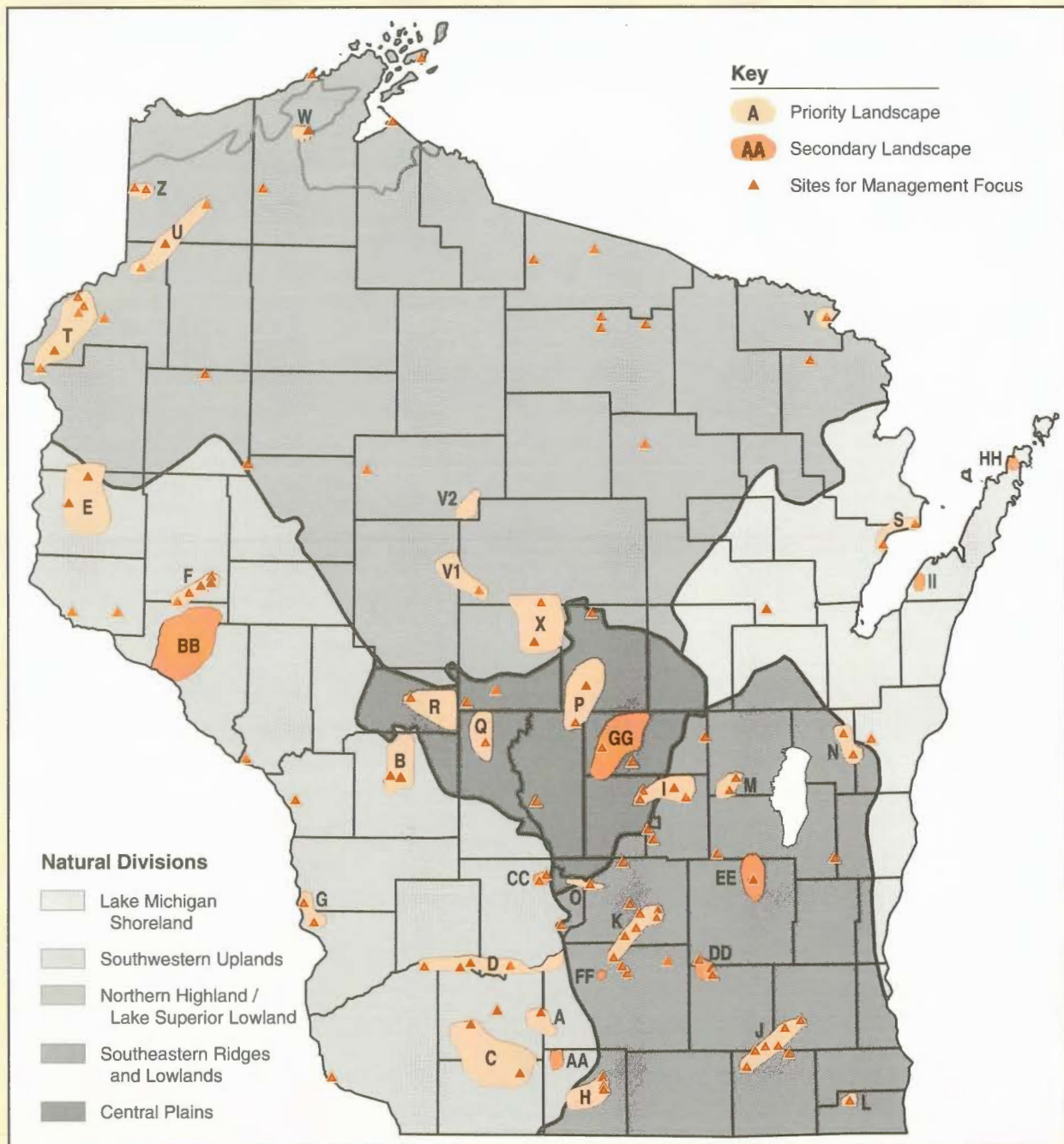


FIGURE 8. Location of priority landscapes and sites for grassland bird management in Wisconsin.

Map Location ^a	Statewide Rank ^b	Priority Landscape (ranked within natural division)
Southwestern Upland		
A	1	Thomson Prairie Grasslands
B	9	Fort McCoy Barrens
C	8	Yellowstone/Pecatonica River Grasslands and Savannas
D	10	Lower Wisconsin River Prairies and Barrens
E	6	Star Prairie Pothole Grasslands
F	17	Lower Chippewa River Savannas and Prairies
G	26	Rush Creek/Battle Bluff Goat Prairies and Savannas
Southeastern Ridges and Lowlands		
H	3	Muralt/Monroe Grasslands
I	5	White River Marsh Complex ^c
J	18	Southern Kettle Moraine Complex
K	16	Columbia/Dane County Prairie Wetlands
L	15	Bong Recreation Area
M	19	Rush Lake Grasslands and Sedge Meadows
N	22	Brillion/Killsnake Grasslands
O	23	Pine Island Area Grasslands
Central Plains		
P	4	Buena Vista/Leola Grasslands
Q	14	Necedah Barrens
R	21	Bear Bluff Wetlands
Lake Michigan Shoreland		
S	24	Green Bay West Shore Sedge Meadows
Northern Highland/Lake Superior Lowland		
T	2	Crex Meadows/Fish Lake Complex
U	7	Namekagon/Douglas County Barrens
V (1,2)	12	North Central Prairie Chicken Grasslands
W	11	Moquah Barrens
X	20	Mead/Paul J. Olson Grasslands
Y	13	Spread Eagle Barrens
Z	25	Black Lake/Belden Swamp

^a Alphabetical order reflects ranking within natural division. For example, in the Southwestern Upland, A is highest-ranking and G is lowest.

^b See Appendix G. Note that landscapes are not ranked in the same order statewide as they are within each natural division. This is due to differences in the scale of the two rankings. For example, because Ft. McCoy Barrens is unique in the Southwestern Upland as the largest and best barrens landscape in that division, it ranks high in the division but is outranked by some surrogate grassland landscapes in the statewide ranking.

^c The White River Marsh Complex includes sites in both the Southeastern and Central natural divisions, and therefore is included in the maps for both of those divisions (Figures 10 and 11).

All 26 priority landscapes represent unique opportunities for landscape-scale grassland management that should not be missed. The top ten landscapes are all of the highest management priority; taken together they represent all the habitat types required by high priority grassland bird species and communities.

The Buena Vista Prairie-Chicken Management Area is an important example of a current large-scale grassland area that serves as a model for our concept of an area combining public and private land.



Savannah sparrow

Historical prairie areas have the topography and climatic conditions most conducive to the maintenance of open grassland habitat with the least effort.

For all priority landscapes, the importance of grassland conservation needs to be weighed along with the potential importance of conservation of other communities, such as forest and wetland habitat types.

Wisconsin's tension zone is a border between northern and southern floristic provinces (Curtis 1959), based on the zone where the highest number of plant species reach their range boundaries. Historically, most of the state's prairie acreage was south of this zone.



Of the five large-scale grassland areas mentioned above, only Fort McCoy is south of the tension zone (see sidebar), where we currently lack large landscapes of publicly owned and managed grasslands. This area of the state is particularly important for several reasons (Sample et al. 1994, Henderson and Krause 1995, Henderson and Sample 1995):

- Historical prairie areas have the topography and climatic conditions most conducive to the maintenance of open grassland habitat with the least effort.
- Former prairie landscapes retain a relatively treeless aspect, even today.
- Some bird species are restricted to or most abundant in the area south of the tension zone.
- Many former prairie areas have scattered patches of residual native sod that can serve as sources of prairie insects and soil micro-flora and -fauna.
- Plant species richness of native prairie increases as one moves south and west from the tension zone.

At least two of the new large-scale landscapes should be developed south of the tension zone. The landscapes that hold the best promise for this purpose include Thomson Prairie Grasslands (A), Muralt/Monroe Grasslands (H), Yellowstone/Pecatonica River Grasslands (C), Star Prairie Pothole Grasslands (E), and White River Marsh Complex (I). The Glacial Habitat Restoration Area is another example of a landscape-scale grassland management project that is south of the tension zone, but it consists primarily of widely scattered tracts in a very large (838 miles²), intensive agricultural landscape without a large core area of permanent grassland. This project is currently being evaluated to determine its value for grassland birds.

Nine of the 26 priority landscapes are identified as having the potential to be managed for medium-scale areas only (Appendix G, page 136). Seven of these areas currently have more than 1,000 acres of permanent grassland and therefore probably function as medium-scale landscapes: Lower Wisconsin River Prairies and Barrens (D), Bong Recreation Area (L), Pine Island Area Grasslands (O), Necedah Barrens (Q), Green Bay West Shore Sedge Meadows (S), Spread Eagle Barrens (Y), and Black Lake/Belden Swamp (Z). The Lower Wisconsin River and Green Bay West Shore landscapes are both in need of more connectivity between grassland sites, however.

In addition, the following ten sites—a majority of which are in the Northern Highlands/Lake Superior Lowland Natural Division—are not included in the priority landscapes but already contain over 1,000 acres of permanent grassland (most in blocks > 100 acres) and thus may function as medium-scale landscapes:

Site Name	Locator Map	
	Page	Site No.
Badger Army Ammunition Plant	94	52
Glacial Habitat Restoration Area	94	57
<i>(represented by the Patouille/Bulwalda Easement)</i>		
Grand River Marsh Wildlife Area	94	58
Sandhill Wildlife Area		
Barrens/Buffalo Pasture	102	75
Pershing Wildlife Area	116	86
Amsterdam Sloughs Wildlife Area	116	94
Bayfield County Fuelbreaks	116	100
Kakagon Slough Sedge Meadow	116	104
Powell Marsh Wildlife Area	116	105
Thunder Lake Wildlife Area	116	109

An assessment of these sites is needed to see if they meet the criteria for medium-scale areas. There are additional sites outside of the priority landscapes that have less permanent grassland than the above ten sites but that may have the potential for management as medium-scale landscapes.

In addition to the above landscapes and sites, at least seven of the 17 potential large-scale areas identified above could instead be managed as medium-scale areas; these are potential large-scale landscapes that currently lack large blocks of permanent grassland or consist of areas of permanent grassland separated by currently unsuitable grassland habitat. Included in this list are Thomson Prairie Grasslands (A), Muralt/Monroe Grasslands (H), Columbia/Dane County Prairie Wetlands (K), Southern Kettle Moraine Complex (J), Rush Lake Grasslands and Sedge Meadows (M), Brillion/Killsnake Grasslands (N), and North Central Prairie Chicken Grasslands (V1 and V2).

Overall, there are currently at least 26 landscapes and sites that may qualify or have the potential to be managed as medium-scale grassland management areas. In addition to the large-scale areas, we recommend establishing or maintaining a total of at least 25 medium-scale grassland areas in the state.

An assessment of all landscapes that currently have enough permanent grassland to qualify as either large- or medium-scale grassland management areas is needed to determine how they can

be improved for grassland birds. An assessment is also needed for most of the other landscapes and sites to determine in detail the current amount and configuration of grassland habitats, as well as the potential for further grassland management and expansion. In addition, for all priority landscapes, the importance of grassland conservation needs to be weighed along with the potential importance of conserving other communities, such as forest and wetland habitat types, (for example at the Southern Kettle Moraine Complex (J)).

The 26 priority landscapes and sites, as well as the eight secondary landscapes (marked with double letters in Figure 8, are not the only places where grassland management should occur. Many other sites on both public and private lands can provide valuable grassland bird habitat if managed according to the guidelines in this publication.

As with bird species, the native habitat types and landscapes they occur in and most of the surrogate grasslands have varied distributions among the natural divisions. For example, open, diverse, and brush prairie barrens, northern sedge meadow, open bog, and grass hay occur primarily in the Northern Highland/Lake Superior Lowland and Lake Michigan Shoreland, while dry or sand prairie and oak or river barrens occur in the Southwestern Upland and the Central Plains. Upland pasture is most highly concentrated in the Southwestern Upland.

Differences in priority birds and priority habitats among and within natural divisions should be taken into account when planning and implementing management actions. In each natural division, we should manage for the habitats and landscapes preferred by the bird communities that include the priority species of that division. The following sections address management priorities for birds, habitats, landscapes, and sites within each natural division. For each of the natural division accounts that follows, bird communities typically associated with the habitat types discussed can be located in Table 1, page 12 and Appendix E, page 126. Habitat preferences of bird species are summarized in Table 5, page 58, and Appendix F, page 132.

We... got into one of the most exquisitely beautiful regions I have ever seen in any part of the world...

The prairie...took the form of ridges somewhat elevated, which frequently resolved themselves into masses of gracefully-rounded hills, separated by gentle depressions...America will justly boast of this unrivalled spectacle when it becomes known, for certainly it is formed of elements that no magic could enable all Europe to bring together upon so great a scale...

every moment produced a new excitement; the...frequent flushing of the prairie-ben from her nest, gave animation to the still beauty around us.

—George Featherstonaugh, describing
the landscape between Madison and Blue
Mounds in *A Canoe Voyage Up the Minnay
Sotor* (Featherstonaugh 1847)



Southwestern Upland

Prior to settlement by Europeans, this unglaciated and hilly part of the state was dominated by oak savanna, with scattered areas of prairies, southern oak forests, extensive lowland hardwood forests along rivers, and southern mesic forests. A few areas of pine and oak barrens and pine forest were present along the northeastern fringe, and barrens habitats also occurred along the lower Chippewa and Wisconsin rivers. Wetlands and lakes were (and are) not common in this division except at its northern edge in the pot-hole area of St. Croix County. Most of the grassland bird habitat was in the oak savanna and prairie areas. The major prairies were Star Prairie in St. Croix and Pierce counties in the northwestern part of the division and Military Ridge Prairie in Iowa, Grant, and Dane counties in the southern part.



Lark sparrow

Species of management concern in the Southwestern Upland

(in order of priority)

Henslow's sparrow *

Loggerhead shrike

Lark sparrow

Grasshopper sparrow *

Eastern meadowlark *

Field sparrow *

Upland sandpiper *

Western meadowlark

Bell's vireo *

Short-eared owl

Dickcissel *

Northern harrier

Bobolink *

Blue-winged teal *

Greater prairie-chicken

Clay-colored sparrow (north) *

Brewer's blackbird (north)

Savannah sparrow *

Barn owl

red-headed woodpecker *

orchard oriole *

Birds

The 19 priority species for this division (see sidebar) include all of the midgrass species and species requiring woody vegetation or nest structures from the statewide list (see Table 5, page 58), all but one of the shortgrass species (excepting vesper sparrow), as well as four of the five species requiring large areas. The priority list includes only one tallgrass species—Henslow's sparrow—and one of the open-water species—blue-winged teal.

Shortgrass species. Western meadowlark is widespread. Upland sandpiper and grasshopper sparrow are more common in the southern part than elsewhere in the division.

Midgrass species. Bobolink and savannah sparrow can be found throughout the division, while eastern meadowlark is most abundant in the southern part. Dickcissel is most abundant here, compared to the other divisions. It is especially common in the southern part of the division in most years.

Tallgrass species. Henslow's sparrow is more common in the southern part than in the northern part of this division. Henslow's sparrow is best managed for in the Thomson Prairie Grasslands (A), Yellowstone/Pecatonica River Grasslands and Savannas (C), and Star Prairie Pothole Grasslands (E) (Figure 9) and at sites such as Governor Dodge State Park (4) and other permanent grassland sites within the division.

Species requiring woody vegetation or nest structures. Lark sparrow is most common in the Southwestern Upland. However, it is largely restricted to present and former sand prairies and oak or river barrens such as those on the lower Wisconsin and Chippewa River terraces and at Fort McCoy Military Reservation. It will benefit from the expansion of these sand prairies and barrens. Field sparrow is most common in this division and is widespread. Bell's vireo occurs most regularly in the southern half of the division, while Brewer's blackbird and clay-colored sparrow occur mainly in the northern part. Loggerhead shrike is better managed for in the southern and northern parts than in the central part of this division.

Species requiring open water. Blue-winged teal—the one wetland species on the Southwestern Upland's priority list—is locally common in the prairie pothole area of St. Croix County.

Species requiring large areas. Short-eared owl and northern harrier occur mainly in the northern part of the division, including the open-grassland landscapes in St. Croix County that include large blocks of idle tallgrass habitat, many of which are Waterfowl Production Areas (WPA's). In southern counties, northern harrier—and rarely short-eared owl—depend on and may nest in relatively treeless landscapes where there is sufficient grassy cover, such as lightly grazed pasture, CRP land, old fields, and small grains in and near Thomson Prairie Grasslands (A) and Yellowstone/Pecatonica River Grasslands and Savannas (C) (Figure 9). Barn owls are likely to use habitats with a higher component of hedgerows, woodlots, and wet meadows. Greater

prairie-chicken was extirpated from the Southwestern Upland in the 1940s and 1950s and is included because it could possibly be reintroduced in suitably large grassland landscapes in the southern part of the division.

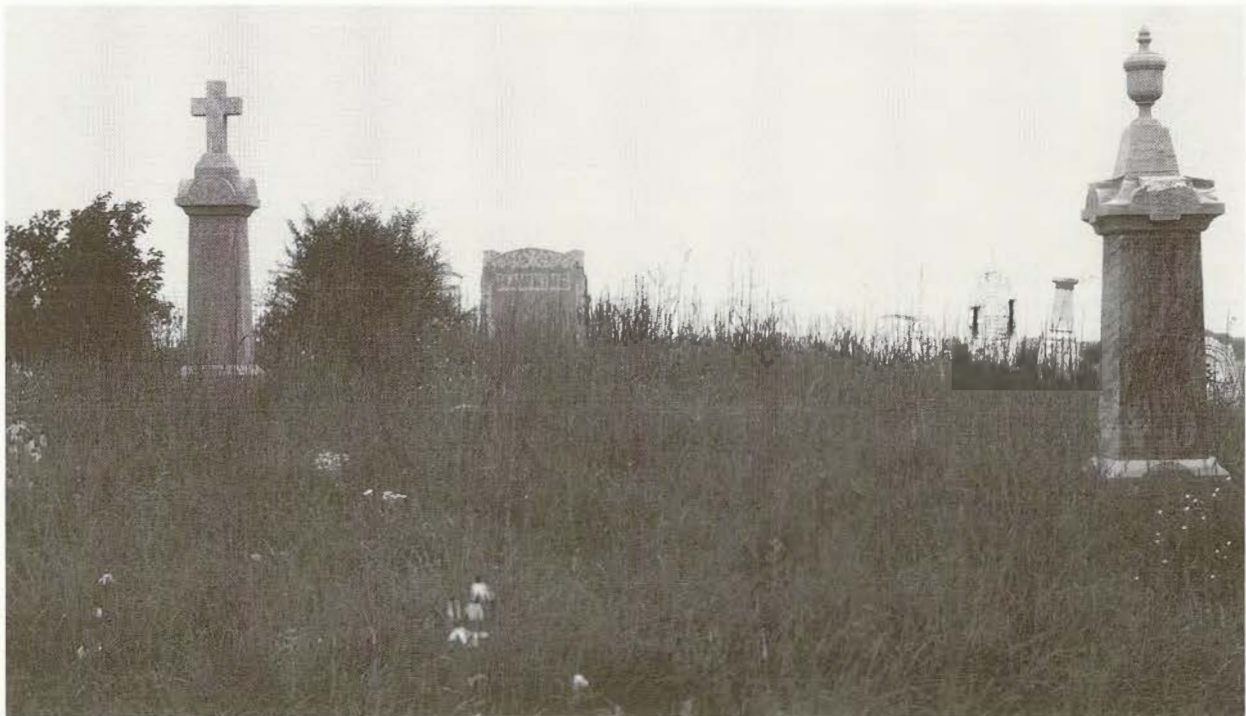
Habitats, Landscapes, and Sites

The Southwestern Upland provides some of the best overall habitat for upland grassland bird species in the state, especially shortgrass and midgrass species, species requiring woody vegetation or nest structures, some species requiring large areas, and species near the northern edges of their range in Wisconsin (see preceding section). Agriculture is generally less intensive in this hilly area than it is in the Southeastern Ridges and Lowlands, Lake Michigan Shoreland, and southern part of the Northern Highland/Lake Superior Lowland. Forest cover is generally the most extensive—and grasslands the most fragmented—from

the Military Ridge (Grant, Iowa, and Dane counties) north to roughly the Chippewa River. Open agricultural and grassland habitats dominate to the north and south of this area. Row crops are most prevalent in Lafayette and Grant counties in the southern part of the division. Alfalfa is more abundant in the southern counties of this division than anywhere in the state except for parts of the Lake Michigan Shoreland division, while grass-dominated hay is quite common in northernmost counties. Small grains are grown commonly in St. Croix, Pierce, and Pepin counties and to a lesser degree in Grant and Lafayette counties. Acreage of habitats favorable to many upland grassland birds, specifically pasture and CRP land, is higher in the Southwestern Upland than in any other natural division. This division also has the highest combined acreage of prairie remnants of any natural division.

The overall character and pattern of agricultural land use in the Southwestern Upland is

Most mesic prairie remnants are limited to small sites including railroad rights-of-way and cemeteries such as this one in St. Croix County. These remnants are generally too small to provide habitat for grassland birds.



ERIC EPSTEIN

The overall character and pattern of agricultural land use in the Southwestern Upland is largely responsible for the abundant and diverse grassland bird communities there.



Dickcissel

largely responsible for the abundant and diverse grassland bird communities there. However, habitats in this natural division are highly vulnerable to changes in agricultural policy and practices and to increasing human development, because of the lack of permanent grassland. Compared to other natural divisions, a relatively low percentage of this natural division is publicly owned and managed for grassland habitat. An estimated 14,000 acres of the permanent grassland and barrens in the division is in blocks greater than 100 acres, over 65% (8,900 acres) of which is at Fort McCoy.

Priority habitats, landscapes, and sites for the Southwestern Upland are listed next to Figure 9. Five of the top ten ranked landscapes statewide occur in this natural division. Fort McCoy Barrens (B), Lower Wisconsin River Prairies and Barrens (D), and Lower Chippewa River Savannas and Prairies (F) contain the largest patches of native grassland vegetation in the division: the barrens areas at Fort McCoy and the prairies and river barrens on the terraces of the Wisconsin and Chippewa rivers. The Fort McCoy Barrens Landscape currently has some large open areas of sand prairie that are used heavily by grassland birds. It also has the potential for expanding barrens habitat through restoration. The complex of sites in both the Lower Chippewa and Wisconsin river landscapes contain high quality bird habitat in dry or sand prairie and oak or river barrens sites, which are especially important for lark sparrow and associated species. The Lower Wisconsin River also includes Avoca Prairie (8), a wet-mesic prairie which is the largest remnant prairie in the state. Both landscapes, but particularly the Lower Wisconsin River, have the potential for connecting sites along the river corridor and expanding grassland acreage through restoration and buffering. These opportunities should be pursued where possible.

The potential for managing dry or shortgrass habitat is greatest in the Southwestern Upland because of its varied topography, thin soils, its southern and western exposures, and because of the economic viability of pasture (grazing) in the division. The abundance of pastures—some of which are on unplowed prairie sod—and other fields with shrubby invasion makes this natural division excellent for upland shrub-grassland species such as loggerhead shrike, field sparrow, clay-colored sparrow (north only), and Bell's vireo. Bell's vireo, whose range is largely restricted to this natural division, also uses shrub habitats along major river terraces and some upland-wetland interfaces such as those found at Trempealeau National Wildlife Refuge (17) (Thompson 1992). These species depend on the maintenance of upland shrub or other grasslands with a shrub component (shrubby pastures and old fields).

The best opportunities for managing large areas of relatively treeless grassland bird habitat that attract area-sensitive birds are in

the open surrogate grassland landscapes of the former prairie and oak savanna areas of Dane, Iowa, Lafayette, and St. Croix counties, including Thomson Prairie Grasslands (A), Yellowstone/Pecatonica River Grasslands and Savannas (C), and Star Prairie Pothole Grasslands (E). These counties contain large treeless landscapes where farming is not dominated by row crops, where there are still many large pasture systems, and where much land is currently enrolled in the CRP. Lark sparrow is perhaps the only priority species not likely to benefit from grassland management in these areas. These landscapes are large enough to incorporate areas of upland shrub habitat, as

well as shortgrass, midgrass, and tallgrass habitats. Savanna habitats can also be easily found and potentially restored in these landscapes. The Thomson Prairie Grasslands Landscape contains a high density of scattered remnant dry and dry-mesic prairies, many of which are not currently valuable as bird habitat because they are not buffered by idle grassland, restored prairie, CRP lands, or other suitable habitats. However, those remnants that are buffered, such as at The Nature Conservancy's Thomson Prairie (1), do receive high use from grassland birds. Expanding prairie acreage through restoration will increase the value of these habitats for birds.

The Lower Wisconsin River Prairies and Barrens landscape includes a number of unconnected native grassland sites along the Wisconsin River corridor. Some of the sites are quite large, such as the 1,500 acre Avoca Prairie-Savanna State Natural Area in Iowa County, shown here. Connection and buffering of native grassland habitats is a priority in this landscape.



MICHAEL MOSSMAN

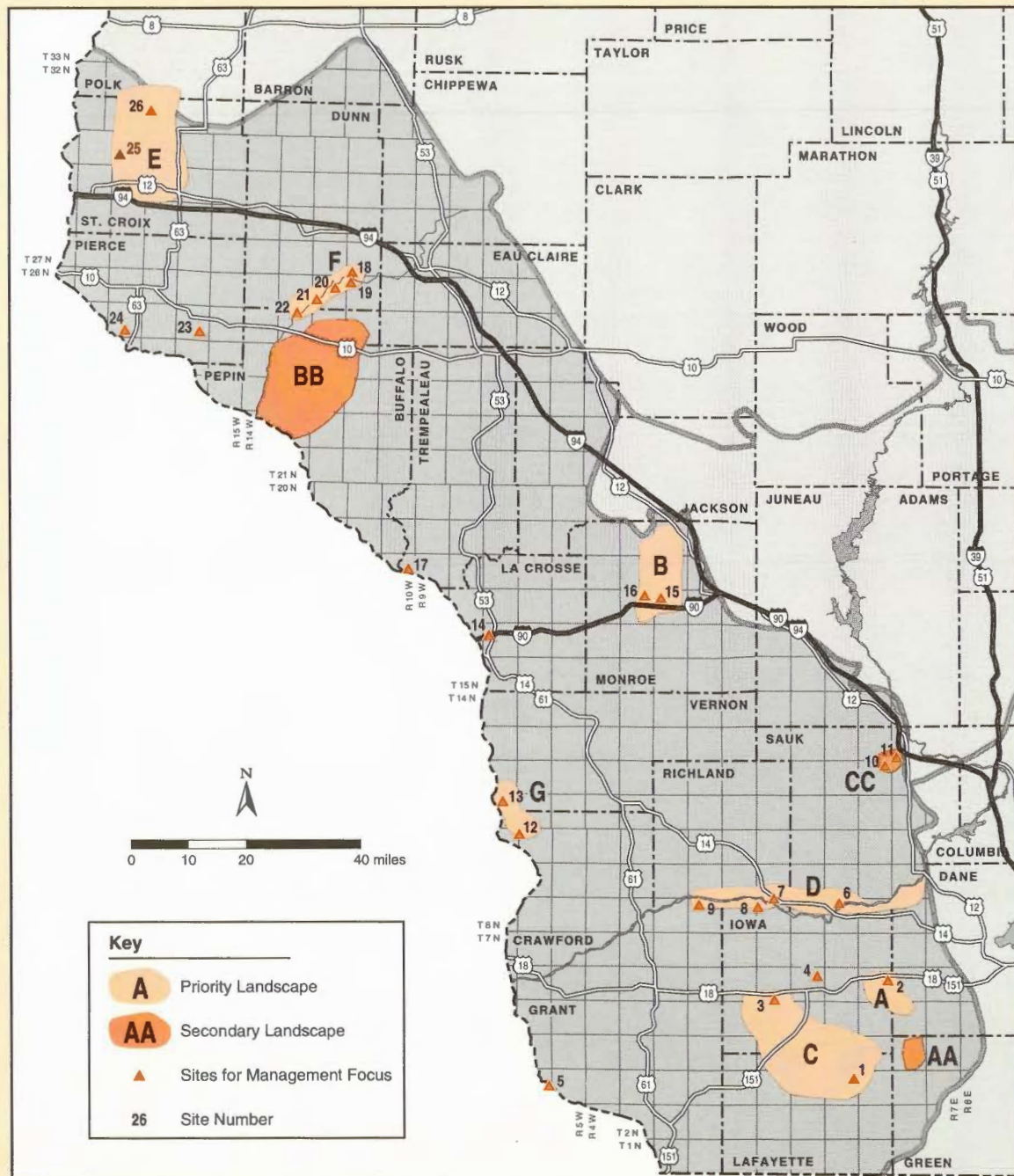


FIGURE 9. Priority landscapes and sites for grassland bird management in the Southwestern Upland Natural Division.

Landscape and Site Names¹**Habitat Types** (*see next page for key to 4-letter codes*)

A. Thomson Prairie Grasslands	ICSG, IWSG, UPSH, PAST, DMPR, DSPR, DROF, OASA, SMGR ²
Sites: 2. Thomson Prairie (The Nature Conservancy; includes several remnants)	DSPR, DMPR, ICSG, UPSH
B. Fort McCoy Barrens	ORBA, OASA, DSPR, IWSG, ICSG
Sites: 15. Fort McCoy Military Reservation Drop Area	DSPR
16. Fort McCoy State Natural Area (SNA)	DSPR, ORBA
C. Yellowstone/Pecatonica River Grasslands and Savannas	PAST, OASA, ICSG, UPSH, IWSG, DROF, DMPR, SMGR
Sites: 1. Yellowstone Wildlife Area (WA) and Yellowstone Lake State Park (SP)	IWSG, ICSG, OASA, DROF, WEOF, DMPR, DSPR, UPSH
3. Iowa County Farm	IWSG, ICSG
D. Lower Wisconsin River Prairies and Barrens	DROF, DSPR, IWSG, ORBA, SHSW, SWOF, SSME, SSMA, OASA
Sites: 6. Spring Green Reserve SNA	DSPR, DROF, ORBA
7. Gotham Jack Pine Barrens SNA	ORBA, DROF
8. Avoca Prairie-Savanna SNA	OASA, WMWP, SHSW, SSME,
9. Blue River Sand Barrens SNA	ORBA, DSPR
E. Star Prairie Pothole Grasslands	ICSG, GLHA, PAST, SMGR, IWSG, OASA, UPSH, DMPR, FAFI, YCPL
Sites: 25. Lundy Pond, Tenmile Creek, and Three Lakes Waterfowl Production Areas (WPAs)	ICSG, IWSG, DROF, SSMA, OASA, SHSW
26. Bierbrauer, Amschler, Oak Ridge, and Erickson WPAs	IWSG, ICSG, DROF
F. Lower Chippewa River Savannas and Prairies	ORBA, DROF, IWSG
Sites: 18. Spring Brook Terrace	DSPR
19. Caryville Savanna SNA	ORBA, DSPR, UPSH
20. Meridean Barrens	DSPR, ORBA, DROF
21. Dunnville WA	ORBA, DROF, IWSG, DRSP, SWOF
22. Nine Mile Island SNA	DSPR, ORBA
G. Rush Creek/Battle Bluff Goat Prairies and Savannas	DSPR, DROF, OASA
Sites: 12. Rush Creek SNA	DSPR, OASA, DROF
13. Battle Bluff Prairie SNA	DSPR, DROF
AA. York Prairie Grasslands	PAST, ICSG, DMPR, IWSG, OASA, FAFI
BB. Buffalo River/Lima Mounds Savannas	OASA, DSPR, UPSH
CC. Mirror Lake Barrens	COBA, DROF, UPSH
Sites: 10. Van Zelst Barrens	COBA, DROF, DSPR
11. Mirror Lake SP	DSPR, COBA
Other Sites Located Outside of Landscapes:	
4. Governor Dodge SP	IWSG, ICSG, DROF, UPSH, WEOF, OASA
5. Dewey Heights Prairie SNA (in Dewey Heights State Park)	DSPR
14. La Crosse Municipal Airport	DSPR, DROF
17. Trempealeau National Wildlife Refuge (NWR)	SWOF, SHSW, ICSG, IWSG, UPSH, DROF, DRSP, OASA
23. Morgan Coulee Prairie SNA	DSPR, OASA
24. Trenton Bluff Prairie SNA	DSPR

¹ Landscapes are ranked from highest priority to lowest priority. Sites are **not** ranked within landscapes. When a landscape overlaps more than one natural division, the landscape is listed within the division where most of its land area occurs. Four-letter codes represent priority habitat types that are present in the sites and landscapes.

² Codes listed after landscape names refer to habitats common or present within the landscape, in areas other than the numbered sites.

Priority Grassland Habitats for Management in the Southwestern Upland¹

(ranked by priority)

DSPR Dry or sand prairie:

- Sand prairie: (6) Spring Green Reserve SNA, (15) Fort McCoy Military Reservation Drop Area, (9) Blue River Sand Barrens SNA, (D) Lower Wisconsin River Prairies and Barrens, (B) Fort McCoy Barrens, (16) Fort McCoy SNA, (19) Caryville Savanna SNA, (20) Meridean Barrens, (22) Nine Mile Island SNA, (10) Mirror Lake SP, (11) Van Zelst Barrens, (14) La Crosse Municipal Airport, (21) Dunnville WA, (18) Spring Brook Terrace, (17) Trempealeau NWR
- Dry prairie with relatively flat topography: (A) Thomson Prairie Grasslands, (1) Thomson Prairie
- Dry prairie with mostly steep hillsides-currently little use by birds: (12) Rush Creek SNA, (13) Battle Bluff Prairie SNA, (6) Spring Green Reserve SNA, (5) Dewey Heights Prairie SNA, (23) Morgan Coulee Prairie SNA, (G) Rush Creek/Battle Bluff Goat Prairies and Savannas, (24) Trenton Bluff Prairie SNA, (B) Buffalo River/Lima Mounds Savannas, (2) Yellowstone WA/Yellowstone SP

IWSG Idle warm season grass/forb (medium and tall):

(A) Thomson Prairie Grasslands, (C) Yellowstone/Pecatonica River Grasslands and Savannas, (2) Yellowstone WA/Yellowstone Lake SP, (4) Governor Dodge SP, (25) Lundy Pond, Tenmile Creek, & Three Lakes WPAs, (26) Bierbrauer, Amschler, Oakridge, & Erickson WPAs, (D) Lower Wisconsin River Prairies and Barrens, (E) Star Prairie Pothole Grasslands, (3) Iowa County Farm, (17) Trempealeau NWR, (B) Fort McCoy Barrens, (21) Dunnville WA, (F) Lower Chippewa River Savanna and Prairies, (AA) York Prairie Grasslands

PAST Pasture:

(A) Thomson Prairie Grasslands, (C) Yellowstone/Pecatonica River Grasslands and Savannas, (E) Star Prairie Pothole Grasslands, (AA) York Prairie Grasslands

UPSH Upland shrub:

(A) Thomson Prairie Grasslands, (1) Thomson Prairie, (C) Yellowstone/Pecatonica River Grasslands and Savannas, (E) Star Prairie Pothole Grasslands, (4) Governor Dodge SP, (19) Caryville Savanna SNA, (17) Trempealeau NWR, (BB) Buffalo River/Lima Mounds Savannas, (2) Yellowstone WA/Yellowstone SP, (CC) Mirror Lake Barrens

ICSG Idle cool season grass/forb (short, medium, and tall):

(A) Thomson Prairie Grasslands, (1) Thomson Prairie, (C) Yellowstone/Pecatonica River Grasslands and Savannas, (E) Star Prairie Pothole Grasslands, (25) Lundy Pond, Tenmile Creek, & Three Lakes WPAs, (26) Bierbrauer, Amschler, Oakridge, & Erickson WPAs, (2) Yellowstone WA/Yellowstone Lake SP, (4) Governor Dodge SP, (AA) York Prairie Grasslands, (B) Fort McCoy Barrens, (3) Iowa County Farm, (17) Trempealeau NWR

DROF Dry old field:

(A) Thomson Prairie Grasslands, (D) Lower Wisconsin River Prairies and Barrens, (6) Spring Green Reserve SNA, (C) Yellowstone/Pecatonica Grasslands and Savannas, (26) Bierbrauer, Amschler, Oakridge, & Erickson WPAs, (25) Lundy Pond, Tenmile Creek, & Three Lakes WPAs, (F) Lower Chippewa River Savanna and Prairies, (4) Governor Dodge SP, (2) Yellowstone WA/Yellowstone Lake SP, (21) Dunnville WA, (12) Rush Creek SNA, (G) Rush Creek/Battle Bluff Goat Prairies and Savannas, (20) Meridean Barrens, (CC) Mirror Lake Barrens, (10) Mirror Lake SP, (13) Battle Bluff Prairie SNA, (7) Gotham Jack Pine Barrens SNA, (14) La Crosse Municipal Airport, (17) Trempealeau NWR

ORBA Oak or river barrens:

(B) Fort McCoy Barrens, (F) Lower Chippewa River Savanna and Prairies, (9) Blue River Sand Barrens SNA, (16) Fort McCoy SNA, (D) Lower Wisconsin River Prairies and Barrens, (19) Caryville Savanna SNA, (22) Nine Mile Island SNA, (20) Meridean Barrens, (6) Spring Green Reserve SNA, (7) Gotham Jack Pine Barrens SNA, (21) Dunnville WA

DMPR Dry-mesic prairie:

(A) Thomson Prairie Grasslands, (1) Thomson Prairie, (AA) York Prairie Grasslands, (E) Star Prairie Pothole Grasslands, (C) Yellowstone/Pecatonica Grasslands and Savannas, (2) Yellowstone WA/Yellowstone Lake SP

OASA Oak savanna (open with scattered trees):

(C) Yellowstone/Pecatonica Grasslands and Savannas, (12) Rush Creek SNA, (G) Rush Creek/Battle Bluff Goat Prairies and Savannas, (BB) Buffalo River/Lima Mounds Savannas, (B) Fort McCoy Barrens, (A) Thomson Prairie Grasslands, (8) Avoca Prairie-Savanna SNA, (AA) York Prairie Grasslands, (E) Star Prairie Pothole Grasslands, (4) Governor Dodge SP, (25) Lundy Pond, Tenmile Creek, & Three Lakes WPAs, (23) Morgan Coulee Prairie SNA, (D) Lower Wisconsin River Prairies and Barrens, (2) Yellowstone WA/Yellowstone Lake SP, (17) Trempealeau NWR

COBA Conifer barrens:

(CC) Mirror Lake Barrens, (10) Mirror Lake SP, (11) Van Zelst Barrens

SWOF Shrubby wet old field:

(17) Trempealeau NWR, (D) Lower Wisconsin River Prairies and Barrens, (21) Dunnville WA

SHSW Shrub swamp:

(17) Trempealeau NWR, (D) Lower Wisconsin River Prairies and Barrens, (8) Avoca Prairie-Savanna SNA, (25) Lundy Pond, Tenmile Creek, & Three Lakes WPAs

WMWP Wet-mesic or wet prairie:

(8) Avoca Prairie-Savanna SNA

FAFI Fallow fields:

(E) Star Prairie Pothole Grasslands, (AA) York Prairie Grasslands; use as buffers

SSME Southern sedge meadow:

(8) Avoca Prairie-Savanna SNA, (D) Lower Wisconsin River Prairies and Barrens

WEOF Wet old field:

(4) Governor Dodge SP, (2) Yellowstone WA/Yellowstone Lake SP

SMGR Small grains:

(E) Star Prairie Pothole Grasslands, (A) Thomson Prairie Grasslands, (C) Yellowstone/Pecatonica Grasslands and Savannas; use especially as buffers for idle grassland

GLHA Grass or grass/legume hay:

(E) Star Prairie Pothole Grasslands

SSMA Southern sedge marsh:

(D) Lower Wisconsin River Prairies and Barrens, (25) Lundy Pond, Tenmile Creek, & Three Lakes WPAs

YCPL Young conifer plantation:

(E) Star Prairie Pothole Grasslands

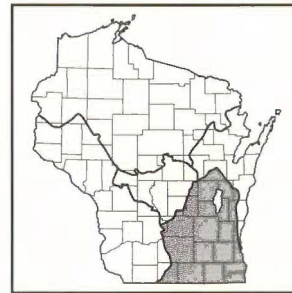
¹ Habitats are ranked by priority within the division. Each habitat is followed by suggested landscapes and sites for management, arranged roughly from highest to lowest priority. Landscape letter codes and site number codes in parentheses correspond to the map. See Table 1, page 12, and Appendix E, page 126, for descriptions of bird communities expected in the habitats listed.

*While crossing this marvellous
region... thousands upon thousands
of prairie chickens, partridges, and
pheasants flew up before us
continuously....*

—Count Agoston Haraszthy writing
about a trip from Madison to Lake
Winnebago in 1840 (Schorger 1943)



Blue-winged teal



Southeastern Ridges and Lowlands

In presettlement times, this natural division was dominated by oak savannas (west, southeast, and north-central) and southern mesic forest, with a mosaic of prairies, extensive sedge meadows, southern dry forests, and some conifer swamps and lowland hardwood forests. Wetlands and lakes were abundant. Most prairies and sedge meadows were embedded in the savanna landscapes where most of the grassland bird habitat was located. The largest prairies were the Empire (or Arlington) Prairie in Columbia and Dane counties, the Rock Prairie in Rock and Walworth counties, and the Barnes Prairie in Racine and Kenosha counties.

Species of management concern in the Southeastern Ridges and Lowlands

(in order of priority)

Henslow's sparrow
 Loggerhead shrike
 Dickcissel
 Bobolink
 Eastern meadowlark
 Upland sandpiper
 Sedge wren
 Grasshopper sparrow
 Vesper sparrow
 Savannah sparrow
 Blue-winged teal
 Bell's vireo
 Wilson's phalarope
 Northern harrier
 Short-eared owl
 Barn owl

Birds

The 16 priority bird species for the Southeastern Ridges and Lowlands (see sidebar) include three of the four shortgrass species, all the midgrass species, two each of the tallgrass species and species requiring woody vegetation or nest structures, three of the species requiring large areas, and both species requiring open water from the statewide list (see Table 5, page 58). The three tallgrass species not included as priorities for this natural division—yellow rail and Le Conte's and Nelson's sharp-tailed sparrows—are sedge meadow birds that occur only rarely in the northern portion of the division. While not listed as a priority species, the greater prairie-chicken has the potential to be reintroduced in this division in appropriate landscapes, for example in the Muralt/Monroe Grasslands (H).

Shortgrass species. Grasshopper sparrow is most common in the southern and western parts of this division, while upland sandpiper and vesper sparrow are more broadly distributed. Upland sandpiper is especially likely where there are large blocks of idle grassland and pasture. Vesper sparrow is most common and abundant in row crops and small grains in this division.

Midgrass species. Dickcissel is typically most common in the southern part of this division. Bobolink, eastern meadowlark, and savannah sparrow are all relatively widespread.

Tallgrass species. Sedge wren is most abundant in the northern part. Henslow's sparrow is locally distributed throughout. This is one of the most important natural divisions for managing habitat for Henslow's sparrow. There are good opportunities for management of tallgrass species in this natural division.

Species requiring woody vegetation or nest structures. Bell's vireo is most common in the southwestern part. The rare Loggerhead shrike has an unpredictable distribution in the division.

Species requiring open water. Blue-winged teal and Wilson's phalarope occur most frequently in the northwestern part of this division in association with required wetland habitats.

Species requiring large areas. Short-eared owl, barn owl, and northern harrier have unpredictable distributions but always depend on large areas of suitable habitat and, as elsewhere, on small mammal populations. These species are best managed for in the priority landscapes indicated in Figure 10.

Habitats, Landscapes, and Sites

Most of the state's row crops are grown in the Southeastern Ridges and Lowlands, where agriculture is the most intensive. Small grains are common in the east-central part. Almost all prairies and many sedge meadows were converted to agriculture because of the division's relatively flat topography and rich soils. Most of the former forests are now farmland as well. An estimated 21,000 acres of permanent

grassland is in blocks greater than 100 acres—the vast majority in uplands.

Because of the generally intensive agricultural and urban land uses, grassland bird habitat is largely restricted to idle grassland habitat on publicly owned properties and on unfarmed, privately owned grasslands such as wet meadows. However, some landscapes have considerable pasture or CRP acreage, such as parts of Green and Columbia counties. This natural division also contains the heart of the best historical duck and pheasant range in Wisconsin and thus has a large number of State Wildlife Areas and other publicly owned lands that are managed in part for grassland nesting habitat. The potential for improving habitat quality for grassland birds on those properties is great.

Priority habitats, landscapes, and sites for grassland management in the Southeastern Ridges and Lowlands are listed next to Figure 10. While this division has the greatest number of landscapes and sites, the only two landscapes to rank in the top ten are the Muralt/Monroe Grasslands (H)—a landscape dominated by private lands—and the White River Marsh Complex (I)—a landscape dominated by large public ownerships. Both of these landscapes have more extensive areas of idle grassland or sedge meadow habitat than the other landscapes in the division. The White River Marsh Complex has the most permanent, publicly owned grassland and sedge

meadow in the division, although there is a substantial amount of woody vegetation scattered throughout the landscape as well. Management for grassland birds there will involve consolidation and expansion of open grassland habitat.

This natural division has diverse geography, hydrology, and grassland habitats. We believe that management opportunities are best in the eight priority landscapes, the one secondary landscape, and the other sites we have identified (Figure 10). Some of these landscapes include native grassland remnants, such as the Southern Kettle Moraine Complex (J), where the challenge is to expand and connect remnants to increase effective grassland habitat size. The Southern Kettle Moraine landscape will also require careful coordination of grassland, wetland, savanna, and southern interior forest conservation efforts, since all of these habitats are present.

Even in landscapes lacking concentrations of remnants, habitat size can be increased through expansion and connection of habitat patches, because many blocks of grassland habitat in the division are isolated from other suitable habitats. Some Wildlife Areas and other permanent grassland blocks in the division—such as some sites in the Glacial Habitat Restoration Area—were not selected as priority sites. However, many of these can still provide valuable habitat if priority habitats are managed following the general habitat management recommendations in this guidebook.



MICHAEL MOSSMAN

Pictured here is the Scuppernong basin in the southern unit of the Kettle Moraine State Forest in Waukesha County. This landscape includes a variety of both surrogate and native grassland habitats in a largely fragmented landscape that includes wooded and agricultural habitats. Expanding, restoring, buffering, and connecting grasslands will improve habitat for grassland birds here. Grassland management needs to be coordinated with interior forest management, which is also a priority in this area.

Landscape and Site Names¹**Habitat Types** *(see next page for key to 4-letter codes)*

H. Muralt/Monroe Grasslands	PAST, ICSG, IWSG, SMGR, DROF, UPSH, DMPR, OASA, DSPR, SSME, GLHA ²
Sites: 36. Oliver Prairie State Natural Area (SNA)	DMPR
37. Muralt Bluff Prairie SNA	DSPR, DMPR
38. Albany Wildlife Area (WA)	ICSG, IWSG, UPSH
I. White River Marsh Complex³	SSME, WMWP, SSMA, ICSG, PAST, ORBA, DROF, WEOF, SWOF, OASA, YCPL
Sites: 60. Puchyan Prairie SNA	WMWP, SSME
61. White River Marsh WA	SSME, ICSG, IWSG, WMWP, SHSW, SSMA, DROF, WEOF, SWOF
J. Southern Kettle Moraine Complex	ICSG, IWSG, OASA, SSME, WMWP, PAST, DROF, WEOF, SWOF, UPSH, OPBO
Sites: 30. Genesee Oak Opening and Fen SNA	OASA, WMWP
31. Scuppernong River Basin Complex (includes Scuppernong Prairie State Natural Area, Kettle Moraine Fen and Low Prairie SNA, and Ottawa Lake Fen SNA)	SSME, WMWP, OASA, ICSG, DMPR, DROF, SHSW, UPSH, WEOF, SWOF
32. Eagle Oak Opening SNA	OASA
33. Blue Spring Oak Opening SNA/Restoration Area	OASA, DROF
34. Young Prairie SNA	WMWP, IWSG, OASA, DROF, SWOF
35. Clover Valley Fen SNA	WMWP, SSME, ICSG, WEOF
K. Columbia/Dane County Prairie Wetlands	ICSG, IWSG, DROF, WEOF, PAST, SSME, SSMA, SMGR, DMPR, DSPR, UPSH, SHSW, OASA, FAFI
Sites: 45. Northern Dane County Prairie Pastures	PAST, DMPR, ICSG,
46. Audubon Goose Pond SNA	IWSG, ICSG, DROF
47. Schoeneberg Marsh Waterfowl Protection Areas (WPAs)	ICSG, IWSG, SSMA, DROF, SHSW
48. Mud Lake WA	ICSG, IWSG, UPSH, DROF, SSMA, DMPR
49. Otsego WPAs (includes Severson, Vangen, Manthey, and other nearby WPAs)	ICSG, IWSG, SHSW, SSMA
50. Grassy Lake WA	IWSG, ICSG, SSMA, DROF, UPSH, SHSW
L. Bong Recreation Area	
Sites: 28. Bong State Recreation Area (SRA)	ICSG, IWSG, DROF, SWOF, OASA, UPSH, WMWP, WEOF
M. Rush Lake Grasslands and Sedge Meadows	SSME, SHSW, GLHA, ICSG, PAST, WEOF, WMWP, OASA
Sites: 62. Gromme Preserve (several sites)	SSME, WEOF, ICSG, IWSG, OASA, WMWP, SHSW, SWOF, SSMA
63. Uihlein WPA	ICSG, IWSG, SSMA
N. Brillion/Killsnake Grasslands	ICSG, SMGR, PAST
Sites: 65. Killsnake WA	ICSG, IWSG, SSME, UPSH, OASA, SHSW, SWOF
66. Brillion WA	ICSG, IWSG, SSME, UPSH, OASA, WEOF, SHSW, SWOF
O. Pine Island Area Grasslands	ORBA, OASA, SSME, IWSG
Sites: 53. Pine Island WA	IWSG, DROF, ICSG, UPSH, DSPR, SWOF, WMWP, SSME
DD. Waterloo Area Prairies	PAST, SWOF, ICSG, OASA, WMWP, DROF, WEOF, SHSW, SSME
Sites: 39. Faville Prairie SNA	WMWP, SHSW, SSME, ICSG
40. Snapper Prairie SNA	WMWP, WEOF
41. Waterloo WA (includes Blue Joint Fen and Waterloo Fen & Springs SNA)	IWSG, ICSG, WMWP, SSME, SHSW, UPSH, OASA
EE. Horicon Marsh Grasslands	
56. Horicon NWR/Horicon WA	IWSG, ICSG, DROF, WEOF, SWOF, UPSH, SHSW, SSME
FF. Saint Peter's Prairie	DMPR, DSPR, ICSG
Other Sites Located Outside of Landscapes:	
27. Chiwaukee Prairie SNA	WMWP, SSME, DMPR, ICSG, WEOF, OASA
29. Lulu Lake SNA	SSME, WMWP, OASA, DSPR, SHSW, DROF, OPBO
42. Deansville WA (Includes Deansville Fen SNA)	ICSG, WEOF, SWOF, WMWP, IWSG
43. Cherokee Marsh (includes Cherokee Marsh SNA)	SSME, SHSW, WEOF, SWOF, WMWP, DROF, IWSG, ICSG
44. Bong Road/Westport Drumlin SNA	DMPR, UPSH, ICSG, DROF, DSPR
51. Rocky Run State Fisheries Area (SFA) (includes Rocky Run Oak Savanna SNA)	OASA, DROF, ICSG, IWSG, UPSH
52. Badger Army Ammunition Plant	IWSG, PAST, ICSG, DROF, OASA
54. French Creek WA	SSME, IWSG, ICSG, WMWP, DROF, OASA, SSMA
55. Jersey Flats Prairie Restoration	IWSG
57. Patrouille/Buwalda Easement (in Glacial Habitat Restoration Area)	IWSG, FAFI, ICSG, WEOF, WMWP
58. Grand River Marsh WA (includes Fountain Creek Wet Prairie SNA)	ICSG, IWSG, SSME, WMWP, OASA, DROF, SHSW, WEOF, SWOF
59. Fox River Crane Marsh	SSME, SSMA, SHSW
64. Poygan Marsh WA	SSMA, SHSW, ICSG

¹ Landscapes are ranked from highest priority to lowest priority. Sites are **not** ranked within landscapes. When a landscape overlaps more than one natural division, the landscape is listed within the division where most of its land area occurs. Four-letter codes represent priority habitat types that are present in the sites and landscapes.

² Codes listed after landscape names refer to habitats common or present within the landscape, in areas other than the numbered sites.

³ The White River Marsh Complex Landscape has sites in both the Southeastern Ridges and Lowlands Division and the Central Plains Division.

Priority Grassland Habitats for Management in the Southeastern Ridges and Lowlands¹ (ranked by priority)

IWSG Idle warm season grass (medium and tall):

(L) Bong SRA, (61) White River Marsh WA, (H) Muralt/Monroe Grasslands, (K) Columbia/Dane County Prairie Wetlands, (53) Pine Island WA, (65) Killsnake WA, (66) Brillion WA, (58) Grand River Marsh WA, (O) Pine Island Area Grasslands, (48) Mud Lake WA, (50) Grassy Lake WA, (47) Schoeneberg Marsh WPAs, (49) Otsego WPAs, (54) French Creek WA, (38) Albany WA, (55) Jersey Flats Prairie Restoration, (41) Waterloo WA, (J) Southern Kettle Moraine Complex, (56) Horicon NWR/Horicon WA, (46) Audubon Goose Pond SNA, (57) Patrouille/Bulwada Easement, (52) Badger Army Ammunition Plant, (34) Young Prairie SNA, (42) Deansville WA, (51) Rocky Run SFA, (62) Gromme Preserve, (43) Cherokee Marsh, (63) Uihlein WPA

SSME Southern sedge meadow:

(61) White River Marsh WA, (59) Fox River Crane Marsh, (60) Puchyan Prairie SNA, (58) Grand River Marsh WA, (M) Rush Lake Grasslands and Sedge Meadows, (I) White River Marsh Complex, (31) Scuppernong River Basin Complex, (41) Waterloo WA, (35) Clover Valley Fen SNA, (J) Southern Kettle Moraine Complex, (K) Columbia/Dane County Prairie Wetlands, (62) Gromme Preserve, (29) Lulu Lake SNA, (43) Cherokee Marsh, (54) French Creek WA, (66) Brillion WA, (65) Killsnake WA, (O) Pine Island Area Grasslands, (27) Chiwaukee Prairie SNA, (DD) Waterloo Area Prairies, (H) Muralt/Monroe Grasslands, (53) Pine Island WA, (39) Faville Prairie SNA, (56) Horicon NWR/Horicon WA

ICSG Idle cool season grass (short, medium, and tall):

(H) Muralt/Monroe Grasslands, (61) White River Marsh WA, (I) White River Marsh Complex, (K) Columbia/Dane County Prairie Wetlands, (L) Bong SRA, (M) Rush Lake Grasslands and Sedge Meadows, (58) Grand River Marsh WA, (48) Mud Lake WA, (J) Southern Kettle Moraine Complex, (65) Killsnake WA, (66) Brillion WA, (N) Brillion/Killsnake Grasslands, (38) Albany WA, (54) French Creek WA, (31) Scuppernong River Basin Complex, (53) Pine Island WA, (47) Schoeneberg Marsh WPAs, (41) Waterloo WA, (56) Horicon NWR/Horicon WA, (50) Grassy Lake WA, (49) Otsego WPAs, (35) Clover Valley Fen SNA, (62) Gromme Preserve, (45) Northern Dane County Prairie Pastures, (46) Audubon Goose Pond SNA, (27) Chiwaukee Prairie SNA, (51) Rocky Run SFA, (43) Cherokee Marsh, (42) Deansville WA, (39) Faville Prairie SNA, (DD) Waterloo Area Prairies, (57) Patrouille/Bulwada Easement, (63) Uihlein WPA, (64) Poygan Marsh WA, (52) Badger Army Ammunition Plant, (44) Bong Road/Westport Drumlin SNA, (FF) Saint Peter's Prairie

PAST Pasture:

(H) Muralt/Monroe Grasslands, (45) Northern Dane County Prairie Pastures, (I) White River Marsh Complex, (J) Southern Kettle Moraine Complex, (K) Columbia/Dane County Prairie Wetlands, (M) Rush Lake Grasslands and Sedge Meadows, (N) Brillion/Killsnake Grasslands, (52) Badger Army Ammunition Plant, (DD) Waterloo Area Prairies

UPSH Upland shrub:

(H) Muralt/Monroe Grasslands, (J) Southern Kettle Moraine Complex, (K) Columbia/Dane County Prairie Wetlands, (48) Mud Lake WA, (31) Scuppernong River Basin Complex, (53) Pine Island WA, (50) Grassy Lake WA, (38) Albany WA, (L) Bong SRA, (66) Brillion WA, (65) Killsnake WA, (56) Horicon NWR/Horicon WA, (44) Bong Road/Westport Drumlin SNA, (41) Waterloo WA, (51) Rocky Run SFA

WMWP Wet-mesic or wet prairie:

(31) Scuppernong River Basin Complex, (34) Young Prairie SNA, (61) White River Marsh WA, (60) Puchyan Prairie SNA, (41) Waterloo WA, (27) Chiwaukee Prairie SNA, (41) Waterloo WA (Blue Joint Fen), (58) Grand River Marsh WA (mainly Fountain Creek SNA), (39) Faville Prairie SNA, (40) Snapper Prairie SNA, (35) Clover Valley Fen SNA, (42) Deansville WA, (54) French Creek WA, (DD) Waterloo Area Prairies, (I) White River Marsh Complex, (J) Southern Kettle Moraine Complex, (29) Lulu Lake SNA, (30) Genesee Oak Opening and Fen SNA, (62) Gromme Preserve, (L) Bong SRA, (M) Rush Lake Grasslands and Sedge Meadows, (53) Pine Island WA, (43) Cherokee Marsh, (57) Patrouille/Bulwada Easement

DSPR Dry or sand prairie:

(37) Muralt Bluff Prairie SNA, (H) Muralt/Monroe Grasslands, (K) Columbia/Dane County Prairie Wetlands, (53) Pine Island WA, (FF) Saint Peter's Prairie (small remnants surrounded by cropland), (29) Lulu Lake SNA, (44) Bong Road/Westport Drumlin SNA

OASA Oak savanna:

(33) Blue Spring Oak Opening SNA/Restoration Area, (J) Southern Kettle Moraine Complex, (30) Genesee Oak Opening and Fen SNA, (51) Rocky Run SFA, (H) Muralt/Monroe Grasslands, (58) Grand River Marsh WA, (K) Columbia/Dane County Prairie Wetlands, (M) Rush Lake Grasslands and Sedge Meadows, (I) White River Marsh Complex, (31) Scuppernong River Basin Complex, (29) Lulu Lake SNA, (34) Young Prairie SNA, (32) Eagle Oak Opening SNA, (DD) Waterloo Area Prairies, (L) Bong SRA, (52) Badger Army Ammunition Plant, (62) Gromme Preserve, (65) Killsnake WA, (66) Brillion WA, (O) Pine Island Area Grasslands, (27) Chiwaukee Prairie SNA, (54) French Creek WA, (41) Waterloo WA

DROF Dry old field:

(H) Muralt/Monroe Grasslands, (J) Southern Kettle Moraine Complex, (31) Scuppernong River Basin Complex, (33) Blue Spring Oak Opening SNA/Restoration Area, (61) White River Marsh WA, (I) White River Marsh Complex, (53) Pine Island WA, (K) Columbia/Dane County Prairie Wetlands, (51) Rocky Run SFA, (L) Bong SRA, (34) Young Prairie SNA, (48) Mud Lake WA, (56) Horicon NWR/Horicon WA, (46) Audubon Goose Pond SNA, (50) Grassy Lake WA, (47) Schoeneberg Marsh WPAs, (41) Waterloo WA, (DD) Waterloo Area Prairies, (58) Grand River Marsh WA, (44) Bong Road/Westport Drumlin SNA, (43) Cherokee Marsh, (52) Badger Army Ammunition Plant, (29) Lulu Lake SNA, (54) French Creek WA

GLHA Grass or grass/legume hay:

(M) Rush Lake Grasslands and Sedge Meadows, (H) Muralt/Monroe Grasslands

WEOF Wet old field:

(61) White River Marsh WA, (31) Scuppernong River Basin Complex, (I) White River Marsh Complex, (K) Columbia/Dane County Prairie Wetlands, (35) Clover Valley Fen SNA, (J) Southern Kettle Moraine Complex, (66) Brillion WA, (56) Horicon NWR/Horicon WA, (58) Grand River Marsh WA, (40) Snapper Prairie SNA, (41) Waterloo WA, (DD) Waterloo Area Prairies, (27) Chiswaukee Prairie SNA, (57) Patrouille/Bulwada Easement, (42) Deansville WA, (43) Cherokee Marsh, (62) Gromme Preserve, (M) Rush Lake Grasslands and Sedge Meadows, (28) Bong SRA

SSMA Southern sedge marsh:

(59) Fox River Crane Marsh, (64) Poygan Marsh WA, (61) White River Marsh WA, (I) White River Marsh Complex, (K) Columbia/Dane County Prairie Wetlands, (47) Schoeneberg Marsh WPAs, (48) Mud Lake WA, (50) Grassy Lake WA, (49) Otsego WPAs, (62) Gromme Preserve, (54) French Creek WA, (63) Uihlein WPA

ORBA Oak or river barrens:

(I) White River Marsh Complex, (O) Pine Island Area Grasslands

SMGR Small grains:

(H) Muralt/Monroe Grasslands, (K) Columbia/Dane County Prairie Wetlands, (N) Brillion/Killsnake Grasslands

DMPR Dry-mesic prairie:

(37) Muralt Bluff Prairie SNA, (H) Muralt/Monroe Grasslands, (45) Northern Dane County Prairie Pastures, (44) Bong Road/Westport Drumlin SNA, (36) Oliver Prairie SNA, (K) Columbia/Dane County Prairie Wetlands, (31) Scuppernong River Basin Complex, (27) Chiswaukee Prairie SNA, (48) Mud Lake WA, (FF) Saint Peter's Prairie (small remnants surrounded by cropland)

SHSW Shrub swamp:

(31) Scuppernong River Basin Complex, (61) White River Marsh WA, (K) Columbia/Dane County Prairie Wetlands, (M) Rush Lake Grasslands and Sedge Meadows, (DD) Waterloo Area Prairies, (47) Schoeneberg Marsh WPAs, (39) Faville Prairie SNA, (49) Otsego WPAs, (66) Brillion WA, (65) Killsnake WA, (62) Gromme Preserve, (56) Horicon NWR/Horicon WA, (58) Grand River Marsh WA, (64) Poygan Marsh WA, (29) Lulu Lake SNA, (43) Cherokee Marsh, (41) Waterloo WA, (59) Fox River Crane Marsh, (50) Grassy Lake WA

SWOF Shrubby wet old field:

(61) White River Marsh WA, (I) White River Marsh Complex, (31) Scuppernong River Basin Complex, (34) Young Prairie SNA, (J) Southern Kettle Moraine Complex, (L) Bong SRA, (62) Gromme Preserve, (66) Brillion WA, (53) Pine Island WA, (56) Horicon NWR/Horicon WA, (DD) Waterloo Area Prairies, (42) Deansville WA, (43) Cherokee Marsh, (65) Killsnake WA, (58) Grand River Marsh WA

OPBO Open Bog:

(J) Southern Kettle Moraine Complex, (29) Lulu Lake SNA

FAFI Fallow fields:

(57) Patrouille/Bulwada Easement, (K) Columbia/Dane County Prairie Wetlands

YCPL Young conifer plantation:

(I) White River Marsh Complex

¹ Habitats are ranked by priority within the division. Each habitat is followed by suggested landscapes and sites for management, arranged roughly from highest to lowest priority. Landscape letter codes and site number codes in parentheses correspond to the map. See Table 1, page 12, and Appendix E, page 126, for descriptions of bird communities expected in the habitats listed.

Most of the interest in prairie restoration has been purely botanical; hence, most areas of attempted restoration are too small to harbor viable breeding populations of prairie birds. But an exciting possibility would be to upgrade a few prairie preserves to make them as large and complete as possible, favoring birds ranging from Bobolinks and Northern Harriers to Sedge Wrens and Greater Prairie-Chickens, and other animals ranging from lizards, snakes, and pocket gophers to badgers and bison... Is it not too soon to explore such possibilities, for agricultural practices could suddenly intensify further, while all open space continues to shrink under mounting pressures of human population.

—James Hall Zimmerman,
The Landscape and the Birds
(Zimmerman 1991)



Greater prairie-chicken



Central Plains

The Central Plains historically was dominated by oak savanna and pine and oak barrens, with a mix of extensive wet meadows and some pine and southern oak forests, conifer swamps, prairies, and lowland hardwood forests. While there was no extensive open prairie habitat, grassland birds were probably abundant in many parts of this division. Most of the division, once covered by Glacial Lake Wisconsin, is flat and characterized by sandy soils, shallow peats, and mucks.

Species of management concern in the Central Plains

(in order of priority)

Greater prairie-chicken
Henslow's sparrow
Sedge wren
Northern harrier
Wilson's phalarope
Bobolink
Grasshopper sparrow
Vesper sparrow
Upland sandpiper
Sharp-tailed grouse
Short-eared owl
Western meadowlark
Field sparrow
Le Conte's sparrow
Lark sparrow
Clay-colored sparrow
Brewer's blackbird
Bell's vireo
Barn owl



Vesper sparrow

Birds

There are 19 priority bird species in this natural division (see sidebar). They include all of the shortgrass species and species requiring large areas, one midgrass species, one of the species requiring open water, three of the five tallgrass species, and five of the six species requiring woody vegetation or nest structures from the statewide list (see Table 5, page 58).

Shortgrass species. The distribution of these species generally follows the distribution of dry upland soils with shortgrass habitats. Vesper sparrow reaches its highest densities in this natural division and is found mainly in row crops and conifer and oak or river barrens. Upland sandpiper is most numerous on large blocks of idle or lightly grazed grassland, such as the Buena Vista/Leola Grasslands (P). Grasshopper sparrow and Western meadowlark occur in suitable shortgrass habitats throughout the division.

Midgrass species. Bobolink occurs throughout the division in appropriate upland and lowland habitats.

Tallgrass species. Henslow's sparrow is irregularly distributed throughout the division. It can be locally common on sites with good habitat, such as Buena Vista Grasslands. Sedge wren is common in wet grass and sedge meadows. The Central Plains is an important natural division for managing this and other sedge meadow species, including Le Conte's sparrow. Yellow rail has recently occurred at Comstock Bog-Meadow (67), and may warrant addition to the list of priority bird species for this division.

Species requiring woody vegetation or nest structures. Lark sparrow is locally distributed in oak or river barrens and conifer barrens, especially in the southern part. Bell's vireo is mostly restricted to the southern part of this division. Clay-colored sparrow is common in both upland and lowland shrub habitats and young conifer plantations. Field sparrow is common throughout, especially in dry habitats with brush. Brewer's blackbird is found in large open grasslands, especially those with some scattered trees or snags.

Species requiring open water. Wilson's phalarope occurs irregularly in large sedge meadows and sedge marshes.

Species requiring large areas. The Central Plains is currently the most important natural division for conservation of the greater prairie-chicken, in particular at the Buena Vista/Leola Grasslands Landscape (P) and Dewey Marsh Wildlife Area (78). Sharp-tailed grouse occur in relatively low numbers in the western part of this natural division, primarily in wetland habitats such as Wood County Wildlife Area (74) and Dike 17 (73). Large expanses of grasslands, such as at the Buena Vista/Leola Grasslands, are the main areas of importance for northern harrier and short-eared owl, although other sites may be used. Short-eared owl is particularly unpredictable and variable in its distribution, as is the very rare barn owl. The presence of area-sensitive birds in this division indicates the quality and size of grassland landscapes there.

Habitats, Landscapes, and Sites

Agriculture is not well developed in much of the Central Plains. However, in parts of the division the acreage devoted to irrigated vegetable crops such as potatoes, corn, and snap beans is substantial and increasing. This division is also the primary area for cranberry production, which is increasing in the state.

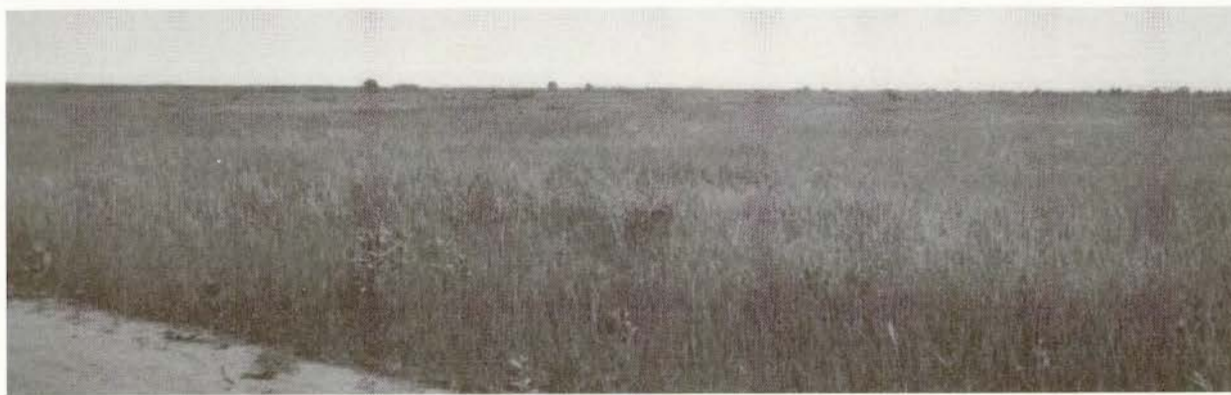
Priority habitats, landscapes, and sites for grassland management in the Central Plains are listed next to Figure 11. An estimated 19,000 acres of permanent grasslands—the vast majority of it upland—are in blocks greater than 100 acres in this small natural division. Most of these blocks are in the Buena Vista/Leola Grasslands (P), Necedah Barrens (Q), and Bear Bluff Wetlands (R). These three landscapes offer special opportunities for grassland, sedge meadow, barrens, and open bog management at fairly large scales. The potential for managing for or conserving southern sedge meadows is high because this extinct glacial lake bed has many open, poorly drained areas (one case in point are the sedge meadows occurring on county forest lands in the Bear Bluff Wetlands Landscape). Sandy soil areas are likely locations for restoring and expanding barrens and dry-mesic prairie habitats. Commercially mossed sphagnum bogs typically support a simple breeding bird community dominated by sedge wren, savannah sparrow, and

Henslow's sparrow. The value of mossed bogs is elevated because they tend to occur in large open bog landscapes. However, mossed bog replaces open bog, a native habitat that is in trouble in the Central Plains, and conversion should be discouraged.

The close proximity of Necedah Barrens Landscape (Q), Bear Bluff Wetlands Landscape (R), and the Wood County Wildlife Area (74) in the Central Plains with the nearby Fort McCoy Barrens (B) in the Southwestern Upland offers unique opportunities for connection of large blocks of a variety of grassland habitats.

At Buena Vista/Leola Grasslands (P), which is the model for our concept of large-scale management areas, the challenge is to maintain suitable habitats on private lands. Currently the encroachment of irrigated row crops and cranberry bogs may threaten the value of the entire landscape for prairie-chickens and other grassland birds, which is currently very high (Sample 1995). This landscape is the single most important in the natural division, and most of the priority bird species occur there. The 4,000 acre barrens restoration activities at Necedah National Wildlife Refuge (Q) hold real promise for grassland birds, especially if adequate areas are kept sufficiently open—that is, with relatively low tree density—and are not entirely isolated by more closed, wooded habitats.

Wide open, almost treeless horizons are typical of the Buena Vista Grasslands, shown here. This landscape, a mosaic of public and private lands, is home to a highly diverse community of grassland birds, including the greater prairie-chicken. It is one of the best examples of a functioning large-scale grassland management area in the state.



DAVID SAMPLE

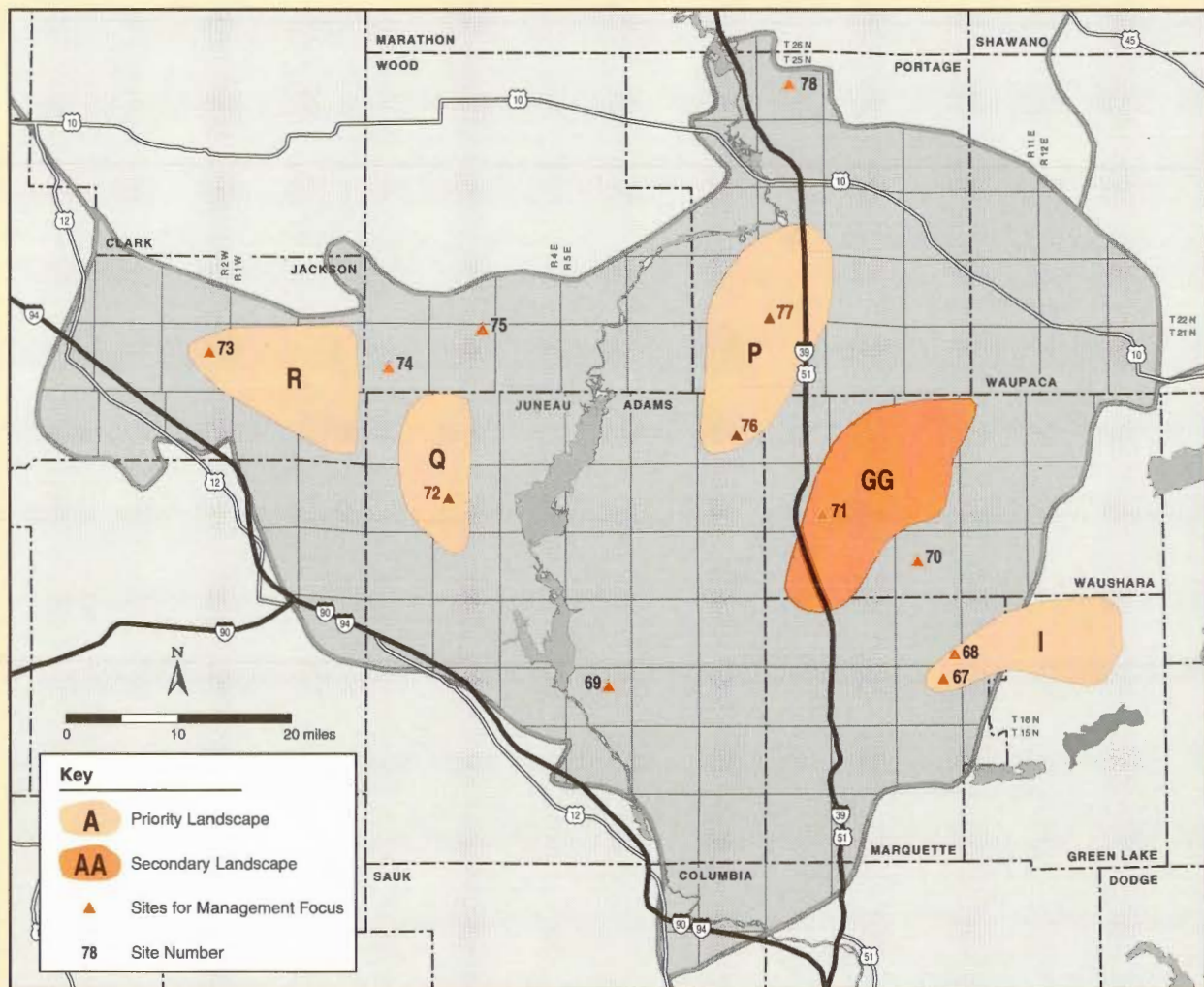


FIGURE 11. Priority landscapes and sites for grassland bird management in the Central Plains Natural Division.

Landscape and Site Names¹**Habitat Types** *(see next page for key to 4-letter codes)*

I. White River Marsh Complex²	SSME, WMWP, SSMA, ICSG, PAST, ORBA, DROF, WEOF, SWOF, OASA, YCPL ³
Sites: 67. Comstock Bog-Meadow	
State Natural Area (SNA)	NSME, SSME, OPBO, SHSW
68. Germania Wildlife Area (WA)	SSME, SHSW, DROF, IWSG, WMWP, ICSG, SSMA
P. Buena Vista/Leola Grasslands	PAST, UPSH, DROF
Sites: 76. Leola Marsh WA	ICSG, PAST
77. Buena Vista Grasslands	
(Includes Buena Vista Quarry Prairie SNA and	
Buena Vista Prairie Chicken Meadow SNA)	ICSG, DROF, DMPR, IWSG, PAST, UPSH, WEOF, SWOF, SHSW
Q. Necedah Barrens	
Sites: 72. Necedah NWR Barrens Restoration	
(Includes Necedah Oak-Pine Savanna SNA)	DIBA, BPBA, IWSG, DROF, WEOF, SHSW, SSMA, DSPR, SSME
R. Bear Bluff Wetlands	NSME, OPBO, NSMA, SSMA, MOBO, DIBA, SHSW, UPSH, BPBA
Sites: 73. Dike 17 WA	SSME, SSMA, SHSW, DROF, BPBA, ICSG, IWSG, DMPR, SWOF, WMWP
GG. Coloma Barrens and Savannas	ORBA, YCPL, DSPR, DROF
Sites: 71. Greenwood WA	IWSG, OASA, SSME
Other Sites Located Outside of Landscapes:	
69. Quincy Bluff and Wetlands SNA	SSME, NSME, ICSG, ORBA, BPBA
70. Lunch Creek Wetlands	SSME, WMWP, ICSG, SHSW
74. Wood County WA	OPBO, SSME, SSMA, SHSW, DROF, WEOF, SWOF
75. Sandhill WA	
(Includes Barrens Restoration	
and Buffalo Pasture)	SSMA, SSME, PAST, ORBA, SHSW, CBOV, SWOF, DROF, OPBO
78. Dewey Marsh WA	NSME, OPBO, SHSW, NSMA, UPSH, DROF, ICSG

¹ Landscapes are ranked from highest priority to lowest priority. Sites are **not** ranked within landscapes. When a landscape overlaps more than one natural division, the landscape is listed within the division where most of its land area occurs. Four-letter codes represent priority habitat types that are present in the sites and landscapes.

² The White River Marsh Complex Landscape has sites in both the Southeastern Ridges and Lowlands Division and the Central Plains Division.

³ Codes listed after landscape names refer to habitats common or present within the landscape, in areas other than the numbered sites.

Priority Grassland Habitats for Management in the Central Plains¹

(ranked by priority)

IWSG Idle warm season grass/forb (medium and tall):

(71) Greenwood WA, (72) Necedah NWR Barrens Restoration, (68) Germania WA, (77) Buena Vista Grasslands, (73) Dike 17 WA

SSME Southern sedge meadow:

(67) Comstock Bog-Meadow SNA, (I) White River Marsh Complex, (70) Lunch Creek Wetlands, (73) Dike 17 WA, (68) Germania WA, (69) Quincy Bluff and Wetlands SNA, (71) Greenwood WA, (72) Necedah NWR Barrens Restoration, (74) Wood County WA, (75) Sandhill WA

NSME Northern sedge meadow:

(78) Dewey Marsh WA, (R) Bear Bluff Wetlands, (67) Comstock Bog-Meadow SNA, (69) Quincy Bluff and Wetlands SNA

ICSG Idle cool season grass/forb (short, medium, and tall):

(77) Buena Vista Grasslands, (68) Germania WA, (I) White River Marsh Complex, (76) Leola Marsh WA, (73) Dike 17 WA, (69) Quincy Bluff and Wetlands SNA, (78) Dewey Marsh WA, (70) Lunch Creek Wetlands

PAST Pasture:

(P) Buena Vista/Leola Grasslands, (76) Leola Marsh WA, (77) Buena Vista Grasslands, (75) Sandhill WA, (I) White River Marsh Complex

DSPR Dry or sand prairie:

(72) Necedah NWR Barrens Restoration, (GG) Coloma Barrens and Savannas

DROF Dry old field:

(77) Buena Vista Grasslands, (68) Germania WA, (I) White River Marsh Complex, (P) Buena Vista/Leola Grasslands, (72) Necedah NWR Barrens Restoration, (73) Dike 17 WA, (GG) Coloma Barrens and Savannas, (74) Wood County WA, (75) Sandhill WA, (78) Dewey Marsh WA

WMWP Wet-mesic or wet prairie:

(68) Germania WA, (I) White River Marsh Complex, (73) Dike 17 WA, (70) Lunch Creek Wetlands

DIBA Diverse barrens:

(72) Necedah NWR Barrens Restoration, (R) Bear Bluff Wetlands

COBA Conifer Barrens:

Scattered sites; mainly found in parts of the Black River State Forest in Jackson County, in Adams and Juneau counties, and in southeast Wood County.

BPBA Brush prairie barrens:

(72) Necedah NWR Barrens Restoration, (73) Dike 17 WA, (69) Quincy Bluff and Wetlands SNA, (R) Bear Bluff Wetlands

SSMA Southern sedge marsh:

(68) Germania WA, (I) White River Marsh Complex, (72) Necedah NWR Barrens Restoration, (73) Dike 17 WA, (R) Bear Bluff Wetlands, (74) Wood County WA, (75) Sandhill WA

NSMA Northern sedge marsh:

(R) Bear Bluff Wetlands, (78) Dewey Marsh WA

OPBO Open bog:

(R) Bear Bluff Wetlands, (67) Comstock Bog-Meadow SNA, (74) Wood County WA, (75) Sandhill WA, (78) Dewey Marsh WA

ORBA Oak or river barrens: (GG) Coloma Barrens and Savannas, (I) White River Marsh Complex, (69) Quincy Bluff and Wetlands SNA, (75) Sandhill WA

WEOF Wet old field:

(77) Buena Vista Grasslands, (I) White River Marsh Complex, (72) Necedah NWR Barrens Restoration, (74) Wood County WA

SHSW Shrub swamp:

(67) Comstock Bog-Meadow SNA, (68) Germania WA, (77) Buena Vista Grasslands, (72) Necedah NWR Barrens Restoration, (73) Dike 17 WA, (R) Bear Bluff Wetlands, (70) Lunch Creek Wetlands, (74) Wood County WA, (75) Sandhill WA, (78) Dewey Marsh WA

DMPR Dry-mesic prairie:

(77) Buena Vista Grasslands, (73) Dike 17 WA

UPSH Upland shrub:

(P) Buena Vista/Leola Grasslands, (77) Buena Vista Grasslands, (R) Bear Bluff Wetlands, (78) Dewey Marsh WA

SWOF Shrubby wet old field:

(77) Buena Vista Grasslands, (73) Dike 17 WA, (I) White River Marsh Complex, (74) Wood County WA, (75) Sandhill WA

OASA Oak savanna:

(I) White River Marsh Complex, (71) Greenwood WA

MOBO Mossed Bog:

(R) Bear Bluff Wetlands

YCPL Young conifer plantation:

(GG) Coloma Barrens and Savannas, (I) White River Marsh Complex

CBOV Cut- or burned-over:

(75) Sandhill WA; also scattered sites mainly in the western half of the division.

¹ Habitats are *ranked by priority* within the division. Each habitat is followed by suggested landscapes and sites for management, arranged roughly from highest to lowest priority. Landscape letter codes and site number codes in parentheses correspond to the map. See Table 1, page 12, and Appendix E, page 126, for descriptions of bird communities expected in the habitats listed.

*Twenty of thirty years [ago] the cheerful, chattering
song of the active bird, the short-billed marsh wren
(Cistothorus stellaris) (sic) was heard in every low
prairie covered with fine carex... I have seen or heard
scarcely a bird of this kind for fifteen or twenty years.
Their song has been silenced by the click of the mower.
The hay harvest comes before the young are fledged,
hence the mower is fatal to this wren's best interests.
They have gone, I hope, somewhere where carex
abounds and mowers do not.*

—Philo R. Hoy, *Man's Influence on the
Avifauna of Southeastern Wisconsin*
(Hoy 1885)



Sedge wren



Lake Michigan Shoreland

Before European settlement, this natural division was largely dominated by northern mesic forests, with pockets of conifer swamps, pine barrens, pine forests, sedge meadows, lowland hardwood forests, boreal forests (northern Door County), southern mesic forests (in the southern tip), and a few oak savannas. Major habitat for grassland birds was generally limited to the extensive emergent marshes and sedge meadows of the west shore of Green Bay, some of the barrens habitats, and a few oak savannas.

Species of management concern in the Lake Michigan Shoreland

(in order of priority)

Upland sandpiper
Yellow rail
Bobolink
Sedge wren
Wilson's phalarope
Eastern meadowlark
Savannah sparrow
Brewer's blackbird (north)
Barn owl



Brewer's blackbird

Birds

There are nine priority bird species in this natural division (see sidebar), including one each of the shortgrass species, species requiring woody vegetation or nest structures, and species requiring open water, two of the tallgrass species, three of the midgrass species, and one species requiring large areas from the statewide list (see Table 5, page 58).

Shortgrass species. Upland sandpiper reaches high densities in parts of this division, including southern Door County and in some counties along Lake Michigan, where hay and small grains are common.

Midgrass species. Savannah sparrow, bobolink, and eastern meadowlark are common in pastures and hayfields throughout.

Tallgrass species. Yellow rail is found mainly in the sedge meadows on the western shore of Green Bay, where it was historically abundant (Le Conte's sparrow historically occurred there and may still). Sedge wrens occur throughout the division.

Species requiring woody vegetation or nest structures. Brewer's blackbird is most common in the northern part of this division. (This division, especially Door county, was formerly a stronghold for loggerhead shrike, but restoration potential is uncertain because the area is now isolated from other breeding populations.)

Species requiring open water. Wilson's phalarope is locally distributed in suitable habitat throughout, for example in the Peshtigo Harbor Unit of Green Bay Shores Wildlife Area (82).

Species requiring large areas. Barn owls have used grassland habitats for foraging and nesting in several counties bordering Lake Michigan (Matteson and Petersen 1988).

Habitats, Landscapes, and Sites

Much former forest land has been converted to agriculture, especially in the southern and eastern parts of the division. The Lake Michigan Shoreland division is one of the prime areas for growing small grains and hay, especially alfalfa, in the state. There are roughly 4,500 acres of permanent grassland habitat in blocks greater than 100 acres in the Lake Michigan Shoreland—the lowest amount of any division. Two-thirds of this acreage is wet grass or sedge meadows.

Priority habitats, landscapes, and sites for grassland management in the Lake Michigan Shoreland are listed next to Figure 12. This formerly forested division probably has fewer opportunities for grassland bird management than any other division. Green Bay West Shores Sedge Meadows Landscape (S), the sedge meadows on the west shore of Green Bay, offers the best opportunity in the division for management of sedge meadow birds, including yellow rail.

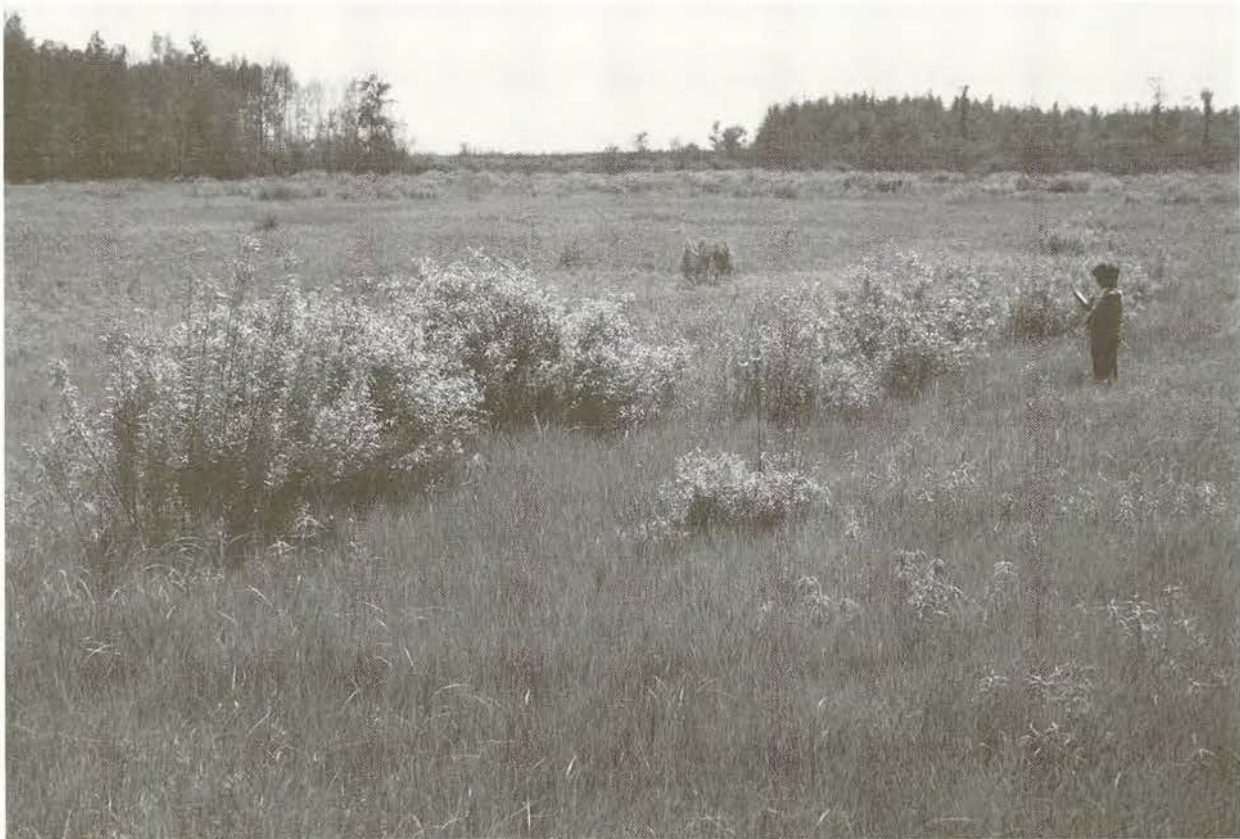
The agricultural grasslands in Door County such as Brussels Area Grasslands (II) and Liberty Grove Grasslands (HH) offer opportunities

for management of upland sandpiper and associated species—for example, by promoting pasture, late-cut grass hay or mixed grass and legume hay, small grains, and idle shortgrass and midgrass habitats. Any grassland management activities at the Liberty Grove Grasslands (GG) in the northern Door peninsula, however, will require careful coordination with efforts to preserve important northern forest and wetland communities immediately to the north (e.g., the Mink River corridor); grasslands may be of secondary importance there.

Areas in the counties along Lake Michigan south of Door County also have similar grassland

management opportunities, because of the current lack of forest cover and the character of the agricultural landscapes. An example is the open, wetland-dotted agricultural landscape north of Two Rivers in Manitowoc County (Two Rivers and Two Creeks townships). As in Door County, forest management and restoration issues need to be evaluated along with any proposed grassland management at sites such as this. For example, remnant forest at Point Beach State Forest and State Park may benefit from expansion of forest acreage; grassland management activities adjacent to the forest may therefore be determined to be inappropriate or of low priority.

This northern sedge meadow near Peshtigo Harbor is part of the Green Bay West Shore Sedge Meadows landscape, the only priority landscape in the Lake Michigan Shoreland Natural Division. This habitat type was historically much more extensive throughout the landscape than it is today.



MICHAEL MOSSMAN

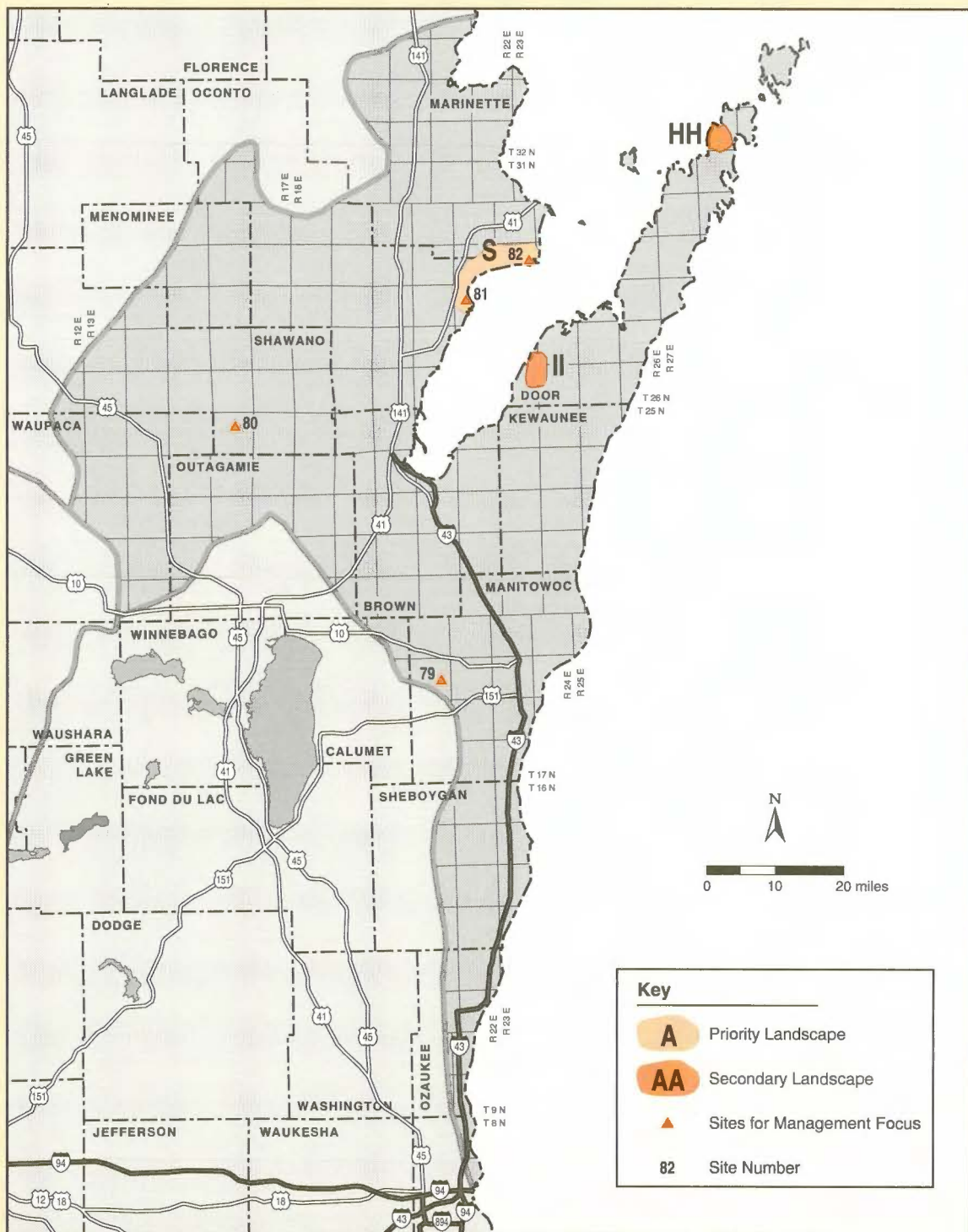


FIGURE 12. Priority landscapes and sites for grassland bird management in the Lake Michigan Shoreland Natural Division.

Landscape and Site Names¹**Habitat Types** (see next page for key to 4-letter codes)**S. Green Bay West Shore Sedge Meadows** NSME, SSME, SSMA, SHSW²

Sites: 81. Oconto Marsh-Reed Lake Unit;

Green Bay Shores Wildlife Area (WA) NSME, NSMA, SHSW

82. Peshtigo Harbor Unit (Green Bay Shores WA) NSME, SHSW, SSMA

HH. Liberty Grove Grasslands GLHA, SMGR, DROF, UPSH**II. Brussels Area Grasslands** GLHA, SMGR, PAST, DROF**Other Sites Located Outside of Landscapes:**

79. Collins Marsh WA IWSG, ICSG, OASA, SHSW, SSME, WEOF

80. Navarino WA NSME, IWSG, ICSG, DROF, SHSW, UPSH, SWOF, OPBO, OASA

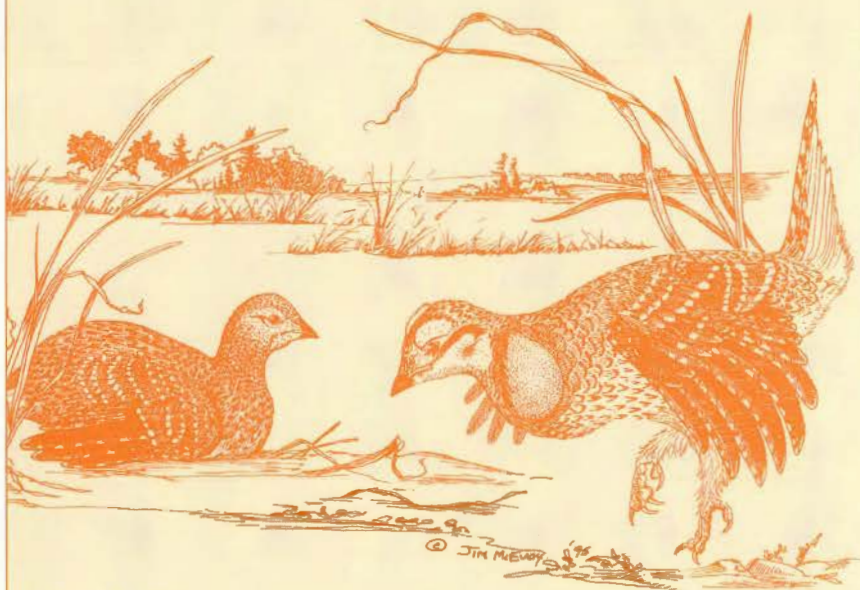
¹ Landscapes are ranked from highest priority to lowest priority. Sites are **not** ranked within landscapes. Four-letter codes represent priority habitat types that are present in the sites and landscapes.² Codes listed after landscape names refer to habitats common or present within the landscape, in areas other than the numbered sites.**Priority Grassland Habitats for Management in the Lake Michigan Shoreland¹**

(ranked by priority)

NSME Northern sedge meadow: (S) Green Bay West Shore Sedge Meadows Landscape, (80) Navarino WA, (81) Oconto Marsh-Reed Lake Unit, (82) Peshtigo Harbor Unit**PAST Pasture:** (II) Brussels Area Grasslands Landscape, and on agricultural lands throughout the division**SSME Southern sedge meadow:** (S) Green Bay West Shore Sedge Meadows Landscape, (79) Collins Marsh WA**IWSG Idle warm season grass/forb (medium and tall):** (80) Navarino WA, (79) Collins Marsh WA**ICSG Idle cool season grass/forb (short, medium, and tall):** (80) Navarino WA, (79) Collins Marsh WA**DROF Dry old field:** (HH) Liberty Grove Grasslands Landscape, (80) Navarino WA, (II) Brussels Area Grasslands Landscape**GLHA Grass or grass/legume hay:** (HH) Liberty Grove Grasslands Landscape, (II) Brussels Area Grasslands Landscape; elsewhere in counties along Lake Michigan**NSMA Northern sedge marsh:** (81) Oconto Marsh-Reed Lake Unit**SSMA Southern sedge marsh:** (82) Peshtigo Harbor Unit, (S) Green Bay West Shore Sedge Meadows Landscape**UPSH Upland shrub:** (HH) Liberty Grove Grasslands Landscape, (80) Navarino WA**WEOF Wet old field:** (79) Collins Marsh WA**SMGR Small grains:** (HH) Liberty Grove Grasslands Landscape, (II) Brussels Area Grasslands Landscape**OPBO Open bog:** (80) Navarino WA**SHSW Shrub swamp:** (81) Oconto Marsh-Reed Lake Unit, (82) Peshtigo Harbor Unit, (S) Green Bay West Shore Sedge Meadows Landscape, (79) Collins Marsh WA, (80) Navarino WA**OASA Oak savanna:** (79) Collins Marsh WA, (80) Navarino WA**SWOF Shrubby wet old field:** (80) Navarino WA¹ Habitats are ranked by priority within the division. Each habitat is followed by suggested landscapes and sites for management, arranged roughly from highest to lowest priority. Landscape letter codes and site number codes in parentheses correspond to the map. See Table 1, page 12, and Appendix E, page 126, for descriptions of bird communities expected in the habitats listed.

*When dandelions have set the mark of May on Wisconsin pastures,
it is time to listen for the final proof of spring. Sit down on a tus-
sock, cock your ears at the sky, dial out the bedlam of meadowlarks
and redwings, and soon you may hear it: the flight-song of the
upland plover, just now back from the Argentine... Soon a flash of
silver will tell you on which post the plover has alighted and folded
his long wings. Whoever invented the word "grace" must have seen
the wing-folding of the plover. There was a time in the early 1900's
when Wisconsin farms nearly lost their immemorial timepiece,
when May pastures greened in silence, and August nights brought
no whistled reminder of impending fall. Universal gunpowder, plus
the lure of plover-on-toast for post-Victorian banquets, had taken
too great a toll. The belated protection of the federal migratory bird
laws came just in time.*

—Aldo Leopold, *A Sand County
Almanac and Sketches Here and
There* (Leopold 1949)



Sharp-tailed grouse



Northern Highland/Lake Superior Lowland

Most of this natural division was historically dominated by northern mesic forests that included large landscapes of barrens habitats (northwest and northeast); pine forests, conifer swamps, bogs, and boreal forests (near Lake Superior); extensive sedge meadows; and some lowland hardwood forests and southern oak forests.

Grassland bird habitat was limited mostly to the sedge meadows, open bogs, barrens, and recently burned-over forest lands. Many of the former barrens areas succeeded to forest, while large areas of former mesic forest in the southern and western parts of the division were cleared and converted to agriculture.

Species of management concern in the Northern Highland/Lake Superior Lowland

(in order of priority)

Yellow rail
Sharp-tailed sparrow
Le Conte's sparrow
Sharp-tailed grouse
Bobolink
Wilson's phalarope
Brewer's blackbird
Greater prairie-chicken
Sedge wren
Upland sandpiper
Savannah sparrow
Short-eared owl
Clay-colored sparrow
Northern harrier
Blue-winged teal
Barn owl

Birds

We identified 16 priority species in this natural division (see sidebar), including one of the shortgrass species, two each of the midgrass, woody and nest structure-dependent, and species requiring open water, four of the tallgrass species, and all five species requiring large areas from the statewide list (see Table 5, page 58).

Shortgrass species. Upland sandpiper is locally common, particularly in large open and diverse barrens in the northwestern and northeastern parts of the division. It also occurs wherever there are sufficiently large idle grasslands, old fields, grass hayfields, and other suitable habitats.

Midgrass species. Bobolink and savannah sparrow are common in appropriate habitats—such as hayfields, old fields, and other idle grasslands—in agriculture-dominated parts of the division. They also occur in open bogs and sedge meadows.

Tallgrass species. Three of the four tallgrass species (yellow rail, sharp-tailed and Le Conte's sparrow) are most common in this division and are typically restricted to large sedge meadows and sedge marshes, especially in the Crex Meadows/Fish Lake Complex (T). Le Conte's sparrow is more of a generalist than the other three species and also occurs in hayfields and other idle grasslands in counties scattered throughout the division, including Ashland, Bayfield, Taylor, and Marathon counties. Sedge wren is locally common.

Species requiring woody vegetation or nest structures. Brewer's blackbird is generally most common in the open and diverse barrens in the northwest and northeast, in open bogs, and in the agricultural grasslands in the south. Clay-colored sparrow is widespread in appropriate habitats.

Species requiring open water. Blue-winged teal and Wilson's phalarope are found in suitable landscapes and habitats, such as sedge marshes, throughout.

Species requiring large areas. Prairie-chicken range is rather narrowly defined and runs from Buena Vista/Leola Grasslands (P) in the Central Plains west and north through the Mead/Paul J. Olson Grasslands (X) and up to the open agricultural landscapes in the Unity and Medford areas (North Central Prairie-Chicken Grasslands (V1 and V2). Sharp-tailed grouse is locally distributed but is most common in the barrens, cut- or burned-over forest, sedge meadow, and open bog landscapes of the northwest. Northern harrier and short-eared owl are found in large publicly owned grasslands such as the Crex Meadows/Fish Lake Complex (T); harriers are also found in the open agricultural landscapes in the south. The only confirmed nesting record for barn owl in the last twelve years is from the Antigo area in Langlade County.

Habitats, Landscapes, and Sites

The Northern Highland/Lake Superior Lowland is large and diverse. While most of the area is forested, it also contains a variety of habitats

used by grassland birds, including some of the largest open grassland landscapes in the state. Extensive areas of sedge meadows and open bogs are scattered throughout. There are major areas of barrens habitats in the northwest and northeast and a variety of agricultural grasslands in the south and the Ashland-Bayfield County area. Several counties in this division include some of the major acreage of grass-dominated hay grown in the state. Grassland birds use all of these habitats.

Priority habitats, landscapes, and sites for grassland management in the Northern Highland/Lake Superior Lowland are listed next to Figure 13. There are an estimated 65,000 acres of permanent grassland in blocks greater than 100 acres, including 38% sedge or wet grass meadows, 35% barrens, and 6% upland grass. This is half of the state's permanent grassland acreage in large blocks. The six landscapes identified in Figure 13 include the landscape with the most permanent grassland bird habitat in the state: *Crex* Meadows/Fish Lake Complex (T).

The Northern Highland/Lake Superior Lowland offers special opportunities for birds of large open, diverse, and brush prairie barrens landscapes, and sedge meadows—particularly

those birds restricted to or most common in large northern sedge meadows, such as yellow rail, sharp-tailed and Le Conte's sparrow, and Wilson's phalarope. As mentioned above, forestry practices can help expand the effective habitat size of barrens, by focusing short-rotation, even-age silviculture at the boundaries of barrens rather than within forest interiors or by maintaining wide (greater than 440 yd) herbaceous- and heath-dominated firebreaks within barrens landscapes. This is already being practiced in some areas such as the southwestern Bayfield County forests (100). Areas in the division with concentrations of grass-dominated hayfields can also offer opportunities for management if the amount of idle grassland can be increased and if hay is cut after 15 July. The Northern Highland/Lake Superior Lowland has the advantage of large public ownerships dedicated partly to wildlife management; also, the division is too far north for major production of corn and soybeans—with the exception of southern counties. However, it has some inherent drawbacks: it is out of the range of a number of southern bird species, it lacks a variety of prairie sod types, and most of the permanent grasslands are on the wet or woody ends of the habitat continuum.



MICHAEL MOSSMAN

Although a majority of the Northern Highland/Lake Superior Lowland Natural Division is forest, it also includes large open landscapes of agricultural and native grasslands. This is a northern sedge meadow in the Fish Lake Wildlife Area in Burnett County. It is an important site for species such as yellow rail, Wilson's phalarope, northern barrier, upland sandpiper, short-eared owl, and Le Conte's and Nelson's sharp-tailed sparrow.

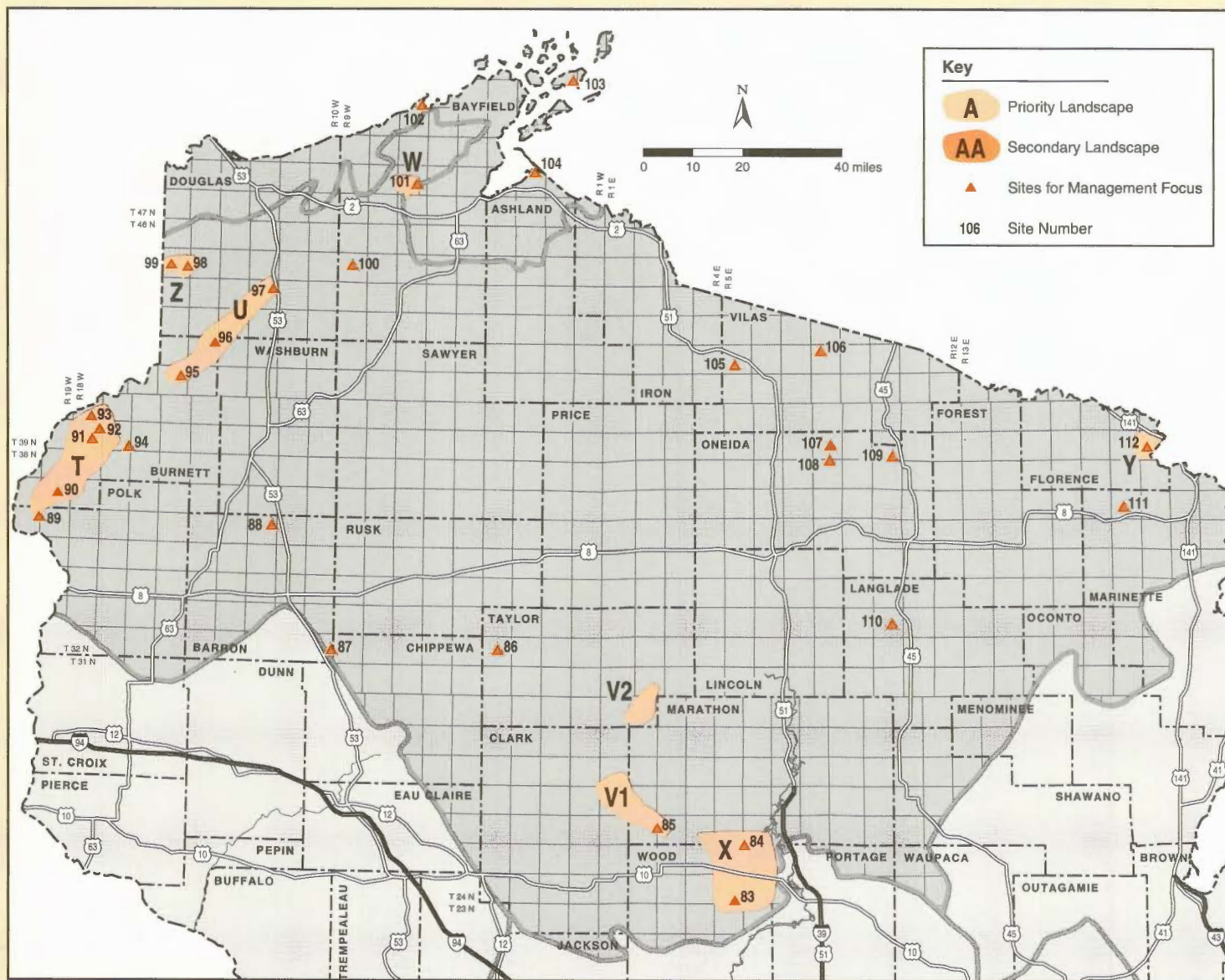


FIGURE 13. Priority landscapes and sites for grassland bird management in the Northern Highland/Lake Superior Lowland Natural Division.

Landscape and Site Names¹**Habitat Types** (see next page for key to 4-letter codes)

T. Crex Meadows/Fish Lake Complex	NSME, PAST, ICSG, SHSW ²
Sites: 89. Meadman Meadows	NSME, SHSW
90. Fish Lake Wildlife Area (WA)	NSME, NSMA, IWSG, OPBA, DIBA, BPBA, COBA
91. Crex Meadows WA, including Crex Sand Prairie State Natural Area (SNA)	BPBA, OPBA, DMPR, NSME, SHSW, DROF, IWSG
92. Reeds Lake Bog Meadow	NSME, OPBO
93. Kohler-Peet Barrens and Cedar Swamp SNA	OPBA, DROF, BPBA
U. Namekagon/Douglas County Barrens	CBOV, NSME, BPBA, DIBA
Sites: 95. Fenton Lake Fuelbreak	CBOV, DIBA, BPBA
96. Namekagon Barrens WA	CBOV, BPBA, OPBA, DIBA
97. Solon Springs Sharptail Barrens SNA /Douglas County WA	CBOV, OPBA, DIBA, DROF
V(1). North Central Prairie-Chicken Grasslands	GLHA, DROF, NSME, FALL, PAST, SMGR, SHSW, YCPL, ICSG
Sites: 85. McMillan Marsh WA	ICSG, DROF, SHSW, NSME
V(2). North Central Prairie-Chicken Grasslands	GLHA, DROF, NSME, FALL, PAST, SMGR, SHSW, YCPL, ICSG
W. Moquah Barrens	CBOV, OPBA, DIBA, BPBA
Sites: 101. Moquah Barrens SNA	
*X. Mead/Paul J. Olson Grasslands	PAST, GLHA, ICSG, DROF, SHSW
Sites: 83. Paul J. Olson WA	NSME, DROF, WEOF, ICSG, UPSH, SHSW, OPBO
84. Mead WA	NSME, IWSG, ICSG, DROF, NSMA, SHSW, WEOF, OPBO, UPSH, SWOF, COBA
Y. Spread Eagle Barrens	
Sites: 112. Spread Eagle Barrens SNA	CBOV, OPBA, DIBA, BPBA
Z. Black Lake/Belden Swamp	OPBO, NSME, SHSW
Sites: 98. Belden Swamp	OPBO, NSME, SHSW
99. Black Lake Bog SNA	OPBO, SHSW, NSME
Other Sites Located Outside of Landscapes:	
86. Pershing WA	BPBA, DROF, SHSW, CBOV
87. New Auburn WA	IWSG, ICSG, WMWP, SHSW, NSME, DROF
88. Bear Lake Sedge Meadow	NSME, SHSW
94. Amsterdam Sloughs WA	NSME, NSMA, SHSW, IWSG
100. Bayfield County Fuelbreaks	CBOV, OPBA, BPBA
102. Bark Bay Sedge Meadow	NSME, SHSW, OPBO
103. Stockton Island Tombolo (Apostle Islands National Lakeshore)	NSME, DIBA, NSMA
104. Kakagon Slough Sedge Meadow	NSME, OPBO, NSMA, SHSW
105. Powell Marsh WA	NSME, NSMA, OPBO, ICSG
106. Johnson Lake Barrens	DIBA, NSME
107. Rainbow Flowage Sedge Meadow	NSME, SHSW, OPBO
108. Big Swamp	OPBO, NSME
109. Thunder Lake WA	NSME, OPBO, SHSW
110. Bogus Swamp SNA	OPBO
111. Dunbar Barrens SNA	CBOV, DIBA, OPBA

¹ Landscapes are ranked from highest priority to lowest priority. Sites are **not** ranked within landscapes. When a landscape overlaps more than one natural division, the landscape is listed within the division where most of its land area occurs. Four-letter codes represent priority habitat types that are present in the sites and landscapes.

² Codes listed after landscape names refer to habitats common or present within the landscape, in areas other than the numbered sites.

Priority Grassland Habitats for Management in the Northern Highland/Lake Superior Lowland¹

(ranked by priority)

NSME Northern sedge meadow:

(92) Reeds Lake Bog Meadow, (91) Crex Meadows WA, (90) Fish Lake WA, (88) Bear Lake Sedge Meadow, (105) Powell Marsh WA, (104) Kakagon Slough Sedge Meadow, (103) Stockton Island Tombolo, (102) Bark Bay Sedge Meadow, (107) Rainbow Flowage Sedge Meadow, (105) Powell Marsh WA, (94) Amsterdam Sloughs WA, (109) Thunder Lake WA, (84) Mead WA, (89) Meadman Meadows, (T) Crex Meadows/Fish Lake Complex, (U) Namekagon/Douglas County Barrens, (85) McMillan Marsh WA, (V1,2) North Central Prairie-Chicken Grasslands, (83) Paul J. Olson WA, (98) Belden Swamp, (99) Black Lake Bog SNA, (Z) Black Lake/Belden Swamp, (87) New Auburn WA, (106) Johnson Lake Barrens, (108) Big Swamp

OPBA Open barrens:

(96) Namekagon Barrens WA, (97) Solon Springs Sharptail Barrens SNA/Douglas County WA, (W) Moquah Barrens, (91) Crex Meadows WA, (112) Spread Eagle Barrens SNA, (100) Bayfield County Fuelbreaks, (90) Fish Lake WA, (93) Kohler-Peet Barrens and Cedar Swamp SNA, (111) Dunbar Barrens SNA

DIBA Diverse barrens:

(96) Namekagon Barrens WA, (97) Solon Springs Sharptail Barrens SNA/Douglas County WA, (W) Moquah Barrens, (112) Spread Eagle Barrens SNA, (111) Dunbar Barrens SNA, (95) Fenton Lake Fuelbreak, (103) Stockton Island Tombolo, (106) Johnson Lake Barrens, (90) Fish Lake WA, (U) Namekagon/Douglas County Barrens

BPBA Brush prairie barrens:

(96) Namekagon Barrens WA, (W) Moquah Barrens, (91) Crex Meadows WA, (93) Kohler-Peet Barrens and Cedar Swamp SNA, (112) Spread Eagle Barrens SNA, (100) Bayfield County Fuelbreaks, (95) Fenton Lake Fuelbreak, (86) Pershing WA, (90) Fish Lake WA, (U) Namekagon/Douglas County Barrens

IWSG Idle warm season grass/forb (medium):

(87) New Auburn WA, (84) Mead WA, (90) Fish Lake WA, (91) Crex Meadows WA, (94) Amsterdam Sloughs WA

ICSG Idle cool season grass/forb (short, medium, and tall):

(84) Mead WA, (85) McMillan Marsh WA, (T) Crex Meadows/Fish Lake Complex, (V1,2) North Central Prairie-Chicken Grasslands, (83) Paul J. Olson WA, (X) Mead/Paul J. Olson Grasslands, (87) New Auburn WA, (105) Powell Marsh WA, and other public properties such as the Brule River State Forest in Douglas County.

NSMA Northern sedge marsh:

(90) Fish Lake WA, (91) Crex Meadows WA, (105) Powell Marsh WA, (84) Mead WA, (94) Amsterdam Sloughs WA, (103) Stockton Island Tombolo, (104) Kakagon Slough Sedge Meadow

DROF Dry old field:

(84) Mead WA, (85) McMillan Marsh WA, (91) Crex Meadows WA, (93) Kohler-Peet Barrens and Cedar Swamp SNA, (97) Solon Springs Sharptail Barrens SNA/Douglas County WA, (V1,2) North Central Prairie-Chicken Grasslands, (83) Paul J. Olson WA, (X) Mead/Paul J. Olson Grasslands, (86) Pershing WA, (87) New Auburn WA

PAST Pasture:

(T) Crex Meadows/Fish Lake Complex, (V1,2) North Central Prairie-Chicken Grasslands, (X) Mead/Paul J. Olson Grasslands

OPBO Open bog:

(99) Black Lake Bog SNA, (98) Belden Swamp, (110) Bogus Swamp SNA, (105) Powell Marsh WA, (108) Big Swamp, (104) Kakagon Slough Sedge Meadow, (91) Crex Meadows WA, (83) Paul J. Olson WA, (84) Mead WA, (Z) Black Lake/Belden Swamp, (102) Bark Bay Sedge Meadow, (107) Rainbow Flowage Sedge Meadow, (109) Thunder Lake WA, (92) Reeds Lake Bog Meadow

GLHA Grass or grass/legume hay:

(V1,2) North Central Prairie-Chicken Grasslands, and scattered sites in Bayfield/Ashland/Douglas counties (e.g., Brule River State Forest)

CBOV Cut- or burned-over:

(96) Namekagon Barrens WA, (97) Solon Springs Sharptail Barrens SNA/Douglas County WA, (W) Moquah Barrens, (95) Fenton Lake Fuelbreak, (100) Bayfield County Fuelbreaks, (111) Dunbar Barrens SNA, (112) Spread Eagle Barrens SNA and on industrial or managed forest lands adjacent to these areas, (U) Namekagon/Douglas County Barrens, (86) Pershing WA

DMPR Dry-mesic prairie: (91) Crex Meadows WA**UPSH Upland shrub:** (83) Paul J. Olson WA, (84) Mead WA**COBA Conifer barrens:** (91) Crex Meadows WA, (90) Fish Lake WA, (84) Mead WA**WEOF Wet old field:** (83) Paul J. Olson WA, (84) Mead WA**SHSW Shrub swamp:**

(89) Meadman Meadows, (91) Crex Meadows WA, (T) Crex Meadows/Fish Lake Complex, (85) McMillan Marsh WA, (V1,2) North Central Prairie-Chicken Grasslands, (83) Paul J. Olson WA, (84) Mead WA, (X) Mead/Paul J. Olson Grasslands, (98) Belden Swamp, (99) Black Lake Bog SNA, (Z) Black Lake/Belden Swamp, (86) Pershing WA, (87) New Auburn WA, (88) Bear Lake Sedge Meadow, (94) Amsterdam Sloughs WA, (102) Bark Bay Sedge Meadow, (104) Kakagon Slough Sedge Meadow, (107) Rainbow Flowage Sedge Meadow, (109) Thunder Lake WA, (93) Kohler-Peet Barrens and Cedar Swamp SNA

WMWP Wet-mesic or wet prairie: (87) New Auburn WA**SMGR Small grains:** (V1) North Central Prairie-Chicken Grasslands**FAFI Fallow fields:** (V1,2) North Central Prairie-Chicken Grasslands**YCPL Young conifer plantation:** (V1,2) North Central Prairie-Chicken Grasslands**SWOF Shrubby wet old field:** (91) Crex Meadows WA, (84) Mead WA

¹ Habitats are ranked by priority within the division. Each habitat is followed by suggested landscapes and sites for management, arranged roughly from highest to lowest priority. Landscape letter codes and site number codes in parentheses correspond to the map. See Table 1, page 12, and Appendix E, page 126, for descriptions of bird communities expected in the habitats listed.

CONCLUSION

Managing for the diversity of grassland birds in Wisconsin is a complex task. It is also an important task, because of the threats facing species of management concern and their habitats. The plight of grassland birds may provide the catalyst required to promote needed interest and action towards the conservation of grassland ecosystems as a whole.

Wisconsin, with its varied landscapes and ecosystems, holds great management potential for a diversity of grassland habitats and the bird species and communities that inhabit them. Realizing that potential involves management efforts to conserve, restore, and expand valuable grassland habitat where appropriate on public lands and to work in priority landscapes that include private as well as public lands. Because most grassland bird habitat is on private agricultural lands, agricultural policy and changing agricultural practices will continue to play a large role in determining the quality, amount, and distribution of grassland bird habitat on the landscape.

Healthy and diverse grassland bird communities depend on the degree to which habitat on public and private lands accommodates them. In priority landscapes where human development is increasing rapidly, time is of the essence if critical habitat is to be successfully preserved. The cooperation of diverse groups of landowners and managers is vital to the conservation of grassland bird habitat in Wisconsin.

APPENDICES

APPENDIX A. *Grassland birds and other birds that use grassland habitats in Wisconsin.^a*

I. Birds (105 species) that regularly or semi-regularly use grasslands and related open country habitats for some part of their breeding cycle.

Common Name	Scientific Name
American bittern	<i>Botaurus lentiginosus</i>
Cattle egret	<i>Bubulcus ibis</i>
Canada goose	<i>Branta canadensis</i>
Green-winged teal	<i>Anas crecca</i>
American black duck	<i>Anas rubripes</i>
Mallard	<i>Anas platyrhynchos</i>
Northern pintail	<i>Anas acuta</i>
Blue-winged teal	<i>Anas discor</i>
Northern shoveler	<i>Anas clypeata</i>
Gadwall	<i>Anas streper</i>
American wigeon	<i>Anas americana</i>
Ring-necked duck	<i>Aythya collaris</i>
Lesser scaup	<i>Aythya affinis</i>
Turkey vulture	<i>Cathartes aura</i>
Northern harrier	<i>Circus cyaneus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
American kestrel	<i>Falco sparverius</i>
Merlin	<i>Falco columbarius</i>
Gray partridge	<i>Perdix perdix</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>
Greater prairie-chicken	<i>Tympanuchus cupido</i>
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>
Wild turkey	<i>Meleagris gallopavo</i>
Northern bobwhite	<i>Colinus virginianus</i>
Yellow rail	<i>Coturnicops novaboracensis</i>
King rail	<i>Rallus elegans</i>
Virginia rail	<i>Rallus limicola</i>
Sora	<i>Porzana carolina</i>
Sandhill crane	<i>Grus canadensis</i>
Killdeer	<i>Charadrius vociferus</i>
Spotted sandpiper	<i>Actitis macularia</i>
Upland sandpiper	<i>Bartramia longicauda</i>
Common snipe	<i>Gallinago gallinago</i>
American woodcock	<i>Scolopax minor</i>
Wilson's phalarope	<i>Phalaropus tricolor</i>
Ring-billed gull	<i>Larus delawarensis</i>
Herring gull	<i>Larus argentatus</i>
Rock dove	<i>Columba livia</i>
Mourning dove	<i>Zenaida macroura</i>
Barn owl	<i>Tyto alba</i>
Great horned owl	<i>Bubo virginianus</i>
Short-eared owl	<i>Asio flammeus</i>
Common nighthawk	<i>Chordeiles minor</i>
Ruby-throated hummingbird	<i>Archilochus colubris</i>
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Downy woodpecker	<i>Picoides pubescens</i>
Northern flicker	<i>Colaptes auratus</i>
Alder flycatcher	<i>Empidonax alnorum</i>
Willow flycatcher	<i>Empidonax traillii</i>
Eastern phoebe	<i>Sayornis phoebe</i>
Western kingbird	<i>Tyrannus verticalis</i>

(continued on next page)

APPENDIX A. *Continued.*

Common Name	Scientific Name
Eastern kingbird	<i>Tyrannus tyrannus</i>
Horned lark	<i>Eremophila alpestris</i>
Purple martin	<i>Progne subis</i>
Tree swallow	<i>Tachycineta bicolor</i>
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>
Bank swallow	<i>Riparia riparia</i>
Cliff swallow	<i>Hirundo pyrrhonota</i>
Barn swallow	<i>Hirundo rustica</i>
Blue jay	<i>Cyanocitta cristata</i>
American crow	<i>Corvus brachyrhynchos</i>
Common raven	<i>Corvus corax</i>
Black-capped chickadee	<i>Parus atricapillus</i>
House wren	<i>Troglodytes aedon</i>
Sedge wren	<i>Cistothorus platensis</i>
Eastern bluebird	<i>Sialia sialis</i>
American robin	<i>Turdus migratorius</i>
Gray catbird	<i>Dumetella carolinensis</i>
Brown thrasher	<i>Toxostoma rufum</i>
Cedar waxwing	<i>Bombycilla cedrorum</i>
Loggerhead shrike	<i>Lanius ludovicianus</i>
European starling	<i>Sturnus vulgaris</i>
Bell's vireo	<i>Vireo bellii</i>
Yellow warbler	<i>Dendroica petechia</i>
Common yellowthroat	<i>Geothlypis trichas</i>
Yellow-breasted chat	<i>Icteria virens</i>
Northern cardinal	<i>Cardinalis cardinalis</i>
Indigo bunting	<i>Passerina cyanea</i>
Dickcissel	<i>Spiza americana</i>
Eastern towhee	<i>Pipilo erythrophthalmus</i>
Chipping sparrow	<i>Spizella passerina</i>
Clay-colored sparrow	<i>Spizella pallida</i>
Field sparrow	<i>Spizella pusilla</i>
Vesper sparrow	<i>Pooecetes gramineus</i>
Lark sparrow	<i>Chondestes grammacus</i>
Savannah sparrow	<i>Passerculus sandwichensis</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
Henslow's sparrow	<i>Ammodramus henslowii</i>
Le Conte's sparrow	<i>Ammodramus leconteii</i>
Nelson's sharp-tailed sparrow	<i>Ammodramus nelsoni</i>
Song sparrow	<i>Melospiza melodia</i>
Lincoln's sparrow	<i>Melospiza lincolni</i>
Swamp sparrow	<i>Melospiza georgiana</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Eastern meadowlark	<i>Sturnella magna</i>
Western meadowlark	<i>Sturnella neglecta</i>
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>
Brewer's blackbird	<i>Euphagus cyanocephalus</i>
Common grackle	<i>Quiscalus quiscula</i>
Brown-headed cowbird	<i>Molothrus ater</i>
Orchard oriole	<i>Icterus spurius</i>
Baltimore oriole	<i>Icterus galbula</i>
American goldfinch	<i>Carduelis tristis</i>
House sparrow	<i>Passer domesticus</i>

(continued on next page)

APPENDIX A. *Continued.*

II. Non-grassland species that are occasionally associated with grassland habitats.

Common Name	Scientific Name
Least bittern	<i>Ixobrychus exilis</i>
Great blue heron	<i>Ardea herodias</i>
Green heron	<i>Butorides virescens</i>
Black tern	<i>Chlidonias niger</i>
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>
Eastern wood-pewee	<i>Contopus virens</i>
Least flycatcher	<i>Empidonax minimus</i>
Great-crested flycatcher	<i>Myiarchus crinitus</i>
White-breasted nuthatch	<i>Sitta carolinensis</i>
Marsh wren	<i>Cistothorus palustris</i>
Veery	<i>Catharus fuscescens</i>
Warbling vireo	<i>Vireo gilvus</i>
Blue-winged warbler	<i>Certhia pinus</i>
Nashville warbler	<i>Vermivora ruficapilla</i>
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>

^a Species are listed in taxonomic order, following the 6th edition of the American Ornithologists' (AOU) Union check-list of North American birds (AOU 1983) and the 40th supplement to the AOU check-list (AOU 1995).

APPENDIX B. *List of plants mentioned in the text.^a*

Common Name	Scientific Name	Common Name	Scientific Name
Herbaceous Species			
Barley	<i>Hordeum vulgare</i>	Redtop	<i>Agrostis gigantea</i>
Big bluestem	<i>Andropogon gerardii</i>	Rye	<i>Secale cereale</i>
Birdsfoot-trefoil	<i>Lotus corniculatus</i>	Scribner's panicum	<i>Panicum leibergii</i>
Bluejoint grass	<i>Calamagrostis canadensis</i>	Sedge spp.	<i>Carex spp.</i>
Canada bluegrass	<i>Poa compressa</i>	Side-oats gramma	<i>Bouteloua curtipendula</i>
Cat-tail spp.	<i>Typha spp.</i>	Smooth brome	<i>Bromus inermis</i>
Corn	<i>Zea mays</i>	Snap beans	<i>Phaseolus vulgaris</i>
Dandelion	<i>Taraxacum officinale</i>	Soybeans	<i>Glycine max</i>
Indian grass	<i>Sorghastrum nutans</i>	Switchgrass	<i>Panicum virgatum</i>
Junegrass	<i>Koeleria pyramidata</i>	Tall fescue	<i>Festuca elatior</i>
Kentucky bluegrass	<i>Poa pratensis</i>	Timothy	<i>Phleum pratense</i>
Little bluestem	<i>Schizachyrium scoparium</i>	Wheat	<i>Triticum aestivum</i>
Oats	<i>Avena sativa</i>	Yellow coneflower	<i>Ratibida pinnata</i>
Orchardgrass	<i>Dactylis glomerata</i>		
Potato	<i>Solanum tuberosum</i>	Woody Species	
Poverty-oats	<i>Danthonia spicata</i>	Apple/crabapple	<i>Pyrus spp.</i>
Prairie dock	<i>Silphium terebinthinaceum</i>	Hawthorn	<i>Crataegus spp.</i>
Prairie dropseed	<i>Sporobolus heterolepis</i>	Hill's oak	<i>Quercus ellipsoidalis</i>
Prairie smoke	<i>Geum triflorum</i>	Jack pine	<i>Pinus banksiana</i>
Quackgrass	<i>Elytrigia repens</i>	Oak spp.	<i>Quercus spp.</i>
Red clover	<i>Trifolium pratense</i>	Plum	<i>Prunus spp.</i>
Reed canary-grass	<i>Phalaris arundinacea</i>	Red cedar	<i>Juniperus virginiana</i>

^a Species are listed in alphabetical order by common name. Taxonomy (except for plants that are common cultivated annuals) follows that in Gleason and Cronquist (1991).

APPENDIX C. *U.S. Forest Service National Hierarchical Framework of Ecological Units for Wisconsin.^a*



^a (Keys et al. 1995). These are the ecoregions currently in use by the DNR. This map can be photocopied onto acetate and overlaid on maps in the text.

DNR Regions

Northern
West Central
Northeast
South Central
South-east

Geographic Management Units (GMU)

Lake Superior
St. Croix
Upper Chippewa
Upper Wisconsin
Upper Green Bay
Lower Chippewa
Central Wisconsin
Wolf
Lower Fox
Lake Shore
Black Buffalo Trempealeau
La Crosse Bad Axe
Upper Fox
Lower Wisconsin
Upper Rock
Lower Rock
Grant-Platte-Sugar Pecos
Illinois Fox
Root-Pike

Counties: BAYFIELD, DOUGLAS, ASHLAND, IRON, VILAS, WASHBURN, SAWYER, PRICE, ONIEDA, FOREST, FLORENCE, BURNETT, POLK, BARRON, RUSK, LINCOLN, TAYLOR, MARATHON, LANGLADE, ST. CROIX, DUNN, CHIPPEWA, CLARK, MENOMINEE, SHAWANO, PIERCE, EAU CLAIRE, PEPIN, WOOD, PORTAGE, WAUPACA, DOOR, Kewaunee, BUFFALO, JACKSON, JUNEAU, ADAMS, WAUSHARA, BROWN, OUTAGAMIE, LACROSSE, MONROE, MARQUETTE, GREEN LAKE, WINNEBAGO, FOND DU LAC, VERNON, SAUK, COLUMBIA, DODGE, CALLUMET, MANITOWOC, SHEBOYGAN, RICHLAND, CRAWFORD, GRANT, IOWA, DANE, WASHINGTON, OZAUKEE, MILWAUKEE, WAUKESHA, RACINE, WALWORTH, ILLINOIS, KENOSHA, LAFAYETTE, GREEN, ROCK.

^a This map can be photocopied onto acetate and overlaid on maps in the text.

APPENDIX E. *Definitions of Wisconsin grassland habitats and lists of associated non-grassland bird species.^a*

- (D) = typically dominant
- (F) = forages only
- (W) = woody vegetation of the appropriate type required for nesting; otherwise forages only
- (S) = specialists (limited distribution; occurs more commonly in this habitat than in most others)

ROW CROPS

Conventionally farmed fields of corn, beans, or potatoes.

Associated non-grassland bird species: Rock dove (F), American robin (F), European starling (F), northern flicker (F), house sparrow (F), chipping sparrow (F), sandhill crane (F).

SMALL GRAINS

Conventionally farmed fields of oats, wheat, barley, or rye.

Associated non-grassland bird species: Same species as row crops.

FALLOW FIELDS

Variable; former annual crop fields not planted in the last one to three seasons; variable litter cover but usually at least some bare soil; vegetation typically dominated by annual weeds; no woody cover; height-density typically under 35 cm.

Associated non-grassland bird species: American robin (F), European starling (F), house sparrow (F).

ALFALFA OR LEGUME HAY

Conventionally farmed hayfields with >50% cover of alfalfa or other legumes (red clover, bird's-foot trefoil) and <25% cover of grasses or other forbs.

Associated non-grassland bird species: Mostly species that forage in cut hayfields, such as European starling (F), American robin (F), American crow (F), house sparrow (F), rock dove (F), chipping sparrow (F), sandhill crane (F).

GRASS OR GRASS/LEGUME HAY

Conventionally farmed hayfields with >25% cover of grasses and forbs other than alfalfa and legumes; often dominated by grasses such as smooth brome, Timothy, and orchardgrass.

Associated non-grassland bird species: See alfalfa or legume hay, above.

PASTURES

Fields grazed by dairy or beef cattle; woody cover typically <5%; light to moderate grazing only (see text—typically between 5-20 cm height-density). Vegetation species composition variable, but typically dominated by non-native cool-season grasses (especially Kentucky bluegrass) with some weedy forbs. Bird communities variable, dependent upon vegetation structure, pasture management, and pasture size.

^a Birds listed are among those found in the Wisconsin grassland bird study. The five swallow species found in Wisconsin, as well as purple martin and chimney swift, can occur in any of these habitats as foragers and sometimes as nesters; none of these species will be mentioned in what follows.

APPENDIX E. *Continued.*

Associated non-grassland bird species: European starling (F), American crow (F), brown thrasher, house sparrow (F), sandhill crane (F), Baltimore oriole (F). In very lightly grazed wet pastures or low areas with tall vegetation or emergents: common snipe, marsh wren, Virginia rail. In heavily grazed pastures: European starling (F), American robin (F), chipping sparrow (F), rock dove (F).

IDLE COOL SEASON GRASSES AND FORBS

Fields typically dominated by non-native grasses, but with a forb component; always with <5% woody cover; usually deliberate wildlife plantings, retired hayfields or retired pastures.

Short Typically Kentucky bluegrass, junegrass, redtop, Canada bluegrass, poverty-oats (0-15 cm height-density; often on droughty or sandy soils).

Associated non-grassland bird species: American robin (F), indigo bunting (F), chipping sparrow (F), northern flicker (F), European starling (F).

Medium Depending on site conditions, typically smooth brome, timothy, orchardgrass, quackgrass (>15-35 cm height-density).

Associated non-grassland bird species: American robin (F), American crow (F), European starling (F), northern cardinal (F), gray catbird (W), house sparrow (F).

Tall Typically reed canary grass, bluejoint grass, tall fescue, but can include other species such as smooth brome. (>35-60 cm height-density).

Associated non-grassland bird species: Yellow warbler (W), marsh wren.

IDLE WARM SEASON GRASSES AND FORBS

Established stands dominated by a mix of native warm season grasses but with a substantial native forb component; always <5% woody cover. **Not** monotypic stands of grass, which are common but tend to be dominated—especially monotypic switchgrass—by fewer bird species than mixed stands.

Medium (>15-35 cm height-density; often with short-stature grasses such as prairie dropseed, little bluestem and side-oats grama).

Associated non-grassland bird species: American robin (F), house sparrow (F), chipping sparrow (F), brown thrasher.

Tall (>35-60cm height-density; typical species include big bluestem, indiagrass, and switchgrass).

Associated non-grassland bird species: European starling (F), American woodcock.

DRY OLDFIELD

Variable; former cropland on well-drained or droughty soils with predominantly non-native grasses **and** a strong forb component; herbaceous cover consists of <60% grasses; <5% woody cover; height-density usually below 35 cm.

Associated non-grassland bird species: Chipping sparrow (F), American robin (F), indigo bunting (W), cedar waxwing (F), gray catbird (F), brown thrasher, northern cardinal (F), European starling (F).

UPLAND SHRUB COMMUNITIES

Exists anywhere idle herbaceous, grass-dominated fields contain scattered shrubs (1-3m in height); shrub cover 5-30%. Dry oldfield, upland pasture, dry prairie, or dry-mesic prairie with shrubs are examples. A variety of grass height-densities allowable, but usually between 5-50cm. May grade into wet soils and have bird communities similar to shrub swamps or wet shrubby oldfields.

(continued on next page)

APPENDIX E. *Continued.*

Associated non-grassland bird species: Gray catbird (D), American robin (D), chipping sparrow (D), cedar waxing (D), eastern towhee, indigo bunting, yellow warbler, brown thrasher, rose-breasted grosbeak, blue-winged warbler, northern cardinal, house wren, blue jay, black-capped chickadee, Baltimore oriole, yellow-breasted chat; many other species possible.

WET OLDFIELD

Same as dry oldfields but on mesic or wet sites; height-density typically >35 cm.

Associated non-grassland bird species: Yellow warbler (W), American robin (F), European starling (F), northern flicker (F), American woodcock, common snipe.

SHRUBBY WET OLDFIELD

Former cropland on wet soils with 5-30% woody cover.

Associated non-grassland bird species: Gray catbird (D), yellow warbler (D), cedar waxwing, American robin, northern flicker (F), European starling (F), indigo bunting, brown thrasher, house wren, chipping sparrow, blue jay, common snipe, sandhill crane, Baltimore oriole, yellow-breasted chat (S); many other species possible.

DRY OR SAND PRAIRIE

Relatively undisturbed sites, typically with <10% woody cover, on sandy or droughty soils, dominated by little bluestem, prairie dropseed, side-oats grama, junegrass, and other native dry prairie species but not on steep slopes; height-density <15 cm. Dry prairies on steep hillsides or bluffs (historically called "goat prairies") tend to be shrubby, but even if they are not shrubby, most characteristic nesting grassland bird species of management concern are rare or absent from them (except for field and vesper sparrow and eastern meadowlark).

Associated non-grassland bird species: Chipping sparrow (D), northern cardinal (D), blue jay, brown thrasher, American robin, black-capped chickadee, indigo bunting, northern flicker (F), cedar waxwing, eastern towhee (the latter two species are dominant in hillside prairies), house wren, European starling (F), gray catbird. As with all idle grasslands, woody-dependent bird species not present as nesters if shrubs are absent.

DRY-MESIC PRAIRIE

Sites characterized by slightly taller vegetation (grasses often include indiagrass and big bluestem) on more mesic soils than dry or sand prairies. Woody vegetation cover typically <5%.

Associated non-grassland bird species: European starling (F), American robin (F), American crow (F), chipping sparrow (F).

WET-MESIC OR WET PRAIRIE

Restorations or remnants of native vegetation on wet-mesic to wet soils. Wet-mesic prairies are dominated by big bluestem and other native prairie grasses and forbs; <10% woody cover; height-density averages around 35cm. Wet sites (also <10% woody cover) are dominated by species such as bluejoint grass, prairie cordgrass, sedges, and big bluestem and have a lower forb component than wet-mesic prairies; height-density averages 50-60cm. As with dry, sand, and dry-mesic prairies, most sites are relatively small. Large, open tracts have the most rich grassland bird communities.

Associated non-grassland bird species: Sandhill crane, yellow warbler, American robin, gray catbird, northern flicker (F), indigo bunting (W), American crow (F), cedar waxwing (W). Wet prairies are more likely than wet-mesic prairies to have swamp sparrow, sedge wren, Henslow's sparrow, and Wilson's phalarope (all grassland species) as well as sora rail, common snipe, and marsh wren.

APPENDIX E. Continued.

SOUTHERN SEDGE MEADOW

Relatively undisturbed wet meadows, usually south of the tension zone and typically dominated by broad-leaved sedge species, sometimes with bluejoint grass; <5% woody cover.

Associated non-grassland bird species: Marsh wren, sandhill crane, yellow warbler (W), gray catbird (W), house wren (W), common snipe, sora rail, Virginia rail, cedar waxwing (W), other species.

NORTHERN SEDGE MEADOW

Relatively undisturbed wet meadows, usually north of the tension zone and dominated by "wiregrass sedge" species. Woody cover <5%.

Associated non-grassland bird species: Same species as southern sedge meadows, plus American bittern.

SOUTHERN SEDGE MARSH

Southern sedge meadows interspersed with open water (average around 25%) and some cover of emergent vegetation.

Associated non-grassland bird species: Marsh wren (D), black tern (D), great blue heron (D, F), sandhill crane, gray catbird (W), yellow-headed blackbird, green heron, yellow warbler (W), common snipe, least bittern (S), American bittern (S), sora rail (S), Virginia rail (S), and other species.

NORTHERN SEDGE MARSH

Northern sedge meadows interspersed with open water (average around 25%) and some emergent cover.

Associated non-grassland bird species: Black tern (D), yellow-headed blackbird (D), marsh wren (D), American bittern (S), common snipe, sora rail, great blue heron (F), sandhill crane, Virginia rail, yellow warbler (W), least bittern, and other species, including waterfowl.

SHRUB SWAMP

Wet sites, relatively undisturbed (not former cropland), dominated by shrub cover (always <70% cover and typically <50% cover, but always >20%) with a tall, dense herbaceous understory (often sedge-dominated); emergent cover <5%.

Associated non-grassland bird species: Yellow warbler (D), gray catbird (D), cedar waxwing, Baltimore oriole, sandhill crane, rose-breasted grosbeak, house wren, great blue heron (F), northern flicker (W), black-capped chickadee, veery, indigo bunting, yellow-breasted chat, and other species. **Note:** In southern willow and dogwood carr: willow flycatcher is dominant. In northern alder swamp: alder flycatcher is dominant. In conifer-shrub swamps: veery and blue jay are dominant.

OPEN BOG

Northern sites on quaking bog mats; usually dominated by sphagnum and ericaceous heath (low shrubs); <50% sedge cover (wiregrass varieties); <10% cover of woody vegetation above 1m.

Associated non-grassland bird species: Lincoln's sparrow (S), merlin (S,F), American robin, great blue heron (F), American crow (F), American bittern, common snipe, yellow warbler.

MOSSED BOG

Mossed sphagnum bogs that have become dominated by grasses and wiregrass sedges; <5% woody cover.

Associated non-grassland bird species: Sandhill crane.

(continued on next page)

APPENDIX E. *Continued.***OAK SAVANNA**

Variable, but not on sterile sands (savannas on sandy soils are categorized as oak/river barrens); sites with <30% cover of mature, open-grown trees. Shrub and sapling layers usually <10% cover. Herbaceous understory variable but typically consists of non-native grasses and forbs. Bird community highly variable, depending on structure of understory, development of shrub/sapling layer, and tree density and spacing.

Associated non-grassland bird species:

Species associated with scattered trees: European starling, northern flicker, blue jay, Baltimore oriole, American robin, cedar waxwing, warbling vireo, chipping sparrow, American crow, great-crested flycatcher. As the tree canopy becomes more closed many more woodland species appear, including downy woodpecker, eastern wood-pewee, white-breasted nuthatch, wild turkey, black-capped chickadee, rose-breasted grosbeak, blue-gray gnatcatcher, least flycatcher.

Species associated with shrubs or a shrub understory: Indigo bunting, yellow warbler, house wren, gray catbird, brown thrasher, northern cardinal, eastern towhee, chestnut-sided warbler (north).

OPEN BARRENS

Northern, predominantly herbaceous barrens, recently burned, with most woody vegetation under 1m tall and <5% cover of woody vegetation over 1m tall.

Associated non-grassland bird species: Chipping sparrow, eastern towhee, brown thrasher, sandhill crane (F), house wren, American crow (F), yellow warbler, northern flicker (F).

DIVERSE BARRENS

Northern barrens on large blocks, typically >200 acres. Patchy habitats, with a mix of open and wooded areas; cover of woody vegetation greater than 1m tall ranges from 20-60%.

Associated non-grassland bird species: Eastern towhee (D), chestnut-sided warbler (D), brown thrasher (D), European starling (D), blue jay, cedar waxwing (D), chipping sparrow (D), Nashville warbler (D), American crow, indigo bunting, black-capped chickadee, gray catbird, rose-breasted grosbeak, American robin, yellow warbler, northern flicker, other species.

BRUSH PRAIRIE BARRENS

Northern barrens. Most woody vegetation consists of shrubs <3m tall (15-40% cover), not patchy. Less than 5% woody cover >3m tall.

Associated non-grassland bird species: Yellow warbler (D), eastern towhee (D), indigo bunting, brown thrasher, gray catbird, house wren, cedar waxwing, northern flicker, black-billed cuckoo, blue jay, chipping sparrow, other species.

OAK OR RIVER BARRENS

Sandy-soiled sites on Wisconsin and Chippewa River terraces or on oak-dominated parts of Glacial Lake Wisconsin with mostly native vegetation. Woody cover averages 25-30% (always <70%), but variable proportions of oaks and conifers, mostly Hill's oak, red cedar, and jack pine.

Associated non-grassland bird species: House wren (D), gray catbird (D), eastern towhee (D), American robin (D), brown thrasher (D), cedar waxwing (D), great-crested flycatcher (D), chipping sparrow (D), blue jay, Baltimore oriole, European starling, northern flicker, indigo bunting, black-capped chickadee, Nashville warbler, house sparrow, yellow warbler, other species.

APPENDIX E. *Continued.***CONIFER BARRENS**

Central and northern conifer-dominated barrens; conifer cover ranges from 10-30% and is always greater than cover of hardwoods above 1m tall.

Associated non-grassland bird species: Chipping sparrow (D), eastern towhee (D), American robin (D), Nashville warbler (D), blue jay (D), black-capped chickadee (D), indigo bunting, cedar waxwing, brown thrasher, yellow warbler, American crow, gray catbird, house wren, chestnut-sided warbler, northern cardinal, great-crested flycatcher, black-billed cuckoo, other species.

CUT OR BURNED-OVER

Formerly woods; <20% cover of woody vegetation >3m tall; cover of woody vegetation <3m tall is variable but always below 70%.

Associated non-grassland bird species: Eastern towhee (D), house wren (D), chestnut-sided warbler (D), indigo bunting (D), cedar waxwing (D), brown thrasher (D), yellow warbler, gray catbird, chipping sparrow, black-billed cuckoo, American robin, blue jay, northern flicker; many other species possible.

YOUNG CONIFER PLANTATION

Conifer plantations with trees <3m tall.

Associated non-grassland bird species: Chipping sparrow (D), cedar waxwing, American robin, Nashville warbler (central and north), eastern towhee, blue jay, brown thrasher, indigo bunting, black-capped chickadee (F), gray catbird, other species.

ORCHARD

Mostly apple orchards; cherries (e.g., in Door County) and pears also.

Associated non-grassland bird species: American robin (D), black-capped chickadee (D), chipping sparrow (D), cedar waxwing (D), gray catbird, indigo bunting, Baltimore oriole, European starling, house wren, northern flicker, blue jay.

PARK OR GOLF COURSE

Variable.

Associated non-grassland bird species: Chipping sparrow (D), American robin (D), cedar waxwing (D), European starling (D), American crow (D), northern cardinal, blue jay, house sparrow, house wren, white-breasted nuthatch, eastern towhee, indigo bunting, gray catbird, northern flicker, brown thrasher, Baltimore oriole, warbling vireo. Variable bird community; many other species possible.

APPENDIX F. *Details on general and special habitat features required or preferred by grassland bird species.*

Species are arranged into groups based on general habitat requirements, as in Table 5. Species of management concern are shown in **bold**.

SHORTGRASS SPECIES^a:

- Killdeer Bare ground/rocks/gravel, mudflats, short vegetation (if any); also various types of pavement.
- Horned lark Prefers habitats with very short and sparse vegetation or bare soil (e.g., plowed agricultural fields, heavily grazed pasture, dry prairies); early nester.
- Common nighthawk Areas with short, sparse grass cover or bare soil are preferred, often sandy or gravelly ground with rocky knolls, tolerates some scattered woody vegetation (e.g., dry or sand prairies, barrens). Also flat, gravel rooftops.
- Vesper sparrow** Some bare ground required, sparse or short vegetation (e.g., row crops, fallow fields, barrens); elevated song perches (tree, shrub, forb, fence, etc.) frequently used.
- Grasshopper sparrow** Some bare soil required; most common in habitats with relatively short (5-20 cm height-density) vegetation and fairly diverse structure. Can inhabit taller grass habitats if vegetation is patchy and not overly dense. Stiff-stemmed forbs used for song perches.
- Upland sandpiper** Short to medium height grasslands (5-35 cm height-density); shortgrass especially important for brood-rearing and foraging; makes frequent use of perching posts. Tends to prefer large, open fields (≥ 100 acres).
- Western meadowlark** Likes relatively short, open, idle or grazed grasslands; only a limited amount (<5% cover) of scattered woody vegetation above 1m tall is tolerated; fencelines, forbs, and posts, etc. used for perches. Tends to prefer habitats with less woody cover and shorter vegetation height-density than eastern meadowlark.

MIDGRASS SPECIES^a:

- Savannah sparrow** A habitat generalist. Occurs in habitats with a broad range of vegetation structure; most common in fairly lush, short to medium height grasslands (e.g., hay, pasture). Often uses stiff-stemmed forbs for song perches. Does not require significant standing residual vegetation in the spring.
- Eastern meadowlark** Generalist species, occurring in a variety of habitats. Prefers idle or lightly grazed, grass-dominated habitats with stiff-stemmed forbs; other structures and scattered trees, saplings, and shrubs also readily used for perches when available. Herbaceous vegetation typically 10-35 cm height-density; prefers a dense litter layer.
- Bobolink** Generalist; prefers habitats with lush herbaceous vegetation of medium to tall height-density; readily uses a variety of perches (e.g., forbs, shrubs, occasionally trees) for singing. Does not require standing residual vegetation in spring.
- Dickcissel** Prefers upland grasslands with medium to tall height-density and a significant component of forbs (some stiff-stemmed); forbs, sparse woody vegetation, fences, and utility lines are readily used for singing perches. Arrives and nests late.

^a Species in the first three categories are arranged roughly in order of increasing height-density of required vegetation. In subsequent categories, species are listed in taxonomic order.

APPENDIX F. *Continued***TALLGRASS SPECIES^a:**

- Le Conte's sparrow** Occurs in relatively tall, dense vegetation, typically sedge meadows, but also northern uplands such as idle grasslands or grass hay; prefers abundant residual vegetation.
- Red-winged blackbird **Very** generalized nesting habitat but most common in habitats with relatively tall, dense vegetation.
- Yellow rail** Specialist; occurs in large (>100 acre) expanses of sedge-dominated meadows (typically narrow-leaved varieties), mainly in the north; few scattered shrubs tolerated; abundant residual vegetation preferred.
- Nelson's sharp-tailed sparrow** Specialist; mainly restricted to large sedge meadows (especially those dominated by narrow-leaved sedges) in the extreme north and northwest parts of the state; likes abundant residual vegetation. Similar habitat to that preferred by yellow rails.
- Henslow's sparrow** Prefers habitats with tall to moderately tall, dense vegetation (grass-dominated); prefers habitat with tall standing residual vegetation and a dense litter layer in spring. Some shrubs tolerated; woody cover above 1m typically <2%.
- Common yellowthroat Requires relatively tall, dense vegetation. Shrub component preferred but not necessary (when shrubs are present, herbaceous vegetation can be shorter). Abundant residual vegetation preferred. Tends to prefer wet sites, but occurs in uplands as well.
- Sedge wren** Occurs most frequently in habitats on upland or lowland sites with homogeneous stands of tall, dense vegetation (grass or sedge-dominated); typically requires abundant litter. Variable breeding phenology; may nest late.
- Swamp sparrow Tall, dense vegetation (grass or sedge-dominated), with or without shrubs; most common in wet sites; abundant residual vegetation preferred. Most common in cattail-dominated emergent marshes.

SPECIES REQUIRING WOODY VEGETATION OR OTHER NESTING STRUCTURE:

- Cattle egret Pastures, idle short grass; trees or shrubs needed for nesting.
- Red-tailed hawk Woodlot or mature trees for nesting and perching; adjacent grasslands used for foraging.
- American kestrel Mature trees with cavities or nest boxes near grasslands for foraging.
- Gray partridge Occurs in relatively open cultivated agricultural landscapes; grassy nest cover is typically near brushy fencerows, hedgerows, and shrub clumps used for escape cover. Grains and weed seeds needed for winter food.
- Ring-necked pheasant Most common in tall grassy nest cover with standing residual vegetation present in spring; requires winter food (corn/sorghum) and cover (shrub carr or cattail marsh, dense standing residual vegetation, upland brushy areas).
- Northern bobwhite Idle grasslands, old fields preferred for nesting and foraging; rowcrops and small grains used for foraging; shrubs, brush piles, brushy hedgerows, etc. needed for escape cover and roosting; grains required for winter food.

(continued on next page)

APPENDIX F. *Continued*

Mourning dove	Likes some bare ground; patchy vegetation used for nesting and foraging; adjacent woody cover used for perching and also for nesting.
Red-headed woodpecker . . .	Generalist; requires mature trees for nesting cavities. Most characteristic of landscapes with scattered open-grown trees.
Alder flycatcher	Prefers lowland habitats with shrubs north of the tension zone (e.g., alder swamps, bogs, stream edges).
Willow flycatcher	Prefers lowland habitats with shrubs (especially willow-dominated shrub swamps), but also occurs in upland habitats with shrubs. Occurs mostly south of the tension zone.
Eastern kingbird	Generalist; occurs in a variety of relatively open habitats and habitats with scattered shrubs or trees, edges between wooded and grassland habitats; both upland and lowland sites. At least one sapling or tree required (for nesting and perching).
Barn swallow	Generalized foraging habitat, often over forages over low grasslands and crop fields; nesting structure required (e.g., bridge, barn).
Eastern bluebird	Tree cavity or nest box required for nesting; perches used for foraging; open to somewhat open habitats with relatively short grass vegetation are typically preferred for foraging.
Loggerhead shrike	Requires some—or at least one—shrubs, saplings, or small trees (usually spiny or thorny) for nesting, perching, and impaling prey (e.g., hawthorn, plum, red cedar, apple, crabapple); prefers idle to lightly grazed shortgrass to midgrass habitats for foraging. Also perches on wires; impales prey on barbed wire.
Bell's vireo	Prefers clumps of shrubs or saplings, or shrubby edges of small woods for nesting, with adjacent grassland or herbaceous cover. Often nests near water or wetlands or in lowland sites (e.g., draws or shallow ravines), but also regularly nests in uplands.
Clay-colored sparrow . .	Scattered or locally dense shrubs (typically 1-25% woody cover above 1m tall) in an idle grassland context. Inhabits both upland or lowland sites.
Field sparrow	Scattered shrubs or saplings (typically 1-25% woody cover above 1m tall) mixed with idle grassland; also shrubby woods edge. Prefers dry, upland sites.
Lark sparrow	Habitat specialist. Strongly prefers sites with bare soil or sand blows (e.g., sand prairie) and short, sparse herbaceous vegetation; prefers habitats with a few scattered shrubs or small saplings.
Song sparrow	Generalist; shrub component preferred but not necessary (when shrubs are not present vegetation must be relatively tall and dense); often some bare soil; stiff-stemmed forbs used frequently for perching and singing.
Brewer's blackbird	Prefers short to moderate height grassland with some bare soil (often on recently burned or plowed sites) and typically with a light litter layer. Scattered shrubs, trees, saplings, and snags often used for perching, but does not require woody vegetation in nesting fields.
Common grackle	Generalist; cultivated cropland and relatively short grassland used for foraging; conifers, deciduous shrubs and small trees, and cattails used for nesting.
Brown-headed cowbird . . .	Generalist; perches required for searching for host nests. Relatively short-grass vegetation needed for foraging.

APPENDIX F. *Continued*

- Orchard oriole Generalist; requires trees for nesting. Typical nesting habitats include farmyards with trees, hedgerows or roadsides with trees, savannas, and open or oak/river barrens.
- American goldfinch Generalist; inhabits a wide variety of grasslands and edges with thistles and other Compositae spp.. Prefers, but does not require, a shrub component.

SPECIES REQUIRING OPEN WATER:

- Dabbling ducks: American green-winged teal,
Northern pintail, **Blue-winged teal**,
Northern shoveler, Gadwall,
American wigeon All require water for breeding pairs (temporary and seasonal) and broods (semi-permanent and permanent). Pair and brood water should be within 1 mile of each other. Idle grass nest cover should ideally be located within 1/2 mile of a wetland basin (permanent or semi-permanent). Herbaceous nesting cover requirements are somewhat variable between species(see Table 1).
- Mallard Same requirements for wetlands as other dabbling ducks, but an extreme generalist for nest cover.
- Wilson's phalarope** Specialist in sedge- or grass-dominated meadows interspersed with open shallow water (averages around 15% cover of water). Tends to inhabit blocks of suitable habitat >100 acres in size.

SPECIES REQUIRING LARGE AREAS (AREA-SENSITIVE):

For all species in this group, the overall amount, types, and distribution of grassland habitats are more important than individual field sizes.

- Northern harrier** Inhabits large, open landscapes of idle grass fields, sedge meadows, open bogs, dry and wet old fields, and some cropland; some shrub cover is allowable (typically <20% cover). Both uplands and lowlands used; forages over a wide range of grassland habitats. Prefers blocks of uncultivated grassland >100 to 250 acres and larger.
- Greater prairie-chicken** Requires large expanses of open, idle grassland, which can be scattered in agricultural landscapes of pasture, grass hay, grains, and some row crops. Large open landscapes with blocks of idle grassland >250 acres are best. Short-grass micro-sites are required for booming grounds, while taller vegetation is used for nesting and roosting. Minimal scattered woody vegetation, such as shrub or sapling clumps, or woods edges are used for roosting cover, especially in winter. Grains are an important winter food. Small breeding range in Wisconsin centers on managed properties.
- Sharp-tailed grouse** Prefers brush prairie, open and diverse barrens, cut- or burned-over forest lands; also uses wetlands such as sedge meadows and bogs. Requires significant brush or sapling cover (more than is required for prairie-chickens), especially in fall and winter. Some open, relatively shortgrass habitat required for dancing grounds. Needs large expanses of open habitat (optimally in blocks >250 acres).
- Barn owl** Requires a natural or artificial nesting structure, such as a tree cavity or box. Requires large landscapes of open farmland, idle grassland, and wet meadow for hunting; may be limited by snow depth in winter.
- Short-eared owl** Prefers large open expanses of idle grassland, sedge meadows, pastures, and bogs; some shrub cover often present. Typically nests in blocks of idle grassland >100 to 250 acres and larger.

APPENDIX G. *Statewide ranking and descriptions of priority landscapes for grassland bird management, from highest management priority (1) to lowest (26).*

Rank	Map Location	Priority Landscape	Natural Division ^a					Type ^c	Size (acres) ^b	
			SW	SE	CP	LM	NH		Current ^d	Potential ^e
1	A	Thomson Prairie Grasslands	◆					L _M	260	25,000
2	T	Crex Meadows/Fish Lake Complex					◆	L _C	23,000	76,000
3	H	Muralt/Monroe Grasslands		◆				L _M	1,100	27,000
4	P	Buena Vista/Leola Grasslands			◆			L _C	13,000	60,000
5	I	White River Marsh Complex		◆	◆			L	4,000	64,000
6	E	Star Prairie Pothole Grasslands	◆					L	2,200	134,000
7	U	Namekagon/Douglas County Barrens					◆	L	9,700	65,000
8	C	Yellowstone/Pecatonica River Grasslands and Savannas	◆					L	1,800	200,000

Dominant Habitat Types**Notes**

Existing prairie remnants (mostly dry-mesic prairie) and unplowed prairie pastures, upland brush, extensive surrogate grasslands (hay, pasture, savanna pasture, CRP) in a relatively treeless landscape. Favorable agricultural landscape with little row-cropping.

High potential for surrogate grassland expansion, especially through increasing CRP acreage, buffering prairie remnants, and prairie pasture management. Threats from increasing development.

Open, diverse, brush prairie, and conifer barrens, northern sedge meadow and sedge marsh, open bog.

Very large open landscapes. Potential for barrens restoration (both on DNR WAs and on extensive county forest land) and some potential for development of surrogate grasslands between the two WAs. Also, potential for expansion south to the Sterling Barrens area on the St. Croix River.

Remnant dry and dry-mesic prairie, unplowed pasture sod, large acreages of surrogate grasslands (pastures, savanna pastures, hay, old fields, CRP), southern sedge meadow.

Potential for expansion of the few remaining remnants through buffering. Currently has large blocks and expanses of surrogate grasslands (e.g., CRP and pasture).

Some remnant prairie; surrogate grasslands (e.g., idle cool-season and warm-season idle grasses and forbs, pasture, oldfields)—including some large blocks.

Threats from increasing irrigated agriculture and cranberry bogs. Potential for expansion of surrogate grassland blocks, and connection of Leola Marsh WA to Buena Vista Grasslands.

Southern (mostly) and northern sedge meadow, wet-mesic prairie, shrub swamp, surrogate grasslands, oak savanna, southern sedge marsh. Some large open landscapes, some areas fairly wooded.

Potential for connecting blocks of open grasslands. Need to coordinate with management of barrens for Karner Blue butterflies and some forest values.

Surrogate grasslands—some in large blocks—(CRP, WPAs, hay, pasture, old fields), prairie pothole marshes, savanna, upland shrub.

Small potential for restoration of prairie pasture and savanna pasture restoration and for restoration of prairie pothole/upland systems; also potential for expansion of surrogate grasslands such as WPAs. Faces threats from development.

Open, diverse, and brush prairie barrens; cut- or burned-over forest.

High potential for expansion of already large barrens through restoration, including on county forest lands. Placement of large clearcuts adjacent to barrens can expand open barrens habitat.

Surrogate grasslands (large open pastures and savanna pastures—some unplowed, CRP, old field), oak savanna, upland shrub, southern sedge meadow.

Minor prairie restoration potential; better potential for savanna management and surrogate grassland expansion (e.g., pastures and CRP). Potential for some large blocks. Priority area for surveys.

(continued on next page)

APPENDIX G. *Continued.*

Rank	Map Location	Priority Landscape	Natural Division ^a					Type ^c	Size (acres) ^b	
			SW	SE	CP	LM	NH		Current ^d	Potential ^e
9	B	Fort McCoy Barrens	♦					L	8,800	12,000
10	D	Lower Wisconsin River Prairies and Barrens	♦					M _C	2,000	5,000
11	W	Moquah Barrens					♦	L	8,000	11,000
12	V (1,2)	North Central Prairie Chicken Grasslands					♦	L _M	500	72,000
13	Y	Spread Eagle Barrens					♦	M _C	4,000	8,800
14	Q	Necedah Barrens			♦			M _C	3,500	7,000
15	L	Bong Recreation Area		♦				M _C	3,500	4,500
16	K	Columbia/Dane County Prairie Wetlands		♦				L _M	1,400	58,000
17	F	Lower Chippewa River Savannas and Prairies	♦					M	800	5,000

Dominant Habitat Types	Notes
Sand prairie, oak or river barrens, oak savanna; some surrogate grassland.	Some high quality sand prairie is in large blocks. Good potential for restoration and expansion of open barrens habitats. Impacts of military activity need to be assessed.
Dry or sand prairie, oak or river barrens, wet or wet-mesic prairie (includes barrens, prairie, and savanna sites north of Mazomanie), southern sedge meadow, some surrogate grassland.	Some potential for surrogate grasslands, barrens, and sand prairie expansion or restoration. Main need is for connection of sites along river corridor (including bluffs and river barrens).
Open, diverse, and brush prairie barrens; cut-over forest.	Essentially one large block. Potential for additional barrens restoration, including expansion into adjacent forest lands.
Surrogate grasslands (hay, small grains, pasture, old field), northern and southern sedge meadow.	* These former forested regions depend on suitable agricultural practices for grassland bird habitat (e.g., late-cut grass hay). Potential for surrogate grassland expansion (e.g., through CRP).
Open, diverse, and brush prairie barrens habitats; cut- or burned-over forest.	Potential for expansion and restoration of barrens habitats.
Barrens (mainly diverse and brush prairie), southern (mostly) and northern sedge meadow, some surrogate grassland.	Management for more open barrens will benefit grassland birds; needs to be coordinated with management for Karner Blue butterfly. Potential for barrens restoration and expansion of barrens habitat outside of refuge boundary.
Surrogate grasslands, prairie pothole marsh.	Most significant grassland landscape in the far southeast. Emphasize importance of management for open grasslands; potential for expansion limited.
Southern sedge meadow, dry-mesic prairie remnants, prairie pothole marsh, southern sedge marsh, surrogate grasslands (WPAs, hay, pasture, old fields).	A diverse landscape, facing threats from development. Small potential for savanna restoration; expansion of prairie remnants possible through buffering; expansion of surrogate grasslands. Most sites isolated by farmland and need buffering (e.g., prairie pastures).
Dry or sand prairie, oak or river barrens.	High potential for barrens expansion (on islands) and some surrogate grassland expansion.

(continued on next page)

APPENDIX G. *Continued.*

Rank	Map Location	Priority Landscape	Natural Division ^a					Type ^c	Size (acres) ^b	
			SW	SE	CP	LM	NH		Current ^d	Potential ^e
18	J	Southern Kettle Moraine Complex		♦				L _M	3,000	16,000
19	M	Rush Lake Grasslands and Sedge Meadows		♦				L _M	700	24,000
20	X	Mead/Paul J. Olson Grasslands					♦	L	4,900	110,000
21	R	Bear Bluff Wetlands			♦			L	4,500	83,000
22	N	Brillion/Killsnake Grasslands		♦				L _M	3,400	33,000
23	O	Pine Island Area Grasslands		♦				M _C	2,200	5,000
24	S	Green Bay West Shore Sedge Meadows				♦		M _C	3,340	5,000
25	Z	Black Lake/Belden Swamp					♦	M _C	1,500	3,500
26	G	Rush Creek/Battle Bluff Goat Prairies and Savannas	♦					M	230	1,000

^a SW = Southwestern Upland,
SE = Southeastern Ridges and Lowlands,
CP = Central Plains,
LM = Lake Michigan Shoreland,
NH = Northern Highland/Lake Superior Lowland.

^b Landscape sizes are rough estimates.

^c L = large-scale,
M = medium-scale,
L_C or M_C = landscape currently has sufficient permanent grassland (to meet goal),
L_M = potential large-scale landscapes that can also be developed and managed as medium-scale landscapes.

Dominant Habitat Types	Notes
Savanna, upland brush, dry-mesic and wet-mesic prairie, southern sedge meadow, surrogate grasslands. Also important blocks of southern forest.	A highly diverse landscape. Grassland habitat is contained mainly in the Scuppernong valley and Young Prairie area. High potential for savanna expansion (e.g., Blue Spring area). Need to coordinate planning and management for grasslands, savannas, wetlands, and closed forest.
Southern sedge meadow, prairie pothole marsh, surrogate grasslands (hay, pasture, idle grassland), oak savanna.	Important example of prairie marsh/upland system. Potential for sedge meadow and surrogate grassland expansion.
Northern sedge meadow, surrogate grasslands, open bog.	Potential for surrogate grassland expansion and connection between the two WAs. Need to control woody vegetation.
Northern and southern sedge meadows and marshes, diverse and brush prairie barrens, open bog.	Small potential for oak-dominated barrens and savanna restoration. Potential to manage large county-owned sedge meadows. Threats from cranberry bog expansion. Potential for expansion of this landscape into Wood County WA to the east.
Surrogate grasslands, southern sedge meadow.	Potential for further prairie restoration and surrogate grassland expansion, including between the two WAs.
Surrogate grasslands, upland shrub, dry or sand prairie remnants, southern sedge meadow.	Minor restoration potential for sand prairie, savanna, and river barrens. Expand grassland habitat where possible.
Northern and southern sedge meadow, shrub swamp, surrogate grasslands.	Some potential for management of surrogate grasslands in uplands near sedge meadows.
Open bog, northern sedge meadow, shrub swamp.	Two open landscapes; not possible to connect, but minor potential for expansion. Coordinate management at Black Lake with contiguous acreage in Minnesota (roughly 1,000 additional acres).
Dry prairie, oak savanna (~500 acre restoration project), and dry oldfield.	Best example in WI of bluff prairie/river system. Possibility of connecting and expanding bluff prairie remnants, and limited potential for grassland expansion. Overall potential for birds is limited. Need to combine with oak woodland values in planning efforts.

^d Permanent grassland acreage.

^e Based on largest possible landscape boundaries as shown in Figure 8 on page 76; total amount of actual grassland habitat area may be smaller depending on circumstances in each specific landscape, such as presence and distribution of unsuitable habitat.

GLOSSARY

Acreage Conservation Reserve (ACR)

Part of the now-defunct U.S. Department of Agriculture Feed Grain Program that took former row crop fields out of production (set-aside), typically for one year, but sometimes for more than one year. Planted or volunteer vegetation provided soil erosion protection.

Biomass energy crops

Plant-derived materials (such as harvested woody or herbaceous crops) that supply useful energy either by direct combustion or by conversion into liquid or gaseous fuels.

Brood parasitism

An example of brood parasitism: female brown-headed cowbirds laying eggs in the nest of a host species. The host species may then raise the cowbird chick(s) at the expense of their own young.

Conservation Reserve Program (CRP)

A U.S. Department of Agriculture program that takes highly erodible or environmentally sensitive cropland out of production for 10 to 15 years. Farmers receive an annual rental payment in return. Most enrolled land is planted to perennial grasses and grass/legume mixtures. Some land is planted to trees.

Conservation tillage

A set of practices in which varying degrees of crop residue remain on the soil surface before and after planting agricultural crops.

Cool-season grass

Any grass species that reaches its peak growth and photosynthetic activity in the relatively cool weather of spring and fall. These grasses usually flower before July 15. The plant goes dormant or growth slows in the heat and dryness of summer. These grasses include both native and non-native species; the majority, however, are non-native.

Ecological trap

A habitat that attracts nesting birds in the spring but supports only low or no nest productivity, adult survival, or juvenile survival.

Edge effects

The apparent phenomenon of low nest success near certain kinds of habitat edges due to high rates of nest predation and brood parasitism.

Extirpated

Refers to species that formerly occurred in Wisconsin but no longer include the state within their range.

Forbs

Non-grassy herbaceous plants, typically broad-leaved species.

Habitat guild

A group of bird species that tend to occur in similar types of habitats. Wisconsin bird habitat guilds include grassland, forest, wetland, urban/farmstead, and edge/generalist guilds.

Heath

Low-growing (<1 m tall) woody plants, usually referring to ericaceous shrubs but here meaning any low woody plants.

Height-density

One of the tools managers use to assess habitat structure in the field. It is a measurement that represents the height below which vegetation is too dense to permit sight of a graduated pole from a distance of 4 m. This is sometimes also called a visual obstruction measurement (Robel et al. 1970).

Idle grassland

Any habitat that is not cut, burned, cropped, heavily grazed, cultivated, or otherwise disturbed during the bird breeding season.

Linear edge

Structural features in a grassland or agricultural landscape that form linear, sharply defined boundaries or breaks between woody and herbaceous habitat types and that can provide habitat or travel corridors for nest parasites or predators. Examples include brushy ditches and fencelines, hedge rows and tree rows, and woodlot edges.

Litter layer

A horizontal layer of dead herbaceous vegetation on or just above the soil surface.

Mesic (dry-mesic, wet-mesic)

Pertaining to an environment with a moderate amount of moisture; as opposed to wet (hydric) or dry (xeric) environments.

Monotypic stands

Plantings dominated by one species; monocultures.

Openness

Dominance of herbaceous vegetation in landscapes characterized by the absence of major woody vegetation and the absence or low density of farmsteads and other major above-ground structures.

Refugia

Places where organisms can avoid life-threatening disturbances.

Suitable

Used in reference to grassland bird habitat. Refers to habitats that are high quality (e.g., habitats that typically attract good densities of at least some grassland bird species and have relatively high nesting productivity) or that at minimum do not have significant negative impacts on grassland birds (e.g., habitats such as small grains that do not support high diversity or density of nesting birds but that may increase the effective size of an open grassland landscape, buffer other high quality habitats from woody edges, etc.).

Warm-season grass

Any grass species that reaches its peak growth and photosynthetic activity during the warm summer months—typically between June 15 and August 30. These grasses usually flower after July 1 to 15.

Waterfowl Production Area (WPA)

Upland fields and wetlands purchased and managed by the USFWS to provide grassland nesting habitat for waterfowl.

LITERATURE CITED

- Addis, J., R. Eckstein, A. Forbes, D. Gebken, R. Henderson, J. Kotar, B. Les, P. Matthiae, W. McCown, S. Miller, B. Moss, D. Sample, M. Staggs, and K. Visser.
1995. *Wisconsin's biodiversity as a management issue: a report to Department of Natural Resources managers*. Wisconsin Department of Natural Resources, Madison, WI.
- American Ornithologists' Union.
1983. *Check-list of North American birds*. Sixth edition. Allen Press, Lawrence, KS.
1995. Fortieth supplement to the American Ornithologists' Union Check-list of North American birds. *Auk* 112:819-30.
- Basili, G., and S.A. Temple.
1995. A perilous migration. *Natural History* 104:40-46.
- Basore, N.S., L.B. Best, and J.B. Wooley, Jr.
1986. Bird nesting in Iowa no-tillage and tilled cropland. *Journal of Wildlife Management* 50:19-28.
- Best, L.B.
1986. Conservation tillage: ecological traps for nesting birds? *Wildlife Society Bulletin* 14:308-17.
- Bollinger, E.K., and T.A. Gavin.
1992. Eastern bobolink populations: ecology and conservation in an agricultural landscape. Pp. 497-508 in J.M. Hagan and D.W. Johnston, eds. *Ecology and conservation of neotropical migrant landbirds*. Smithsonian Institution Press, Washington, D.C.
- Bollinger, E.K., P.B. Bollinger, and T.A. Gavin.
1990. Effects of hay-cropping on eastern populations of the bobolink. *Wildlife Society Bulletin* 18:142-50.
- Carter, M., G. Fenwick, C. Hunter, D. Pashley, D. Petit, J. Price, and J. Trapp.
1996. Watch list 1996: for the future. *National Audubon Society Field Notes* 50:238-40.
- Cody, M.L.
1985. Habitat selection in grassland and open-country birds. Pp. 191-226 in M.L. Cody, ed. *Habitat selection in birds*. Academic Press, Orlando.
- Curtis, J.T.
1959. *The vegetation of Wisconsin*. University of Wisconsin Press, Madison.
- Ducey, J., and L. Miller.
1980. Birds of an agricultural community. *Nebraska Bird Review* 48:58-67.
- Emlen, J.T., and J.A. Wiens.
1965. The Dickcissel invasion of 1964 in southern Wisconsin. *Passenger Pigeon* 27:51-59.
- Featherstonough, G. W.
1847. *A canoe voyage up the Minnaw Sotor*. 2 volumes. Richard Bentley, London. Reprinted in 1970 by the Minnesota Historical Society, St. Paul.
- Fitzgerald, J.
1996. Physiographic Region 32: dissected till plains. Draft landbird conservation plan. On file at Natural History Division, Missouri Department of Conservation, Jefferson City, MO.
- Frawley, B.J.
1989. The dynamics of nongame bird breeding ecology in Iowa hayfields. Iowa State University, Ames. M.S. Thesis.
- Gatti, R.C.
n.d. Evaluation of managed nest cover for ducks and pheasants in Wisconsin. Unpublished manuscript on file at the Wisconsin Department of Natural Resources, Monona, WI.
- George, R.R., A.L. Fairs, C.C. Schwartz, D.D. Humburg, and J.C. Coffey.
1979. Native prairie grass pastures as nest cover for upland birds. *Wildlife Society Bulletin* 7:4-9.
- Gleason, H.A., and A. Cronquist.
1991. *Manual of vascular plants of northeastern United States and adjacent Canada*. The New York Botanical Garden, New York.
- Good, E.E., and C.A. Dambach.
1943. Effect of land use practice on breeding bird populations in Ohio. *Journal of Wildlife Management* 7:291-97.
- Graber, R.R., and J.W. Graber.
1963. A comparative study of bird populations in Illinois, 1906-1909 and 1956-1958. *Illinois Natural History Survey Bulletin* 28:378-528.
- Gregg, L.
1987. Recommendations for a program of sharp-tail habitat preservation in Wisconsin. Wisconsin Department of Natural Resources. Research Report 141.

- Gremaud, G.K.
1983. Factors influencing nongame bird use of rowcrop fields. Iowa State University, Ames. M.S. Thesis.
- Hamerstrom, F.N., Jr., O.E. Mattson, and F. Hamerstrom.
1957. *A guide to prairie chicken management*. Wisconsin Conservation Department. Technical Wildlife Bulletin 15.
- Henderson, R.A.
1995. Plant species composition of Wisconsin prairies. Wisconsin Department of Natural Resources. Technical Bulletin 188.
- Henderson, R.A., and J. Krause.
1995. Identification of landscape management opportunities and needs in Wisconsin. Wisconsin Department of Natural Resources. Final report. Pittman-Robertson Project W-160-P.
- Henderson, R.A., and D.W. Sample.
1995. Grassland communities. Pp. 116-129 in J. Addis, R. Eckstein, A. Forbes, D. Gebken, R. Henderson, J. Kotar, B. Les, P. Matthiae, W. McCown, S. Miller, B. Moss, D. Sample, M. Staggs, and K. Visser. *Wisconsin's biodiversity as a management issue: a report to Department of Natural Resources managers*. Wisconsin Department of Natural Resources, Madison, WI.
- Herkert, J.R.
1994. The effects of habitat fragmentation on midwestern grassland bird communities. *Ecological Applications* 4:461-71.
- Herkert, J.R.
1995. An analysis of midwestern breeding bird population trends: 1966-1993. *American Midland Naturalist* 134:41-50.
- Herkert, J.R., R.E. Szafer, V.M. Kleen, and J.E. Schwegman.
1993. Habitat establishment, enhancement, and management for forest and grassland birds in Illinois. Illinois Department of Conservation. Natural Heritage Technical Publication 1.
- Herkert, J.R., D.W. Sample, and R.E. Warner.
1996. Management of midwestern grassland landscapes for the conservation of migratory birds. Pp. 89-116 in F.R. Thompson III, ed. *Managing midwestern landscapes for the conservation of neotropical migratory birds*. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul. General Technical Report GTR-NC-187.
- Hine, R.L.
1973. Endangered birds. *Passenger Pigeon* 35:155-58.
- Hole, F.D., and C.E. Germain.
1994. The natural divisions of Wisconsin. Map published by the Wisconsin Department of Natural Resources, Madison WI.
- Hollister, N.
1919. Some changes in the summer bird life of Delavan, Wisconsin. *Wilson Bulletin* 31:103-08.
- Hoy, P.R.
1885. Man's influence on the avifauna of southeastern Wisconsin. *Proceedings of the Natural History Society of Wisconsin* (March, 1885):4-9.
- Igl, L.D.
1991. The role of climate and mowing on Dickcissel (*Spiza americana*) movements, distribution and abundance. Iowa State University, Ames. M.S. Thesis.
- Johnson, R.G., and S.A. Temple.
1986. Assessing habitat quality for birds nesting in fragmented tallgrass prairies. Pp. 245-49 in J. Verner, M.L. Morrison, and C.J. Ralph, eds. *Wildlife 2000: modeling habitat relationships of terrestrial vertebrates*. University of Wisconsin Press, Madison.
- Johnson, R.G., and S.A. Temple.
1990. Nest predation and brood parasitism of tallgrass prairie birds. *Journal of Wildlife Management* 54:106-11.
- Keys, J., Jr., C. Carpenter, S. Hooks, F. Koenig, W.H. McNab, W. Russell, and M.L. Smith.
1995. Ecological units of the eastern United States: first approximation. Map published by U.S. Department of Agriculture Forest Service, Atlanta, GA.
- Knopf, F.L.
1994. Avian assemblages on altered grasslands. *Studies in Avian Biology* 15:247-57.
- Kumlien, L., and N. Hollister.
1903. The Birds of Wisconsin. *Bulletin of the Wisconsin Natural History Society* 2:1-143.

- Leopold, A.
1949. *A sand county almanac and sketches here and there*. Oxford University Press, New York.
- Lymn, N., and S.A. Temple.
1991. Land-use changes in the Gulf Coast Region: links to declines in midwestern loggerhead shrike populations. *Passenger Pigeon* 53:315-25.
- Matteson, S., and L. Petersen.
1988. Wisconsin common barn-owl management plan. Wisconsin Department of Natural Resources. Wisconsin Endangered Resources Report 37.
- Mossman, M.J., and D.W. Sample.
1990. Birds of Wisconsin sedge meadows. *Passenger Pigeon* 52:39-55.
- Mossman, M.J., E. Epstein, and R.M. Hoffman.
1991. Birds of Wisconsin pine and oak barrens. *Passenger Pigeon* 53:137-63.
- Niemuth, N.D.
1995. Avian ecology in Wisconsin pine barrens. University of Wyoming, Laramie. Ph.D. Dissertation.
- Office of Migratory Bird Management.
1995. Migratory nongame birds of management concern in the United States: the 1995 list. U.S. Fish and Wildlife Service, Washington, D.C.
- Paine, L.K., D.J. Undersander, D.W. Sample, G.A. Bartelt, and T.A. Schatteman.
1996a. Cattle trampling of simulated ground nests in rotationally grazed pastures. *Journal of Range Management* 49:294-300.
- Paine, L.K., T.L. Peterson, D.J. Undersander, K.C. Rineer, G.A. Bartelt, S.A. Temple, D.W. Sample, and R.M. Klemme.
1996b. Some ecological and socio-economic considerations for biomass energy crop production. *Biomass and Bioenergy* 10:231-42.
- Partners in Flight.
1996. Unpublished species prioritization scores. Document on file at the Department of Natural Resources, Monona, WI.
- Peterson, R.T.
1980. *A field guide to the birds*. Houghton Mifflin Company, Boston.
- Price, J., S. Droege, and A. Price.
1995. *The summer atlas of North American birds*. Academic Press, London.
- Rabinowitz, D.
1981. Seven forms of rarity. Pp. 205-17 in H. Synge, ed. *The biological aspects of rare plant conservation*. Wiley, New York.
- Ratti, J.T., and K.P. Reese.
1988. Preliminary test of the ecological trap hypothesis. *Journal of Wildlife Management* 52:484-91.
- Robbins, S.D.
1982. Wisconsin's breeding bird survey results: 1966-1980. *Passenger Pigeon* 44:97-121.
1991. *Wisconsin birdlife*. University of Wisconsin Press, Madison.
- Robbins, S.D., D.W. Sample, P.W. Rasmussen, and M.J. Mossman.
1996. The breeding bird survey in Wisconsin: 1966-1991. *Passenger Pigeon* 58:81-179.
- Robel, R.J., J.N. Briggs, A.D. Dayton, and L.C. Hulbert.
1970. Relationships between visual obstruction measurements and weight of grassland vegetation. *Journal of Range Management* 23:295-97.
- Rodenhouse, N.L., and L.B. Best.
1983. Breeding ecology of vesper sparrows in corn and soybean fields. *American Midland Naturalist* 110:265-75.
- Rodenhouse, N.L., L.B. Best, R.J. O'Connor, and E.K. Bollinger.
1995. Effects of agricultural practices and farmland structures. Pp. 269-93 in T.E. Martin and D.M. Finch, eds. *Ecology and management of neotropical migratory birds*. Oxford University Press, New York.
- Rolley, R.
1994. Wisconsin checklist project: 1993 update. *Passenger Pigeon* 56:29-38.
- Ryan, M.R.
1986. Nongame management in grassland and agricultural ecosystems. Pp. 117-36 in J. B. Hale, L.B. Best, and R.L. Clawson, eds. *Management of nongame wildlife in the Midwest: a developing art*. North Central Section, The Wildlife Society.
- Sample, D.W.
1989. Grassland birds in southern Wisconsin: habitat preference, population trends, and response to land use changes. University of Wisconsin, Madison. M.S. Thesis.
1995. Unpublished data on file at the Wisconsin Department of Natural Resources, Monona, WI.

- Sample, D.W., R.A. Henderson, and M.J. Mossman.
1994. Unpublished memorandum on file at the Wisconsin Department of Natural Resources, Monona, WI.
- Samson, F.B.
1980. Island biogeography and the conservation of nongame birds. *Transactions of the North American Wildlife and Natural Resources Conference* 45:245-51.
- Schorger, A.W.
1943. The Prairie chicken and sharp-tailed grouse in early Wisconsin. *Transactions of the Wisconsin Academy of Sciences, Arts, and Letters* 35:1-59.
- Skavlem, H.L.
1912. Recollections of bird-life in pioneer days. *By the Wayside* 13:57-59.
- Skinner, R.M., T.S. Baskett, and M.D. Blenden.
1984. Bird habitat on Missouri prairies. Missouri Department of Conservation. Terrestrial Series 14.
- Stallman, H.R., and L.B. Best.
1996. Bird use of an experimental strip intercropping system in northeast Iowa. *Journal of Wildlife Management* 60:354-62.
- Temple, S.A.
1988. What's behind long-term declines in some breeding bird populations? *Passenger Pigeon* 50:133-38.
1992. Population viability analysis of a sharp-tailed grouse metapopulation in Wisconsin. Pp. 750-58 in D.R. McCullough and R.H. Barrett, eds. *Wildlife 2001: populations*. Elsevier Applied Science, London.
- Temple, S.A., and J.R. Cary.
1987. *Wisconsin birds: a seasonal and geographic guide*. University of Wisconsin Press, Madison.
- Temple, S.A., B.M. Fevold, L.K. Paine, D.J. Undersander, and D.W. Sample.
n.d. Nesting birds and grazing cattle: accommodating both on midwestern pastures. In P.D. Vickery and J.R. Herkert, eds. *Grassland birds of the western hemisphere. Studies in Avian Biology*. Cooper Ornithological Society. [in press]
- Thompson, F.R., S.J. Lewis, J. Green, and D. Ewert.
1993. Status of neotropical migrant landbirds in the midwest: identifying species of management concern. Pp. 145-58 in D.M. Finch and P.W. Stangel, eds. *Status and management of neotropical migratory birds*. U.S. Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. General Technical Report RM-229.
- Thompson, K.L.
1992. Restoration of Bell's vireo (*Vireo bellii*) nesting habitat on the Trempealeau National Wildlife Refuge, Trempealeau, Wisconsin. Unpublished U.S. Fish and Wildlife Service report on file at Wisconsin Department of Natural Resources, Monona, WI.
- Undersander, D.J., B. Albert, P. Porter, and A. Crossley.
1991. Wisconsin pastures for profit: a hands on guide to rotational grazing. University of Wisconsin. Cooperative Extension Publication A3529.
- U.S. Department of Commerce.
1994. 1992 Census of Agriculture. Volume 1, Part 49. Wisconsin state and county data. U.S. Government Printing Office, Washington, D.C.
- U.S. Department of the Interior.
1995. Breeding Bird Survey trends. Unpublished data on file at the Wisconsin Department of Natural Resources, Monona, WI.
- Van Horne, B.
1983. Density as a misleading indicator of habitat quality. *Journal of Wildlife Management* 47:893-901.
- Vickery, P.D., M.L. Hunter, and S.M. Melvin.
1994. Effects of habitat-area on the distribution of grassland birds in Maine. *Conservation Biology* 8:1087-97.
- Volkert, W.K.
1992. Response of grassland birds to a large-scale prairie planting project. *Passenger Pigeon* 54:191-96.
- Warburton, D.B., and W.D. Klimstra.
1984. Wildlife use of no-till and conventionally tilled corn fields. *Journal of Soil and Water Conservation* 39:327-30.
- Warner, R.E., and S.L. Etter.
1989. Hay-cutting and the survival of pheasants: a long term perspective. *Journal of Wildlife Management* 53:455-61.
- Wiens, J.A.
1969. An approach to the study of ecological relationships among grassland birds. American Ornithologist's Union. Ornithological Monograph 8. Allen Press, Inc., Lawrence, Kansas.
- Zimmerman, J.H.
1991. The landscape and the birds. Pp. 35-90 in S.D. Robbins, Jr. *Wisconsin Birdlife*. University of Wisconsin Press, Madison.

SUGGESTED READING

A selection of basic references on grassland birds in Wisconsin and the Midwest. This offering is by no means comprehensive.

Best, L.B., K.E. Freemark, J.J. Dinsmore, and M. Camp.

1995. A review and synthesis of bird habitat use in agricultural landscapes of Iowa.
American Midland Naturalist 134:1-29.

Graber, R.R. and J.W. Graber.

1963. A comparative study of bird populations in Illinois, 1906-1909 and 1956-1958.
Illinois Natural History Survey Bulletin 28:378-528.

Henderson, R.A. and D.W. Sample.

1995. Grassland communities.
Pp. 116-129 in J. Addis, R. Eckstein, A. Forbes, D. Gebken, R. Henderson, J. Kotar, B. Les, P. Matthiae, W. McCown, S. Miller, B. Moss, D. Sample, M. Staggs, and K. Visser.
Wisconsin's biodiversity as a management issue: a report to Department of Natural Resources managers. Wisconsin Department of Natural Resources, Madison, WI.

Herkert, J.R., R.E. Szafoni, V.M. Kleen, and J.E. Schwegman.

1993. Habitat establishment, enhancement, and management for forest and grassland birds in Illinois.
Illinois Department of Conservation. Natural Heritage Technical Publication 1.

Herkert, J.R., D.W. Sample, and R.E. Warner.

1996. Management of midwestern grassland landscapes for the conservation of migratory birds.
Pp. 89-116 in F.R. Thompson III, ed. *Managing midwestern landscapes for the conservation of neotropical migratory birds*. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul. General Technical Report GTR-NC-187.

Hoffman, R.M., and D.W. Sample.

1988. Birds of wet-mesic and wet prairies in Wisconsin.
Passenger Pigeon 50:143-152.

Johnson, R.G. and S.A. Temple.

1986. Assessing habitat quality for birds nesting in fragmented tallgrass prairies.
Pp. 245-249 in J. Verner, M.L. Morrison, and C.J. Ralph, eds. *Wildlife 2000: modeling habitat relationships of terrestrial vertebrates*. University of Wisconsin Press, Madison.

Johnson, R.G. and S.A. Temple.

1990. Nest predation and brood parasitism of tallgrass prairie birds.
Journal of Wildlife Management 54:106-111.

Kahl, R.B., T.S. Baskett, J.A. Ellis, and J.N. Burroughs.

1985. Characteristics of summer habitats of selected nongame birds in Missouri.
University of Missouri-Columbia, College of Agriculture, Agricultural Experiment Station. Research Bulletin 1056.

Koford, R.R., and L.B. Best.

1996. Management of agricultural landscapes for the conservation of neotropical migratory birds.
Pp. 68-88 in F.R. Thompson, III, ed. *Managing midwestern landscapes for the conservation of neotropical migratory birds*. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul. General Technical Report GTR-NC-187.

Mossman, M.J. and D.W. Sample.

1990. **Birds of Wisconsin sedge meadows.**
Passenger Pigeon 52:39-55.

Mossman, M.J., E. Epstein, and R.M. Hoffman.

1991. **Birds of Wisconsin pine and oak barrens.**
Passenger Pigeon 53:137-163.

Rodenhouse, N.L., L.B. Best, R.J. O'Connor, and E.K. Bollinger.

1995. **Effects of agricultural practices and farmland structures.**
Pp. 269-293 in T.E. Martin and D.M. Finch, eds. *Ecology and management of neotropical migratory birds*. Oxford University Press, New York.

Ryan, M.R.

1986. **Nongame management in grassland and agricultural ecosystems.** Pp. 117-136 in J.B. Hale, L.B. Best, R.L. Clawson eds. *Management of nongame wildlife in the Midwest: a developing art*. North Central Section, The Wildlife Society.

Sample, D.W.

1989. **Grassland birds in southern Wisconsin: habitat preference, population trends, and response to land use changes.**
University of Wisconsin, Madison. M.S. Thesis.

Sample, D.W., and R.M. Hoffman.

1989. **Birds of dry-mesic and dry prairies in Wisconsin.**
Passenger Pigeon 51:195-208.

Sample, D.W., and M.J. Mossman.

1994. **Birds of Wisconsin oak savannas: past, present, and future.**
Pp. 155-159 in J.S. Fralish, R.C. Anderson, J.E. Ebinger, and R. Szafoni, eds. *Proceedings of the North American Conference on Barrens and Savannas*. U.S. Environmental Protection Agency, Great Lakes National Program Office.

Skinner, R.M., T.S. Baskett, and M.D. Blenden.

1984. **Bird habitat on Missouri prairies.**
Missouri Department of Conservation. Terrestrial Series 14.

Swanson, D.A.

1996. **Nesting ecology and nesting habitat requirements of Ohio's grassland-nesting birds: a literature review.**
Ohio Department of Natural Resources Division of Wildlife. Ohio Fish and Wildlife Report 13.

Wiens, J.A.

1969. **An approach to the study of ecological relationships among grassland birds.**
Ornithological Monograph No. 8. American Ornithologist's Union. Allen Press, Inc. Lawrence, Kansas.

NOTES

NOTES

Conversion table.

METRIC	U.S. CUSTOMARY
1 hectare	= 2.477 acres
1 square kilometer	= .386 square miles
1 meter	= 1.09 yards (3.279 feet)
1 centimeter	= .39 inches

ACKNOWLEDGMENTS

We owe our sincere thanks to many people and organizations who helped with the Wisconsin grassland bird study and with this publication. First, Lisa Dlutkowski assisted significantly with many aspects of the Wisconsin grassland bird study in both field and office; not the least of her contributions were her tireless hours over 5 seasons in the field counting small brown birds and sampling vegetation.

Hearty thanks also go to Paul Rasmussen, who provided critical and valuable biometrical assistance throughout the course of the grassland bird study. Ron Gatti provided statistical help early in the project and also helped significantly with Geographic Information Systems (GIS) analysis. Robert Rolley gave substantial help with both data analysis and GIS analysis.

Wendy McCown contributed many hours of stellar help and critical guidance with organizing, re-shaping, editing, and overseeing the production of this publication through most of its long history, especially in the crucial final stages. Michelle Jesko's hard work, cooperation, dedication, and talent have been responsible for the final layout and production of the guidebook. Amber Roth also provided substantial help with the final production of the manuscript, including the initial preparation of tables, site keys, appendixes, and other parts. Patricia Allen Duyfhuizen provided considerable and helpful editorial assistance. We appreciate the help of Julee Barnett, Kim Hartwig, Ron Gatti, and Amber Roth, who teamed together with Michelle Jesko to produce the maps in the guidebook. Betty Les assisted with some of the early planning phases for this document.

We thank Sumner Matteson, who, along with Mossman, originally developed the idea for a study of grassland birds in Wisconsin. Randy Hoffman, Eric Epstein, Rich Henderson, Mark Martin, Bill Smith, and Alan Crossley provided valuable advice and shared their knowledge throughout the course of the study. John Emlen provided great inspiration and a historical perspective on grassland birds in Wisconsin. Ursula Petersen, Ken Pruske, and Lisa Hartman assisted with field work.

Thanks go out to many DNR wildlife managers, and especially to Jim Keir, who graciously helped with our field work at Buena Vista Grasslands. Without their assistance much of our field work and other tasks would have been made much more difficult. We are especially indebted to the many private landowners who gave us permission to study grassland birds on their land.

Staff at the USDA Natural Resources Conservation Service—Tom Thrall in particular—and the USDA Farm Service Agency gave us valuable assistance with the grassland bird study, as well as permission to work with private land enrolled in the CRP and ACR programs. Thanks also to staff at the Wisconsin office of The Nature Conservancy, for permission to survey birds on a number of their properties. Others whose help we appreciate include Edward Beals, Brian Dhuey, Jennifer Graetz, Gwen Jongejan, Randy Ristow, Jean Adams, Randy Jurewicz, Jim Herkert, David Flaspohler, Susan Klugman, Julie Bleser, and Suzanne duVair.

Alan Crossley, Gerald Bartelt, and Sumner Matteson provided helpful comments on this manuscript.

The senior author would like to extend his sincere appreciation to his parents, Mary and George, for encouraging a love and appreciation of the natural world and of birds in particular. Heartfelt thanks also to his wife Joan for her support and for enduring what has been a long row to hoe.

We are grateful to the U.S. Department of the Interior's Biological Resources Division for providing BBS data and trend analyses and to the Cornell Laboratory of Ornithology for providing data from their Nest Record Card Program.

This study was supported in part by funds from the Federal Aid to Wildlife Restoration Act under Pittman-Robertson Project W-160-P. It was also supported by a grant from the USFWS, Nongame Bird Conservation Program, Region 3.

Production Credits

Wendy McCown, Managing Editor
Patricia Duyfhuizen and Wendy McCown, Technical Editors
Michelle Jesko, Design and Production
Julee Barnett, Cartography
Cary Hunkel, Bird Illustrations
Jim McEvoy, Bird and Plant Illustrations

Cover Credits

Michael Mossman, Photography
Cary Hunkel and Jim McEvoy, Bird Illustrations

ABOUT THE AUTHORS

David W. Sample is a grassland community ecologist for the Wisconsin DNR Bureau of Integrated Science Services, a position he has held since 1992. He has been studying grassland bird communities in Wisconsin with the DNR since 1985. His other current research activities include pursuing the integration of grassland bird and other wildlife needs into agricultural ecosystems and habitat management for wildlife on private lands.

phone: 608-221-6351 e-mail: sampld@dnr.state.wi.us

Michael J. Mossman is a forest community ecologist for the Wisconsin DNR Bureau of Integrated Science Services and has been a wildlife biologist with the bureau since 1987. He previously worked for the Bureau of Endangered resources as a nongame biologist. He has worked on birds in a variety of habitats in the state, including grasslands. His recent research projects have focused on Trumpeter Swan reintroduction, bird communities in old growth forests, and frog and toad monitoring.

phone: 608-221-6346 e-mail: mossmm@dnr.state.wi.us

Both authors are currently stationed at the DNR Research Center, 1350 Femrite Drive, Monona, Wisconsin 53716.





Printed on recycled paper.

Department of Natural Resources
Bureau of Integrated Science Services
P.O. Box 7921, Madison, WI 53707

PUBL-SS-925-97