Tomorrow's Habitat for the Wild & Rare

An Action Plan for Minnesota Wildlife

Minnesota's Comprehensive Wildlife Conservation Strategy

Minnesota Department of Natural Resources

Tomorrow's Habitat for the Wild and Rare

An Action Plan for Minnesota Wildlife

Minnesota Comprehensive Wildlife Conservation Strategy

Funding Support

Development of *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* was supported by the State Wildlife Grants Program, with help from the U.S. Fish and Wildlife Service Office of Federal Assistance.

DNR Project Manager

Emmett Mullin, Office of Management and Budget Services

DNR Project Staff

Daren Carlson, Ecologist/GIS Analyst
Rachel Hopper, Research Analyst
Brian Stenquist, Project Facilitator

Project Director

Lee Pfannmuller, DNR Ecological Services

Project Editors

Mary Keirstead and Mary Byers

For more information, contact:

Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4040
(651) 296-6157 (Metro Area)1-888-MINNDNR (646-6367) (MN Toll Free)
www.dnr.state.mn.us/cwcs

How to cite this document:

Minnesota Department of Natural Resources, 2006. *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife*, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

Equal opportunity to participate in and benefit from programs of the Minnesota Department of Natural Resources is available to all individuals regardless of race, color, creed, religion, national origin, sex, marital status, public assistance status, age, sexual orientation, disability or activity on behalf of a local human rights commission. Discrimination inquiries should be sent to MN DNR, 500 Lafayette Road, St. Paul, MN 55155-4049; or the Equal Opportunity Office, Department of the Interior, Washington, D.C. 20240.

This document is available in alternative formats to individuals with disabilities by calling (651) 296-6157 (Metro Area) or 1-888-MINNDNR (MN Toll Free) or Telecommunication Device for the Deaf/TTY: (651) 296-5484 (Metro Area) or 1-800-657-3929 (Toll Free TTY).

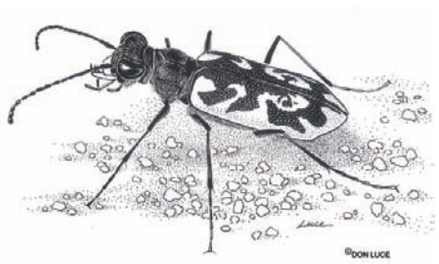
Printed on recycled paper containing a minimum of 10% post-consumer waste and soy-based ink.

©2007, State of Minnesota, Department of Natural Resources, Second Printing

Tomorrow's Habitat for the Wild and Rare

An Action Plan for Minnesota Wildlife

January 2006



Sandy stream tiger beetle (*Cicindela macra macra)*

Minnesota's Comprehensive Wildlife Conservation Strategy

The State Wildlife Grants Program, with the help of USFWS Federal Assistance, supported the development of this Minnesota CWCS.

Acknowledgments

Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife is the result of the hard work of many wildlife and natural resource professionals. The CWCS Project Management Team* would like to acknowledge and offer sincere thanks for their dedication to rare wildlife management and to the creation of this Strategy.

We have listed below many of the people who helped, both formally and informally, with development and review of the 2005 CWCS. Thank you.

Cheryl Adams, Mike Albers, David Andersen, Charles Anderson, Rich Baker, Faith Balch, Pete Bauman, Rocky Beach, Steve Benson, Bill Berg, Lyn Berquist, Robert Blair, Janet Boe, Ed Boggess, Peter Buesseler, Mark Burch, Sue Burks, Mary Byers, Beth Carlson, Bruce Carlson, Mike Carrol, John Casson, Dave Chadwick, Ian Chisolm, John Christian, Karen Cieminski, Mark Cleveland, Bobby Cochran, Phil Cochran, Carmen Converse, Meredith Cornett, Bernice Cramblit, Robert Dana, Mike Davis, Phil Delphey, Don Dindorf, Brian Dirks, Kathy DonCarlos, Kate Drewry, Melissa Driscoll, Gary Drotts, Mike Duval, Mark Ebbers, Naomi Edelson, Jaime Edwards, Lindberg Ekola, Linda Erickson-Eastwood, Bob Fashingbauer, Leonard Ferrington, Fitz Fitzgerald, Shannon Flynn, Joan Galli, Jason Garms, Larry Gates, Lisa Gelvin-Innvaer, Lawson Gerdes, Larry Gillette, Diane Granfors, Jan Green, Tom Groshens, Carol Hall, Maya Hamady, JoAnn Hanowski, Kurt Haroldson, Fred Harris, Jay Hatch, Tex Hawkins, Barbara Hayford, Dan Helwig, Tim Hess, Steve Hirsch, Jeff Hines, Jeanne Holler, Dave Holmbeck, Ralph Holzenthal, Gabe Horner, Rick Horton, John Hunt, Gary Huschle, Jay Huseby, Roy Johannes, Rex Johnson, Terry Johnson, Alan Jones, Mary Keirstead, Tim Kelly, Ann Kessen, Tom Klein, Melinda Knutson, Aaron Kuehl, Kris LaMontagne, Tom Landwehr, Jeff Lerner, Beau Liddell, Jim Lind, John Loegering, Jim Manolis, Mark Martell, John Mathweg, George-Ann Maxson, Doug McCarthur, Michelle McDowell, Steve Merchant, Dave Miller, Jean Miller, Jim Miller, Yvette Monstad, Gary Montz, Brad Moore, John Moriarty, Steve Mortensen, Jill Mrotek, Ann Mulholland, Lori Naumann, Jon Nelson, Harvey K. Nelson, Larry Nelson, Scott Nemela, Gerda Nordquist, Ray Norrgard, Doug Norris, Mike North, Dave Olfelt, Tim O'Hara, Mark Oja, Larry Olson, Dan O'Shea, Cynthia Osmundson, Ron Payer, Bill Penning, Vic Peppe, Jeff Perry, Pam Perry, Larry Peterson, Ann Pierce, Walter Popp, Laura Preus, Nick Proulx, Genevieve Pullis, Ed Quinn, Kelly Randall, Doug Rau, Roleen Roden, Russel Reisz, Marco Restani, Sean Robertson, Erika Rowe, Bob Russel, Kurt Rusterholz, Dave Schad, John Schladweiler, Konrad Schmidt, Susan Schmidt, Jon Schneider, Mike Schrage, Luke Skinner, Ted Sledge, Adele Smith, Jeff Sorensen, Dave Spiering, Steve Stucker, Mike Sweet, Jade Templin, Hannah Texler, Dave Thompson, Bill Thorn, Harvey Tjader, Bob Tomlinson, Ray Valley, Sara Vickerman, Terry Weber, Keith Wendt, Jim Weseloh, Tom Will, Al Williamson, Steve Wilson, Brian Winter, Tim Whitfeld, Jan Shaw Wolff, Dan Wovcha, Terri Yearwood, Dave Zentner, Mike Zicus.

***CWCS Project Management Team**

Daren Carlson, CWCS Ecologist/GIS Analyst, DNR Ecological Services
Bonita Eliason, Natural Heritage & Nongame Research Supv., DNR Ecological Services
Katie Haws, Nongame Wildlife Regional Specialist, DNR Ecological Services
Carrol Henderson, Nongame Wildlife Supervisor, DNR Ecological Services
Rachel Hopper, Research Analyst, DNR Ecological Services
Emmett Mullin, CWCS Project Mgr, DNR Office of Management and Budget Services
Jane Norris, Assistant Federal Aid Coordinator, DNR Fish and Wildlife
Lee Pfannmuller, Director, DNR Ecological Services
Brian Stenquist, Planner, DNR Ecological Services

Dedication

This Strategy is dedicated to all rare animals: the large and the small, the swift and the slow, the hard-shelled and the soft-skinned, the swimmers, the fliers, the crawlers.

It is also dedicated to the women and men who struggle as "intelligent tinkers" to keep all the parts of our native ecosystems and to visionaries like Rachel Carson and Aldo Leopold who offer us light.

> …To learn the hydrology of the biotic stream we must think at right angles to evolution and examine the collective behavior of biotic materials. This calls for a reversal of specialization; instead of learning more and more about less and less, we must learn more and more about the whole biotic landscape.
>
> Ecology is a science that attempts this feat of thinking…. Ecology is destined to become the lore of Round River, a belated attempt to convert our collective knowledge of biotic materials into a collective wisdom of biotic navigation. This, in the last analysis, is conservation.
>
> Conservation is a state of harmony between men and land. By land is meant all of the things on, over, or in the earth. Harmony with land is like harmony with a friend … The land is one organism. Its parts, like our own parts, compete with each other and co-operate with each other. …
>
> The outstanding scientific discovery of the twentieth century is not television, or radio, but rather the complexity of the land organism. … The last word in ignorance is the man who says of an animal or plant: 'What good is it?' … who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.
>
> Aldo Leopold
> from his essay entitled
> "The Round River"

Foreword

Tomorrow's Habitat for the Wild and Rare

An Action Plan for Minnesota Wildlife

Our encounters with wildlife are as diverse as the neighborhoods and towns in which we live. We may listen in wonder to the mysterious yodel of common loons from a cabin in the north woods or delight in watching a tiger swallowtail as it visits our garden searching for nectar on a steamy August afternoon. Perhaps it's the blue racer we spot moving quietly across a limestone outcrop along the Mississippi River or the bubbly chatter of black-capped chickadees that visit our bird feeder after a January snowstorm. Regardless of where we live, we are surrounded by a rich variety of wildlife species native to Minnesota. These species not only contribute to our enjoyment of the outdoors, they also play a significant role in maintaining the health and long-term sustainability of Minnesota's lakes, rivers, wetlands, forests, and grasslands.

Ensuring that these species remain a prominent component of our natural world for generations to come is an increasingly complex challenge. The songbirds that inhabit our northern forest each summer spend only a portion of the year in our woodlands. A tiny Nashville warbler may travel more than 2,000 miles from its winter home in Central Mexico to its summer breeding grounds in north-central Minnesota. That journey is fraught with perils, from sudden weather changes, to disappearing habitats that formerly provided a respite for the weary traveler, to a dense array of communication towers that under poor weather conditions can make migration extremely hazardous. Or maybe it's the increased traffic along a county highway that threatens a female Blanding's turtle as she lumbers from her summer pond to a sand dune on the other side of the road to deposit her eggs.

As our population continues to grow, our responsibility to conserve habitat for these species becomes more important and more challenging. By the year 2030, Minnesota is projected to support 6,268,000 residents, 1.35 million more than in the year 2000. The increased growth will be coupled with heightened demand for goods and services, from transportation to housing, all placing added pressures on our natural resources.

Our challenge as wildlife biologists, conservationists, educators, land managers, outdoor enthusiasts, and government leaders is to ensure that we plan wisely for that growth. The task will not be easy and will require a renewed vigilance on the part of all who care deeply about these resources. Leadership coupled with a clear vision, specific targets, and hard work will be essential.

Minnesota's Comprehensive Wildlife Conservation Strategy is one tool to guide this challenging task. It provides a strategic framework to direct and inform habitat conservation efforts throughout the state. Although the conservation actions detailed in the following pages will benefit a broad array of Minnesota's native plants and animals, the plan places a particular emphasis on wildlife species that are in greatest conservation need. Some of these species have been in the public eye for many years, including the gray wolf, trumpeter swan, and peregrine falcon. Others are well known by Minnesota's hunting and angling community, such as the American woodcock, northern pintail, and lake sturgeon. But the overwhelming majority of

species are ones that the general public knows very little about, from freshwater mussels with comical names like Purple Wartyback and Elephant-ear, to tiger beetles, caddisflies, and an impressive variety of songbirds, frogs, turtles, shiners, and darters. Each species has a place, an important role in maintaining the health of Minnesota's outdoor environments.

Over 100 conservation partners have contributed to Minnesota's Comprehensive Wildlife Conservation Strategy. Their knowledge, experience, and commitment have helped shape this document into a plan that provides outstanding technical information and an excellent framework for guiding conservation work. Whatever the scale of their efforts, it is the goal of this plan to help all our conservation partners provide for the full array of Minnesota's diverse wildlife community.

Lee A. Pfannmuller
Ecological Services Director
Minnesota Department of Natural Resources
January 2006

Tomorrow's Habitat for the Wild and Rare

An Action Plan for Minnesota Wildlife
Comprehensive Wildlife Conservation Strategy (CWCS)

Contents

Page

Foreword iv

Contents vi

List of Abbreviations Used in This Document viii

Executive Summary ix
- How to Use the Plan

Chapter 1. An Introduction to Tomorrow's Habitat for the Wild and Rare 1
- The Purpose of Tomorrow's Habitat for the Wild and Rare
- Working Together to Sustain All of Minnesota's Wildlife

Chapter 2. Developing and Implementing Tomorrow's Habitat for the Wild and Rare ..7
- CWCS Project Structure
- Conservation Stakeholders' Involvement in CWCS Development
- Implementation of the CWCS
- Conservation Stakeholders' Involvement during CWCS Implementation
- CWCS Revision: 2013

Chapter 3. Minnesota's Species in Greatest Conservation Need 23
- Process for Identifying the Set of Species in Greatest Conservation Need
- Species in Greatest Conservation Need

Chapter 4. Framework: Goals, Challenges, and Priority Conservation Actions 35
- Goal I: Stabilize and Increase SGCN Populations
- Goal II: Improve Knowledge about SGCN
- Goal III: Enhance People's Appreciation and Enjoyment of SGCN
- Conclusion

Chapter 5. An Ecological Assessment of Species in Greatest Conservation Need in Minnesota 51
- Province Summaries and Assessments
- Subsection Profiles Overview
- Minnesota State Overview
- Minnesota's Four Provinces and 25 Subsection Profiles

Contents (Continued)

Page

Chapter 6. Habitat Descriptions 237

- Forest-Lowland Deciduous
- Forest-Lowland Coniferous
- Forest-Upland Coniferous
- Forest-Upland Deciduous (Aspen)
- Forest-Upland Deciduous (Hardwood)
- Forest-Upland Deciduous (Oak)
- Prairie
- Shoreline-dunes-cliff/talus
- Shrub - Lowland
- Shrub/Woodland-Upland
- Surrogate Grassland
- Wetland - Nonforested
- Lake-Deep
- Lake-Shallow
- River-Headwater to Large
- River-Very Large

Chapter 7. Methods and Analyses 283

- Species Problem Assessment
- Key Habitat Analysis

Appendixes

A. Species in Greatest Conservation Need Definition
B. Set of Species in Greatest Conservation Need
C. Links to Other Plans (not in printed document, but available for download at http://www.dnr.state.mn.us/cwcs/strategy.html)
D. MN GAP Level 4 Land Cover Class Descriptions
E. Species Occurrence by Subsection
F. Species in Greatest Conservation Need by ECS Province
G. Species in Greatest Conservation Need by ECS Subsection
H. Data Sources for Maps Used in the Subsection Profiles
I. Key River and Stream Reaches by Subsection
J. Wildlife Recreation and Tourism Considerations
K. References by Chapter

Abbreviations Used in This Document

Tomorrow's Habitat for the Wild and Rare

ABS	Areas of Biodiversity Significance
AES	Aquatic Ecological System
CITES	Convention on International Trade in Endangered Species
CWCS	Comprehensive Wildlife Conservation Strategy
DNR	Department of Natural Resources
ECS	Ecological Classification System
EDU	Ecological Drainage Unit
GBCA	Grassland Bird Conservation Area
HAPET	Habitat and Population Evaluation Team (U.S. Fish and Wildlife Service)
IBA	Important Bird Areas
IUCN	World Conservation Union
LIP	Landowner Incentives Program
MCBS	Minnesota County Biological Survey
MN GAP	Minnesota DNR GAP Analysis Project
MPCA	Minnesota Pollution Control Agency
NPC	Native Plant Communities
NRRI	National Resources Research Institute
NRV	See RNV
NWR	National Wildlife Refuge
PIF	Partners in Flight
RNV	Range of Natural Variation
SF	State Forest
SFRMP	Subsection Forest Resource Management Plan
SGCN	Species in Greatest Conservation Need
SNA	Scientific and Natural Area
SP	State Park
SWG	State Wildlife Grants Program
TNC	The Nature Conservancy
USFWS	U.S. Fish and Wildlife Service
WMA	Wildlife Management Area

Executive Summary

Tomorrow's Habitat for the Wild and Rare

An Action Plan for Minnesota Wildlife

*Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlif*e (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS) is a strategic plan focused on managing populations of "species in greatest conservation need." Species in greatest conservation need (SGCN) are defined as animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. There are 292 species in Minnesota that meet this definition.

The 2005 CWCS is the product of a partnership of conservation organizations working together to ensure that these species populations are sustained for future generations. A tenet of this effort recognizes that success hinges upon the engagement of a wide range of conservation stakeholders. The CWCS partnership encourages interested conservation stakeholders to use the information presented in the CWCS as a menu for action, to adopt and adapt to their unique interests and capabilities.

The CWCS identifies habitat loss and degradation as the primary problem facing SGCN in Minnesota. The CWCS recommends a simple and direct approach to this problem: conserve key habitats used by Minnesota's SGCN in order to conserve the majority of Minnesota's wildlife. The CWCS partnership arrived at this approach over the course of an intense 30-month planning effort in consultation with a broad variety of conservation stakeholders. It is based on a series of analyses that examined the needs of all 292 SGCN and identified key habitats that benefit them.

How to Use the Plan

Minnesota's CWCS is a strategic framework designed to guide natural resource managers, working together with Minnesotans throughout the state, in their efforts to ensure a sustainable future for all wildlife. Achieving this extremely important outcome presents complex challenges that cannot be met by simple conservation prescriptions.

To meet these challenges, the CWCS delineates three goals:

I. Stabilize and increase SGCN populations
II. Improve knowledge about SGCN
III. Enhance people's appreciation and enjoyment of SGCN

Under each goal, the CWCS presents management challenges, strategies, and priority conservation actions, to help focus individual and organizational effort.

What resource practitioners will find in the CWCS is a rich diversity of information on Minnesota's natural landscapes, key habitats, and wildlife resources. The plan's utility lies in its use as a conservation tool that can be applied at multiple scales: species, habitat, and ecological landscapes (Minnesota's Ecological Classification System's provinces and subsections; see Figure 5.1.) Resource managers are faced with challenges at all of these levels every day, from minimizing nesting failure of the state's only population of piping plovers on a small island, to ensuring that rock outcrops along miles of river bluff habitat provide essential microhabitat features for denning timber rattlesnakes, to managing a northern hardwoods forest complex, thousands of acres in size, that provides timber for the state's forest products industry and habitat for a multitude of forest-dependent species. There is no "one-size-fits-all" approach to any conservation problem, no matter how large or small.

The resource practitioners who helped develop the CWCS recognize that this plan will be most useful if it provides multiple entry points, ranging, for example, from a question about a particular SGCN to one about the significance of a particular habitat in one region of the state. The heart of the plan is the 25 Ecological Classification System (ECS) subsection profiles in chapter 5. In each subsection, these profiles identify SGCN presence and patterns of occurrence, key habitats, and priority conservation actions to help focus the work of the Department of Natural Resources and its conservation partners during the next 10 years. Each profile was developed to stand alone as reference information that natural resource managers in the CWCS partnership can use in their work with conservation organizations and agencies, industry, transportation planners, local government officials, and citizens. The ECS subsection landscapes are the cornerstone of Minnesota's approach to managing natural resources. They provide a logical gateway to assessing resource challenges that are facing SGCN and are at a fine enough scale to provide a rich abundance of resource information tailored to the species and key habitats present in a particular ecological subsection.

The subsection profiles identify the goals, challenges, strategies, and priority conservation actions necessary to successfully manage SGCN over the next ten years. The goals, challenges, and strategies are the same for each subsection. However, the priority conservation actions for goal one, stabilize and increase SGCN populations, are tailored to the key habitats that occur in each subsection. The conservation actions addressing the other two goals, to improve knowledge about SGCN and to enhance people's appreciation and enjoyment of SGCN, are broad in nature, but are intended to be applied in the key habitats.

These menus of priority conservation action provide direct guidance to the CWCS partnership about what work is most important to undertake in the diverse subsections. Members of the partnership can create projects that focus on managing, surveying, researching, monitoring, or promoting the subsection-specific key habitats and SGCN populations. They may seek support for their projects from the State Wildlife Grants Program, the Landowner Incentive Program, or other partnership funding available to support rare wildlife resource management in Minnesota.

The CWCS project management team strived to develop a statewide strategic plan that also includes a relevant level of detail and operational focus. Maintaining the delicate balance between these often competing goals has been a challenge. The call for a more prescriptive approach was balanced with the recognition that most management decisions are embedded in unique circumstances that often require local perspectives and local dialogue prior to implementation. Indeed, conservation actions by different partners may be framed quite differently depending on their overall mission and goals. For the purpose of the strategic framework, therefore, the CWCS project management team decided to keep the strategic guidance at a broad level. Although we have honed some of these recommendations to be more specific, the priority conservation actions remain a framework, not a prescription. As partners begin implementation of the priority conservation actions, they will be able to develop action plans for more specific on-the-ground work.

The Structure of Minnesota's CWCS

Seven chapters make up Minnesota's CWCS. Although the subsection profiles in chapter 5 are the heart of Minnesota's CWCS, users of the plan can find a range of additional information in the other chapters that will inform their conservation work.

Chapter 1, "An Introduction to Minnesota's Comprehensive Wildlife Conservation Strategy," presents the CWCS as Minnesota's response to a U.S. congressional mandate to address the concerns of wildlife species in greatest conservation need, and articulates the CWCS planning philosophy.

Chapter 2, "Developing and Implementing the Comprehensive Wildlife Conservation Strategy," describes how the strategy was developed, who participated, and how implementation will take place.

Chapter 3, "Minnesota's Species in Greatest Conservation Need," describes the process for determining SGCN from all taxonomic groups. This chapter also illuminates some of the species occurrence patterns that occur at the state, ECS province, and ECS subsection levels. Figure 3.2 provides a statewide perspective on the ecological distribution of SGCN, clearly demonstrating the relationship between the loss of key habitats in the southern and western regions of the state and the relatively large number of SGCN in those areas compared to northeastern Minnesota, where extensive forest landscapes remain intact and the number of SGCN is relatively small. Figure 3.3 provides a set of maps that depict the ecological distribution of species by taxonomic group. (Appendix B provides a complete list of all 292 SGCN and a brief rationale for their inclusion in the set. Appendix E provides a detailed list of the distribution of each SGCN by ecological subsection, and Appendix F provides SGCN by ECS province.) Because of the very large number of SGCN, the CWCS does not provide detailed information about each species' life history, distribution, and management recommendations. Other sources contain this type of information, such as the Minnesota DNR's Rare Species Guide, which is currently being developed.

Chapter 4, “Framework: Goals, Challenges, Priority Conservation Actions,” presents the CWCS planning logic for the strategic framework and describes how that logic links knowledge to action. It includes the SGCN problem assessment, Minnesota’s key habitats by ECS subsection, the three goals of the CWCS, and related priority conservation actions focused on the key habitats.

Chapter 5, “An Ecological Assessment of Species in Greatest Conservation Need in Minnesota,” is the largest and most important chapter in the CWCS. It presents an overview of the ecology of Minnesota at the state, province, and subsection levels. Each subsection profile includes a matrix of SGCN use for all habitats that occur in the subsection and a further assessment of which habitats are the most important to the greatest number of SGCN. Two maps in each subsection profile depict the distribution of SGCN occurrences and number of species by township, the key habitats, and public ownership.

Chapter 6, “Habitat Descriptions,” provides information about 14 broad habitat types in Minnesota, including information about habitat composition as well as important habitat features for SGCN conservation. This chapter crosswalks the 14 CWCS key habitats described in the subsection profiles to the native plant community classifications.

Chapter 7, “Methods and Analyses,” presents the technical assessments used to develop the CWCS. Both the SGCN problem assessment and the analyses used to identify key habitats are described.

Minnesota’s 2005 CWCS is the state’s first thorough technical assessment of wildlife conservation needs in Minnesota. Its special focus is on SGCN, those species that are rare, declining, and vulnerable for a variety of reasons. As such the CWCS complements both conservation work that has been under way since the 1970s on wildlife species that are not traditionally hunted or fished, and work that has been under way since the early 1900s on harvested species. All these conservation efforts have made tremendous strides for Minnesota’s wildlife. Nevertheless, significant work remains in our quest to ensure a sustainable future for all species. The CWCS identifies the challenges before us and provides a framework to direct the work that lies ahead.

Chapter 1

Introduction
Tomorrow's Habitat for the Wild and Rare
An Action Plan for Minnesota Wildlife

Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS) is a strategic plan to better manage populations of "species in greatest conservation need" in Minnesota. The essence of this strategy's approach is for the partnership of conservation organizations across Minnesota to work together to ensure that these species populations are sustained for future generations. Members of the partnership include the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, The Nature Conservancy, Audubon Minnesota, and the University of Minnesota, as well as many other agencies and conservation organizations (see chapter 2, Developing and Implementing the Comprehensive Wildlife Conservation Strategy, for a more complete list of partners). This plan outlines priority conservation actions that partners and interested individuals can use as a menu for action, to adopt and adapt to their unique interests and capacities. Development of Minnesota's Comprehensive Wildlife Conservation Strategy was supported by State Wildlife Grant Program funding (grant T-2-P-1).

Species in greatest conservation need (SGCN) are defined by this strategic plan as animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. There are 292 species in Minnesota's set of SGCN, including those species legally defined as endangered or threatened by the state and the federal government as well as many other species whose populations are in decline. This number represents roughly one-quarter of the almost 1,200 known native wildlife species that occur in Minnesota. This plan relied on available research and professional knowledge to identify these species (the criteria used to define the set of SGCN are described in chapter 3, Minnesota's Species in Greatest Conservation Need).

The Purpose of Tomorrow's Habitat for the Wild and Rare

State Wildlife Grants Program

In 2001, Congress created the State Wildlife Grants Program (SWG) to protect, manage, and address the unmet needs of wildlife species in greatest conservation need. This program provides funding to the states to proactively address species endangerment and habitat conservation. It continues the long history of cooperation between the federal government and the states for managing and conserving wildlife species, going back to landmark laws like the 1937 Pittman-Robertson Wildlife Restoration Act and the 1950 Dingell-Johnson Sportfish Restoration Act. Funding is allocated to states based on a

formula that considers population and land area. Since 2001, the program has allocated more than $7 million to Minnesota.

Table 1.1. Funding of the State Wildlife Grants Program, 2001–2006

	2001	2002	2003	2004	2005	2006	Totals
Federal SWG	$50 million	$80 million	$60 million	$64 million	$69 million	$68.5 million	$391.5 million
MN SWG	$971,000	$1.6 million	$1.1 million	$1.2 million	$1.2 million	$1.2 million	$7.3 million

Almost $5 million in SWG funds has been used for a variety of projects in Minnesota during the first four years of the program:

- Approximately $900,000 was used to fund grants for surveys, research, habitat enhancement, and educational projects by DNR programs that resulted from an internal Request for Proposals in 2001 (educational projects were eligible for funding only the first year federal dollars were available).
- Over $500,000 has been set aside to develop the CWCS.
- Approximately $485,000 is being used to acquire habitat for SGCN.
- Over $700,000 was used to fund CWCS partnership grants for surveys, research, and habitat enhancement projects that benefit SGCN.
- Approximately $500,000 has been used to accelerate completion of the Minnesota County Biological Survey, a systematic, county-by-county survey of the state's rare features.
- $400,000 has been used to improve and update the information system that catalogs Minnesota's SGCN.
- Approximately $400,000 has been used to expand the technical assistance and survey work that DNR staff provide to guide the management of SGCN and to fund the Important Bird Areas initiative.
- More than $500,000 is being used to complete a statewide mussel survey and initiate a long-term mussel monitoring program.

The SWG Program works in concert with other wildlife and habitat conservation efforts, most notably the DNR Nongame Wildlife Program, supported by the tax check-off revenues; the DNR Natural Heritage and Nongame Wildlife Research Program, supported by a variety of funding sources; and the traditional fish and wildlife programs supported by Minnesota's hunting and fishing communities. Minnesota's species in greatest conservation need clearly have benefited considerably from these programs, and the SWG Program is not intended to supplant these important efforts. On the contrary, the program was established to broaden the conservation community's capacity to provide for the full assemblage of Minnesota's wildlife.

The Comprehensive Wildlife Conservation Strategy Requirement

The U.S. Congress mandated that to participate in the SWG Program, states and territories, in partnership with other conservation agencies and organizations, must develop a Comprehensive Wildlife Conservation Strategy (CWCS) to identify and

manage their species in greatest conservation need. The Minnesota CWCS project is our state's response to this congressional mandate.

The Eight Elements

Specifically, each state's Comprehensive Wildlife Conservation Strategy must address the following eight elements:

1. Provide information on the distribution and abundance of species of wildlife, including low and declining populations as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife.
2. Describe locations and conditions of key habitats and community types essential to the conservation of species identified in element 1.
3. Describe problems that may adversely affect species identified in element 1 or their habitats, and priority research and survey efforts needed to identify factors that may assist in restoration and improved conservation of these species and habitats.
4. Describe conservation actions proposed to conserve the identified species and habitats and assign priorities for implementing such actions.
5. Describe plans to monitor species identified in element 1 and their habitats, monitor the effectiveness of the conservation actions proposed in element 4, and adapt these conservation actions to respond appropriately to new information or changing conditions.
6. Describe procedures to review the CWCS at intervals not to exceed 10 years.
7. Coordinate the development, implementation, review, and revision of the CWCS with federal, state, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats.
8. Describe public participation in the development, revision, and implementation of the CWCS.

Working Together to Sustain All of Minnesota's Wildlife

A Historic Opportunity

In 2001, when the U.S. Congress created the State Wildlife Grants Program and required all states to complete a CWCS, it provided a historic opportunity to consider the condition of all native wildlife, including birds, mammals, fish, amphibians, reptiles, mussels, spiders, and insects. In response to this opportunity, the Minnesota CWCS effort created a project structure that engaged well over 100 conservationists across the state. Individuals with a broad range of technical expertise—including knowledge of individual native species, habitats and conservation planning—comprehensively reviewed the best available information to create a set of species in greatest conservation need and a conservation approach that seeks to ensure the survival of all Minnesota's wildlife for future generations to experience and enjoy.

CWCS Philosophy and Approach

The conservation philosophy for the CWCS project is intentionally simple and direct: Work together with conservation organizations, businesses and industries, and Minnesota residents to sustain all wildlife for future generations. A great number of important conservation efforts are already being implemented throughout Minnesota, and each one plays an important role in the broader conservation picture. When individual organizations lay out their conservation priorities, it is important for the conservation community to step back and consider how these goals and missions work together to forge a common vision for the future.

Minnesota is an ecologically diverse state with almost 1,200 known native wildlife species. Approximately one-quarter (292) of the known species have been identified as Minnesota's species in greatest conservation need by the CWCS project because (1) they are rare, (2) their populations are declining, or (3) they face serious threats of decline. These species are rare owing to many interconnected factors, including habitat loss, habitat deterioration and fragmentation, disease, pollution, exploitation, and predation. After careful review of these factors in relation to the SGCN, the Minnesota CWCS project asserts that habitat loss and deterioration are the primary causes of these species' rarity (see chapter 4, Framework: Goals, Challenges, and Priority Conservation Actions, for more detail on Species Problem Analysis.)

Recognizing habitat loss and degradation as the primary problems, the CWCS identifies specific key habitats to be enhanced in each of Minnesota's 25 ecological subsections. The key habitats are those that are most important to Minnesota's SGCN. They were identified through a number of analyses that looked closely at the needs of the 292 SGCN. Specifically, they have been identified by delineating those habitats that:

- are used by the greatest number of SGCN;
- experienced the most alteration over the past 100 years;
- contain high percentages of SGCN that are habitat specialists; or
- are designated by The Nature Conservancy as important stream segments.

Because Minnesota's CWCS must coexist with the current land uses in the state—working alongside agricultural and forestry interests, mining, and urban development—the CWCS does not call for the maintenance or restoration of habitats everywhere. The CWCS habitat goal is to encourage targeted conservation work that benefits species in greatest conservation need. The menu of strategies is diverse and can be applied at multiple scales depending on the conservation issues and challenges at hand. Actions may include providing technical assistance and financial incentives to private landowners, habitat management and/or restoration, research to address a particular management challenge, or habitat protection options.

Minnesota's CWCS paints this broad vision of a better future for wildlife and provides a simple but challenging pathway to success: Conserve key habitats used by

Minnesota's species in greatest conservation need in order to conserve the majority of Minnesota's wildlife and, for the species that fall through this coarse filter, identify individual species-level actions necessary for their conservation. While the coarse-filter/fine-filter approach is not new, the CWCS partnership believes that it offers the best way to conserve all of Minnesota's wildlife. In addition, the new concept of mesofilter conservation is an approach likely to be further developed through CWCS as more information becomes available (Hunter 2005; see below for a further description of mesofilter conservation).

The CWCS's coarse-filter/fine-filter conservation approach offers a simple yet compelling way to address the complex and challenging task of conserving Minnesota's 292 species in greatest conservation need. Another benefit to this approach is that gathering information about the status and distribution of plant communities is easier than gathering detailed information about the multitude of animal species supported by the plant communities. Furthermore, the CWCS provides a framework to apply the coarse-filter habitat approach that can be scaled up or down depending on the problem. This ability to work at multiple conservation levels is critical to ensuring that the full range of wildlife is conserved. Finally, by focusing on key habitats and habitat complexes, the coarse-filter approach can apply important system-level ecological concepts such as structure, function, and process, which are important for ensuring the survival of animal populations (some of these concepts are explained in greater detail in chapter 6, Habitat Descriptions).

Some species will not benefit from a strictly coarse-filter habitat conservation approach. One such group of species is mussels, for example. According to the American Fisheries Society and The Nature Conservancy, mussels are one of North America's most imperiled groups of animals. The decline of many mussel species is due in part to habitat degradation, but also to other challenges such as low population levels still recovering from intensive collection in the past and the current spread of the invasive zebra mussel. Further, the populations of several mussel species are at such vulnerable levels that immediate action is required to ensure their survival. For example, the Minnesota DNR and other organizations are currently removing larval Higgins eye mussels, a state and federally endangered mussel, from the zebra mussel–infested lower reaches of the Mississippi River and relocating them upstream, where zebra mussels are still uncommon. This is a stopgap measure to ensure the survival of this species until habitat is improved and zebra mussels pose less of a threat.

Another fine-filter example is timber rattlesnake conservation. Killed for a bounty in Minnesota until 1989, this species continues to be persecuted through organized raids on its winter dens and by individuals who perceive it to be a threat. In addition to managing the timber rattlesnake's uncommon bluffland habitat, important actions to conserve the species include educating citizens about its value and the fact that it rarely harms people, and enforcing the law against illegal killing of this protected species.

Another important tenet of the CWCS's approach is to conserve quality habitat before restoring habitat that has been lost or degraded. The cost of restoration is many

times greater than proactive conservation. Once high-quality habitat has been conserved, it is important to buffer, connect, and restore adjacent areas. Most key habitats identified in the subsections exist in relationship to other important habitats. Understanding the relationships among these habitats will allow them to be managed within their broader ecological context.

The intent of the coarse-filter/fine-filter approach is to protect the full complement of natural ecosystems and their constituent processes, structures, and species within a network of ecological reserves (Hunter 2005). However, managing landscapes for the benefit of species in greatest conservation need can and must extend into semi-natural areas managed primarily for other reasons. These "working landscapes" cover roughly 90 percent of the earth's surface and, in most places, surround and impact natural reserves (Hunter 2005).

Mesofilter conservation is a new term for the concept of managing seminatural, cultivated, and urban ecosystems and is based on the idea that most ecosystems "contain certain features that are critical to the welfare of many species" (Hunter 2005). While there is much yet to be learned, many opportunities exist to manage for elements within a working landscape that will benefit species in greatest conservation need, as well as more common species and human communities.

Working landscapes often coincide with the places where people live. Identification of key habitats or habitat elements in these landscapes provides opportunities to educate people about SGCN and their habitats. Although these areas may not be ecologically "pristine," they offer opportunities for people to observe wildlife close to home and participate in habitat restoration efforts. These experiences can be the foundation for motivating residents to get involved in conservation actions.

Chapter 2

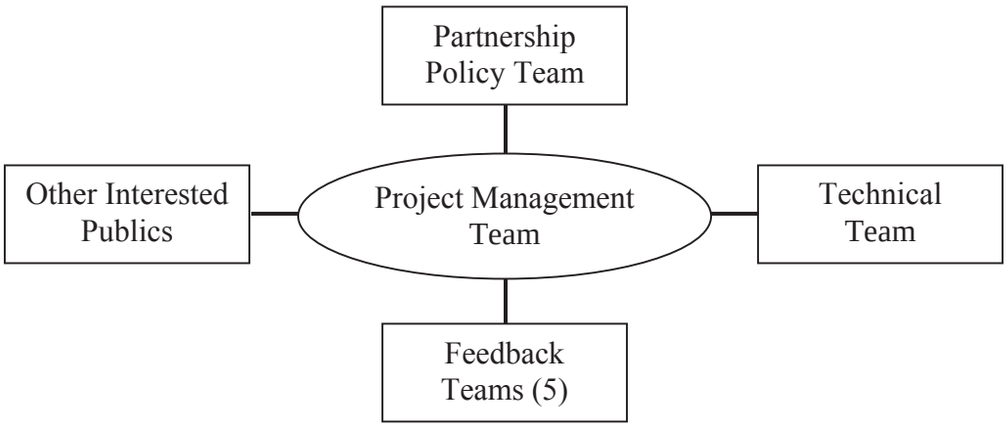
Developing and Implementing Tomorrow's Habitat for the Wild and Rare

Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS) has been a significant undertaking by Minnesota's conservation community. Led by the Minnesota Department of Natural Resources (DNR), project scoping was begun by the DNR Division of Ecological Services in early 2003. Soon afterward, a project manager was hired, and in April 2003, the project manager and the director of the Division of Ecological Services attended an introductory meeting held in Madison, Wisconsin, hosted by the International Association of Fish and Wildlife Agencies and the U.S. Fish and Wildlife Service. The purpose of this meeting was to help states become familiar with the CWCS effort and the eight required elements.

In late summer 2003, a CWCS Project Management Team made up of DNR employees was established and began meeting weekly. The team's goal was to support the development of the CWCS and ensure the involvement of federal, state, and local agencies, Indian tribes, nongovernmental organizations, and many others. They created the project structure, shown in Figure 2.1, to infuse Minnesota's CWCS with the technical expertise and conservation commitment necessary for a successful planning process.

CWCS Project Structure

Figure 2.1. CWCS Project Structure—Minnesota's Conservation Stakeholders



If one ingredient could be identified as the most important to creating a successful CWCS project, it would be the establishment of a broad conservation partnership committed to healthier populations of species in greatest conservation need. Such a partnership has

been created for Minnesota's CWCS project, engaging the people who have a significant stake in the CWCS from its onset. Early on in the project's development, DNR leaders recognized the need to reach beyond the DNR to successfully address concerns about Minnesota's species in greatest conservation need. They created an integrated CWCS project structure that enlisted the support of several DNR divisions, the U.S. Fish and Wildlife Service, The Nature Conservancy, Audubon Minnesota, the U.S. Geological Survey, the University of Minnesota, the Natural Resources Research Institute, and numerous others.

Partnership Policy Team

The Partnership Policy Team ensured that partner organizations were connected and committed to the CWCS project. Chaired by the DNR's director of Ecological Services, the team included leaders from the U.S. Fish and Wildlife Service, DNR Division of Fish and Wildlife, The Nature Conservancy, and Audubon Minnesota. These individuals participated because their organizations are broadly focused on the conservation of species in greatest conservation need. Without exception, they offered the time and resources necessary to develop the CWCS. The team met approximately quarterly during the two years of the project and reviewed interim products, providing comments and support.

CWCS Partnership Policy Team

Ed Boggess, Planning and Policy Director, DNR Fish and Wildlife
John Christian, Assistant Regional Director, U.S. Fish and Wildlife Service
Gabe Horner, Legislative Director, The Nature Conservancy
Tom Landwehr, Assistant State Director, The Nature Conservancy
Mark Martell, Director of Bird Conservation, Audubon Minnesota
Ron Payer, Program Director, DNR Fish and Wildlife
Lee Pfannmuller, Director, DNR Ecological Services

Project Management Team

The CWCS Project Management Team was made up of nine DNR employees responsible for designing and managing the CWCS project, including the director of the Division of Ecological Services. She shaped the CWCS vision from the beginning and oversaw the strategy from development to completion. The CWCS project manager chaired this group, and a CWCS ecologist/GIS expert was hired to lead the CWCS technical analysis. The DNR Ecological Services planner participated extensively, facilitating project tasks and guiding CWCS direction. Other key individuals on this team served in the development of the CWCS, supporting the activities of the other teams, ensuring the involvement of interested participants, and helping assemble the final CWCS document.

This team met regularly throughout the 2½-year project. The core CWCS support staff on this team—the project manager, ecologist, and planner—met daily to keep the project moving forward to completion and on to implementation.

CWCS Project Management Team

Daren Carlson, CWCS Ecologist/GIS Analyst, DNR Ecological Services
Bonita Eliason, Natural Heritage and Nongame Research Supervisor, DNR Ecological Services
Katie Haws, Nongame Wildlife Regional Specialist, DNR Ecological Services
Carrol Henderson, Nongame Wildlife Supervisor, DNR Ecological Services
Rachel Hopper, Research Analyst, DNR Ecological Services
Emmett Mullin, CWCS Project Manager, DNR Office of Management and Budget Services
Jane Norris, Assistant Federal Aid Coordinator, DNR Fish and Wildlife
Lee Pfannmuller, Director, DNR Ecological Services
Brian Stenquist, Planner, DNR Ecological Services

Technical Team

The CWCS Technical Team included scientists from the U.S. Fish and Wildlife Service, divisions of the DNR, The Nature Conservancy, Audubon Minnesota, the U.S. Geological Survey, the University of Minnesota, and the Natural Resources Research Institute. The Technical Team designed the technical assessment, defined and identified the set of Minnesota's species in greatest conservation need, determined key habitats, and established the priority conservation actions. They also created frameworks for research, surveys, and monitoring. Throughout 2004, the Technical Team met two days each month. Between meetings, members of the Technical Team conferred with colleagues and brought back their insights to rich and integrative discussions. They met less frequently in 2005, mainly to review and assist with the integration of comments from the five feedback teams and Minnesota's other interested publics.

CWCS Technical Team

Robert Blair, University of Minnesota
Daren Carlson, DNR Ecological Services
Meredith Cornett, The Nature Conservancy
Gary Drotts, DNR Fish and Wildlife
Bonita Eliason, DNR Ecological Services
Linda Erickson-Eastwood, DNR Fish and Wildlife
JoAnn Hanowski, Natural Resources Research Institute
Jay Hatch, University of Minnesota
Katie Haws, DNR Ecological Services
Melinda Knutson, U.S. Geological Survey (currently with USFWS)
Mark Martell, Audubon Minnesota
Emmett Mullin, chair, DNR Office of Management and Budget Services
Gerda Norquist, DNR Ecological Services
Brian Stenquist, DNR Ecological Services
Tom Will, U.S. Fish and Wildlife Service

Feedback Teams

The five CWCS feedback teams were made up of 87 people from almost 40 organizations. Four of these teams were organized around the four DNR regions (Figure 2.2), and one was a statewide team. Their primary responsibility was to review the products of the Technical Team. In particular, they gave feedback on the definition of species in greatest conservation need, the set of species in greatest conservation need, the 25 subsection profiles, and the draft CWCS.

The members of the feedback teams were asked to contribute up to 20 hours of their time during the life of the CWCS project. Many of them offered much more. Over the course of this project, these teams provided hundreds of pages of comments that substantially improved the CWCS, making it more locally grounded, accurate, and relevant.

Figure 2.2. Four DNR Regions

Five CWCS Feedback Teams

Northwest Feedback Team (DNR Region 1)

Janet Boe, DNR Ecological Services, Team Coordinator
Peter Buesseler, DNR Ecological Services
John Casson, U.S. Forest Service
Tom Groshens, DNR Fish and Wildlife
Katie Haws, DNR Ecological Services
Gary Huschle, U.S. Fish and Wildlife Service
Jay Huseby, Red Lake Tribal Government
John Loegering, University of Minnesota—Crookston
John Mathweg, DNR Forestry
George-Ann Maxson, Audubon Minnesota
Doug McCarthur, White Earth Tribal Government
Steve Mortensen, Leech Lake Tribal Government
Larry Olson, Cass County government
Russel Reisz, The Nature Conservancy
Dave Thompson, resort owner
Brian Winter, The Nature Conservancy
Mike Zicus, DNR Fish and Wildlife

Northeast Feedback Team (DNR Region 2)

Pam Perry, DNR Ecological Services, Team Coordinator
Mike Albers, DNR Forestry
Bill Berg, Minnesota Sharptail Grouse Society
Mike Duval, DNR Fish and Wildlife
Fitz Fitzgerald, Minnesota Land Trust
Jan Green, Audubon Minnesota
Maya Hamady, DNR Ecological Services
Jim Lind, NRRI, University of Minnesota
Michelle McDowell, U.S. Fish and Wildlife Service
Larry Peterson, DNR Fish and Wildlife
Mike Schrage, Fond-du-Lac Tribal Government
Al Williamson, U.S. Forest Service
Steve Wilson, DNR Ecological Services
Dave Zentner, Izaak Walton League

Central Feedback Team (DNR Region 3)

Carrol Henderson, DNR Ecological Services, Team Coordinator
Sue Burks, DNR Forestry
Mark Cleveland, DNR Parks and Recreation
Don Dindorf, Minnesota Conservation Federation
Brian Dirks, DNR Ecological Services
Kate Drewry, DNR Metro Greenways
Bob Fashingbauer, DNR Fish and Wildlife

Joan Galli, DNR Ecological Services (now retired)
Larry Gillette, Three Rivers Park District
Fred Harris, Great River Greening
Jeanne Holler, U.S. Fish and Wildlife Service
Beau Liddell, DNR Fish and Wildlife
Mike North, DNR Ecological Services
Bill Penning, DNR Fish and Wildlife
Vic Peppe, Falconers Association
Jeff Perry, Anoka County Parks
Marco Restani, St. Cloud State University
Konrad Schmidt, DNR Ecological Services
Hannah Texler, DNR Ecological Services

Southern Feedback Team (DNR Region 4)

Jaime Edwards, DNR Ecological Services, Team Coordinator
Pete Bauman, The Nature Conservancy
Phil Cochran, St. Mary's University
Jason Garms, DNR Ecological Services
Larry Gates, DNR Fish and Wildlife
Lisa Gelvin-Innvaer, DNR Ecological Services
Diane Granfors, U.S. Fish and Wildlife Service
Kurt Haroldson, DNR Fish and Wildlife
Tex Hawkins, U.S. Fish and Wildlife Service
John Hunt, Trout Unlimited
Aaron Kuehl, Pheasants Forever
Jim Miller, Iowa State University
Mark Oja, Natural Resources Conservation Service
Cynthia Osmundson, DNR Administration
Doug Rau, DNR Forestry
John Schladweiler, DNR Fish and Wildlife
Jon Schneider, Ducks Unlimited

Statewide Feedback Team

Bonita Eliason, DNR Ecological Services, Team Coordinator
Cheryl Adams, UPM-Blandin Paper Company
David Andersen, MN Cooperative F&W Research Unit, USGS
Rich Baker, DNR Ecological Services
Mike Davis, DNR Ecological Services
Phil Delphey, U.S. Fish and Wildlife Service
Mark Ebbers, DNR Fish and Wildlife
Leonard Ferrington, University of Minnesota, Aquatic Invertebrates
Carol Hall, DNR Ecological Services
Rick Horton, Ruffed Grouse Society

Alan Jones, DNR Forestry
Ann Kessen, Minnesota Ornithological Union
Steve Merchant, DNR Fish and Wildlife
John Moriarty, Ramsey County Government
Harvey K. Nelson, MN Waterfowl Association (Consultant), MN Outdoor Heritage Alliance, U.S. Fish and Wildlife Service (retired)
Jon Nelson, DNR Forestry
Ray Norrgard, DNR Fish and Wildlife
Ed Quinn, DNR Parks and Recreation
Susan Schmidt, Trust for Public Land
Jon Schneider, Ducks Unlimited

Other Interested Publics

Minnesota's other interested publics represent the broadest and largest group of governmental agencies, organizations, and individuals in the CWCS project structure. This group includes any organization or person interested in participating in CWCS review, including members of the general public. The role of this group was to help refine and improve the draft CWCS.

Most important, all participants in this effort will be asked to join in implementation, adopting and adapting the CWCS to their unique interests and capacities. This work will entail active engagement in site-based conservation discussions, taking the strategic information presented here and infusing it with local insights and concerns. The end result will be a higher level of coordination among conservation stakeholders and better on-the-ground conservation results.

Conservation Stakeholders' Involvement in CWCS Development

The CWCS Project Management Team's goal for public involvement was to strategically engage Minnesota's conservation community and others, collectively referred to as conservation stakeholders, in the development of the CWCS. The Minnesota CWCS partnership believes meaningful public participation is critical to the development of the strategy. Participation results in a more engaged citizenry that is better informed about Minnesota's species in greatest conservation need and is more likely to participate in CWCS implementation. Participation creates strong partnerships, which will result in improved conditions for Minnesota's species in greatest conservation need (SGCN). This fundamental belief has guided participation during the development of the CWCS from the onset.

From the beginning of the CWCS project in July 2003, the primary approach has been to integrate participation directly into the project structure. Individuals knowledgeable about Minnesota's ecology, wildlife conservation, and the habitats and species of the state were invited to participate on one of the project's teams. A key

responsibility of the CWCS Project Management Team has been to reach out to organizations and individuals concerned about SGCN and encourage them to participate in the development of the CWCS.

The Project Management Team decided not to hold traditional, large public planning meetings. While this oft-used approach is an effective way to solicit broad public input, it is not a good tool to cultivate sustained and detailed involvement. The team strived for targeted involvement, so that when feedback was solicited, stakeholders understood how it would be incorporated. The creation of the five CWCS feedback teams exemplifies this approach.

Project staff also reached out to an even broader spectrum of conservation stakeholders in development of the CWCS through a number of approaches. In early 2004, a Web site dedicated to Minnesota's CWCS was launched (http://www.dnr.state.mn.us/cwcs/index.html). At this site, there was a description of the CWCS project and its participants, the definition of SGCN, and the set of species. Project staff also made presentations at numerous conservation organization meetings and conferences, did outreach to industry groups, and gave lectures at universities. In addition, members of the many partnership groups were encouraged to keep their respective organizations informed and engaged in the development of the strategy.

The CWCS project team members also engaged Minnesota's conservation community directly several times during the development of the plan, for example, at the 2004 and 2005 DNR Roundtable events. Held each January, the DNR Roundtables bring together Minnesota's conservation community to focus on the most pressing issues of the day. The purpose of these engagements was to give stakeholders an understanding of the CWCS development, provide an opportunity to ask questions, and encourage them to become involved in implementation.

Finally, in July 2005 the draft CWCS document was posted on the DNR's Web site for one month, and feedback was solicited. Interested individuals had the opportunity to provide feedback directly to the project manager. A press release was sent to all major media outlets in the state, encouraging citizens and groups to comment. Four hundred fifty postcards were sent to individuals and organizations in Minnesota's conservation community, asking for their help reviewing the document. In addition, a number of organizations and groups were contacted directly and encouraged to participate. All in all, this group provided significant and invaluable comments, all of which were considered and integrated into the draft document to the best of our ability.

Implementation of the CWCS

Successful implementation of the CWCS requires a strong commitment from the partners to move the CWCS into on-the-ground conservation. A logical first step is to reaffirm the current CWCS project structure as the base from which to build successful implementation. This structure embodies the leadership and organizational support necessary to make a successful transition to action.

To ensure a successful transition to CWCS action, the DNR director of Ecological Services has committed three CWCS project staff to continue into the implementation phase. These staff have been at the center of CWCS planning and are well acquainted with the plan's priorities and the partners. During the first year of implementation, they will translate CWCS priorities into actions by facilitating discussions among the CWCS partners and other interested conservation groups. These discussions will take place using existing conservation forums as well as developing new ones. The dedication of staff to this transition will help ensure that CWCS implementation receives the technical and logistical support necessary for success.

Conservation Stakeholders' Involvement During CWCS Implementation

As important as conservation stakeholders' participation has been during the development of the CWCS, we anticipate even more extensive engagement in the implementation of the strategy. We will create a project structure for the implementation that will include a statewide team and dedicated staff committed to promoting public discussion of the CWCS during its implementation.

General public involvement will increase as we use the CWCS to engage citizens in the challenge of ensuring a sustainable future for Minnesota's wildlife. We anticipate reaching citizens through the Internet and the DNR Web site, print publications, participation in local events, and presentations to groups of interested residents. In addition, we think there is tremendous potential to engage members of the public in the work of the CWCS through their interest in outdoor recreation and stewardship education.

Statewide CWCS Partner Implementation Team and Partner Work Planning

At the center of CWCS implementation will be the Partner Implementation Team. Led by the DNR director of Ecological Services and composed of leadership from the organizations invested in CWCS development and committed to its success, this team will coordinate partner involvement during implementation. The team will meet at least two times a year to ensure organizational commitment, provide direction to staff, and address the challenges of implementation. Individual team members may reach out to their field organizations (if appropriate) to coordinate conservation actions. Early in the implementation period, this group may need to meet more frequently.

Currently, the conservation actions in the 25 subsection profiles identified in chapter 5 broadly describe the type of work needed. During implementation, the Partner Implementation Team will guide or develop a process for more detailed operational planning among CWCS partners. This will require meetings involving people knowledgeable about each subsection, to discuss the more specific conservation actions needed. Early on in implementation, it will be important to continue identifying interested partners, as well as understanding their priorities, capacities, and expertise.

For the implementation of CWCS to succeed, partner organizations will need to integrate relevant CWCS priorities into their internal work plans. Partners will consider CWCS priorities to their greatest ability as they plan for the upcoming work and when collaborative opportunities arise, partners will have a common vision.

The Partner Implementation Team will lead biennial evaluations and reviews of CWCS implementation progress. Using the monitoring and evaluation capacities of the individual organizations, the team will assess the effectiveness of the CWCS conservation actions and the status of SGCN, making course corrections when needed and initiating new projects. On a periodic basis, this group will oversee the development of status reports, providing documentation of outcomes and recommendations for renewing and adjusting needed priority conservation actions. These reports will be made available to interested publics. Biennial work planning and evaluation will ensure that revision of the strategy toward the end of the first 10 years will be less daunting than was the initial creation of CWCS.

Minnesota DNR Leadership During CWCS Implementation

CWCS implementation depends directly on a vibrant and engaged partnership. The Minnesota DNR will be the primary action agency responsible for leading and guiding implementation efforts. One fundamental goal of CWCS implementation is to identify important and innovative conservation projects under way and to help support them when their objectives coincide with the priorities to better manage species in greatest conservation need.

CWCS project support of related programs and projects could occur in a number of ways, for example, providing financial or technical assistance or logistical or structural support, or even using the CWCS as a discussion forum to help determine conservation priorities. In some parts of Minnesota, the CWCS project will have a significant on-the-ground presence; in other places, it may only be brought in by CWCS partnership staff working in collaboration on tangentially related projects.

Another primary goal of CWCS implementation is to responsibly administer the State Wildlife Grants funds to initiate new conservation actions and/or provide financial assistance to existing ones that are critical to addressing CWCS priorities. The DNR will use the priority conservation actions established in each of the 25 CWCS subsection profiles in chapter 5 to help guide SWG program funding decisions. In addition to the conservation actions, decision-making criteria regarding importance, urgency,

practicality, and collaboration will be applied. While the conservation actions identified in the profiles are fairly broad, they frame the type of work needed for SGCN management over the next 10 years. Key habitat work provides the first-order priority in each subsection. Within each of the key habitats, there is a variety of work to be done concerning habitat and species management, survey, research, monitoring, outreach, and SGCN appreciation. While the State Wildlife Grants Program has an important role in supporting SGCN work, it does not have the capacity to support all the work needed over the next 10 years.

As part of its long-term commitment to strategic planning, the Minnesota DNR has established "A Strategic Conservation Agenda, 2003–2007," which describes the agency's progress toward achieving conservation results. It identifies 85 indicators and targets in six performance areas: natural lands, fisheries and wildlife, waters and watersheds, forests, outdoor recreation, and natural resources stewardship education. This effort has been directly integrated with Minnesota's CWCS. Eighteen of its 85 indicators are immediately related to the CWCS. These indicators commit the DNR to monitoring and evaluating progress with regard to SGCN, invasive species, and numerous key habitats, and to continuing surveying work, such as completing Minnesota's County Biological Survey. The Conservation Agenda will be kept up-to-date and will be a useful guide and source of information for monitoring CWCS implementation.

Examples of Efforts That Will Aid CWCS Implementation

Here are a few illustrations of efforts that may assist in the implementation of CWCS. Some of them have already begun to aid in the implementation. These examples do not capture the breadth of the conservation efforts that are critical to CWCS implementation. There are simply too many to mention here.

DNR Efforts

The DNR Division of Ecological Services houses numerous efforts that will assist in CWCS implementation. Following are a few examples.

Landowner Incentive Program (LIP)

LIP has served as an important CWCS partner during the planning stages of CWCS and will continue to do so during implementation. LIP is a federally funded, state-implemented program that provides technical and financial assistance to eligible private landowners who wish to voluntarily manage their land to benefit at-risk plant and animal species. LIP is not a land acquisition program, and fee-title acquisition is not an eligible use of LIP funds. The Minnesota DNR Division of Ecological Services implements LIP in Minnesota.

In southeastern Minnesota, LIP staff are working with private landowners to enhance or restore the bluff prairie habitats on their properties to benefit the timber rattlesnake, three other at-risk snake species, and numerous at-risk plant species. LIP

rattlesnake program staff assist landowners with the development and implementation of management plans designed to protect den sites and travel corridors, while minimizing human–snake encounters. The State Wildlife Grants Program provided funding for rattlesnake surveys. In western Minnesota, LIP staff are working with private landowners to protect and manage valuable native prairie that provides habitat for many SGCN.

Nongame Wildlife Management

Nongame wildlife managers have had a central role in the development of the CWCS and will be key to successful implementation. Staff members serve a critical function by providing technical assistance to other DNR disciplines and external stakeholders to ensure that the management needs of nongame wildlife species are taken into account in land management decisions. Their work to survey and monitor select nongame species, restore and manage threatened and endangered species and their habitats, and promote education and recreational opportunities is important. Nongame staff will serve as some of the frontline implementers and have the challenging task of helping to carry the priorities of this effort out to the broader conservation community.

Natural Heritage and Nongame Wildlife Research

These staff collect, manage, analyze, and interpret information about many of Minnesota's species in greatest conservation need as well as native plants and plant communities to promote the wise stewardship of these resources. Staff members have played an essential role in CWCS development and will continue to play a central role managing information about SGCN and their habitats, and developing research and monitoring actions for the CWCS. Natural Heritage plant community ecologists will also serve a lead role in CWCS field implementation through their efforts to conserve habitats key to the sustainability of SGCN.

Minnesota County Biological Survey (MCBS)

MCBS began in 1987 as a systematic survey of rare biological features. The goal of the MCBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and native plant communities. This program has provided field data and interpretations related to species, habitats and native plant communities used in the CWCS planning effort. It will continue to serve as an essential partner in CWCS implementation.

Other Efforts

U.S. Fish and Wildlife Service Habitat and Population Evaluation Team (HAPET) Office: Decision Support Tools

The U.S. Fish and Wildlife Service's HAPET office has designed several decision support tools that have been helpful during the CWCS planning period and will be valuable during implementation to better target areas for conservation work (for more

information on HAPET models, visit http://www.fws.gov/midwest/HAPET/). One of the agency's models was used to create some of the maps in this document. In several of the western Minnesota subsection profiles (see chapter 5), key habitats were identified using the Grassland Bird Conservation Area (GBCA) tool. This tool identifies grassland areas that minimize edge, do not border wooded patches, and are in landscapes with additional grassland cover. Grassland conservation practices (e.g., Conservation Reserve Program, fee-title, restoration) in these areas benefit grassland-dependent birds by restoring or protecting habitat where productivity is believed to be higher than in areas with less grass cover, more edge, and smaller habitat patches. These large areas provide habitat for area-sensitive species such as marbled godwits and greater prairie chickens.

Working Lands Initiative

The working lands initiative is a broad-based cooperative effort among state and federal agencies and nongovernmental organizations to encourage conservation and agricultural interests to work together to address water quality and habitat needs in the prairie pothole region of Minnesota. The initiative will use GIS technology, models, and expert opinion to focus conservation work in areas where the fewest possible acres can be managed with the greatest possible benefit provided. It seeks to mobilize partners—agencies, conservation organizations, and the agricultural community—and programs to work more effectively together to benefit wetland and grassland habitats and reduce erosion in order to support desired wildlife populations and improve water quality.

The Nature Conservancy's Ecoregional Assessments

The Nature Conservancy (TNC) is an international conservation organization dedicated to preserving the diversity of life on earth. In Minnesota, TNC has developed four ecoregional assessments for each of the state's major ecological areas. The purpose of these assessments is to design a portfolio of conservation areas that, with proper management, ensures the long-term survival of the species, communities, and ecological systems within a particular ecoregion. The Nature Conservancy has been a vital partner in the CWCS, and its assessment of terrestrial and aquatic biodiversity has been tremendously helpful (see chapter 7, Methods and Analyses, for a more detailed description of TNC's planning efforts.)

Audubon Minnesota's Important Bird Areas

The goal of the Important Bird Areas Program (IBA) is to identify, conserve, and monitor a network of sites that provide crucial habitat for birds in Minnesota. As part of an international effort, the sites will include breeding, migration, and wintering habitats for all birds and may occur on both public and private land that may or may not be currently protected. The IBA Program will work through partnerships that include government agencies, nongovernmental organizations, and private citizens. The State Wildlife Grants Program has provided financial support for the IBA program for the past three years.

Minnesota DNR Subsection Forest Resources Management Planning Efforts

The Minnesota DNR manages approximately 4.5 million acres of forestland, about one-quarter of all forestland in the state. The DNR plans long-term (50-plus years) and short-term (10-year) vegetation management on these lands through Subsection Forest Resource Management Plans (SFRMPs). SFRMPs, which are based on ecological classification system (ECS) subsections rather than administrative boundaries, are the primary tool for determining the array of forest resources that will be provided and sustained through vegetation management on DNR-administered forestlands.

The DNR began preparing SFRMPs in 2000 and is preparing SFRMPs for the 17 ECS subsections that are considered forested. Local interdisciplinary DNR teams produce the three primary components of the plans: Assessment and Issues, Strategic Direction, and the 10-Year List of Forest Stands to be treated. Each component is made available for public review and comment. The DNR's goal is to complete all SFRMPs by 2007. It will be important for the CWCS effort to explore opportunities to integrate with SFRMP development, providing valuable SGCN information to be considered and incorporated in the planning dialogue.

Bird Conservation Minnesota

The goal of Bird Conservation Minnesota is "to deliver the full spectrum of bird conservation through regionally-based, biologically driven, landscape-oriented partnerships." It is a new collaborative effort among numerous governmental and nongovernmental entities that seek to keep birds common and reverse species declines, building on many of the same CWCS priority actions. This voluntary partnership builds on efforts already under way by government agencies and tourism and conservation organizations.

Campaign Conservation

In celebration of Minnesota's sesquicentennial in 2008, a large number of Minnesota's conservation organizations are joining together to create "Campaign Conservation." This coordinated endeavor will identify and protect some of Minnesota's most important lands and waters. Priorities established in CWCS will serve as important tools to help guide this new initiative.

The CWCS provides a comprehensive framework that will play a critical, integrative role to connect and focus the broad array of existing conservation efforts throughout Minnesota. The programs listed above illustrate only a few of the many opportunities for conservation partnerships. Through creative, open dialogue, the CWCS framework can serve to more efficiently guide resources and staff to better conserve all wildlife.

CWCS Revision: 2013

One of the requirements of the CWCS is the review and revision of the strategy in 10 years. Because implementation of the CWCS will be built on and guided by regular planning and evaluation within the CWCS partnership, the revision process will not require the same start-up time and costs associated with the initial development. The 10-year revision will, however, require substantial public participation to ensure both stakeholder and general public support for the next implementation period.

Formal revision of the CWCS should begin in approximately 2013, eight years into the implementation period, which runs 2005–2015. At that time, a thorough evaluation of the implementation to date should occur, and a determination should be made of both the effectiveness of the conservation actions and whether the status of the set of species in greatest conservation need has changed. While today 2013 seems far off in the future and the exact process for updating the CWCS is not known, the CWCS project's commitment to meaningful public participation is steadfast. A project structure similar to the one created during the initial CWCS planning effort will be an essential element of this next update.

Chapter 3

Minnesota's Species in Greatest Conservation Need

At its base, *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS) is a wildlife plan, and as such, the single most important step in the CWCS technical assessment was to develop the set of species in greatest conservation need (SGCN). The set serves as the reference point that guides all key habitat priorities articulated in this document.

Process for Identifying the Set of Species in Greatest Conservation Need

Minnesota's CWCS Technical Team and partners assessed all taxonomic groups of native terrestrial and aquatic wildlife, both vertebrate and invertebrate species. Addressing this full array of wildlife taxa meant considering the almost 1,200 animal species documented to occur in Minnesota. Further challenges arose since much more information is available for some taxonomic groups than others, birds versus spiders, for example.

To address these challenges, Minnesota used a multistep process to identify the set of SGCN (see Table 3.1). At the outset of this effort, the CWCS Technical Team (see chapter 2.) recognized that the development of the set of SGCN would be a dynamic process and that over time species would be added and removed as their status changed or more information became available. There was also recognition that although Minnesota's set of SGCN contains species that are regulated by state and federal laws, including a species in the set does not by itself provide regulatory protection.

Table 3.1. Overview of Process for Developing the Set of SGCN

Step	Description	Source(s)
1	Define species in greatest conservation need	CWCS Technical Team
2	Review existing species lists and assessments	Fed ETS*, MN ETS, PIF, etc.
3	Input from individual species experts	Variable
4	Technical Team review	CWCS Technical Team
5	Feedback Team review	90 individuals
6	Set finalized	CWCS Technical Team

* ETS = Endangered, threatened, special concern; PIF = Partners in Flight

The first step was to broadly define species in greatest conservation need as species that are rare, declining, or vulnerable in Minnesota (Table 3.2; see the Glossary of Terms, Appendix K, for definitions of *rare*, *declining*, and *vulnerable*). Identification of such species was based on

information about their abundance or population trends or on other factors, such as dependence on threatened habitats, vulnerability to other specific threats, or certain characteristics that make them vulnerable. To the fullest extent possible, species were included in the set if they were declining and vulnerable in a major portion of their range, not just in Minnesota. This decision allowed for the inclusion of some species that are declining elsewhere but are stable in Minnesota.

Table 3.2. Definition of the Species in Greatest Conservation Need

Characteristics of SGCN	Criteria Used to Define SGCN
Species whose populations are *identified* as being rare, declining, or vulnerable in Minnesota	Existing, objective-based, peer-reviewed assessments or lists
Species at risk because they depend upon rare, declining, or vulnerable habitats	***Examples*** - native prairies and grasslands - lakeshores and riparian corridors - wetlands - shrublands, savannas, woodlands - unimpounded river and stream channels - unfragmented interior forest
Species subject to other specific threats that make them vulnerable	***Examples*** - overexploitation - invasive species - disease - contaminants - lack of citizen understanding and stewardship (such as killing large snakes thought to be venomous) - urban and residential development
Species with certain characteristics that make them vulnerable	***Examples*** - require large home ranges/use multiple habitats - depend on large habitat patch sizes - depend on an ecological process (e.g., fire) that no longer operates within the natural range of variation - are limited in their ability to recover on their own due to low dispersal ability or low reproductive rate - have a highly localized or restricted distribution (endemics) - concentrate their populations during some time of the year (such as bats clustering in hibernacula; bird migratory stopovers)
Species whose Minnesota populations are stable but are declining in a substantial part of their range outside of Minnesota	***Examples*** - common loon - black tern

The second step was to determine those species that have already been identified as rare, declining, or vulnerable in an existing, objective-based, and peer-reviewed species assessment or list of Minnesota's native wildlife. A major part of this step was to develop criteria based on existing lists to determine whether these species should be included in the set of species in greatest conservation need (Table 3.3). Some general aspects of those criteria are listed below:

- Species with legal protection status were automatically included in the set. These were any federal or state endangered or threatened species.

- Global population status assessments were automatically included in the set for all species except birds. These were identified from Heritage Global Ranks (G1–G3), the Convention on International Trade in Endangered Species (CITES), and the World Conservation Union (IUCN) Red List of Threatened Species.

- Species identified by other regional processes were considered by the CWCS Technical Team to determine whether they met the definition and criteria. These processes included U.S. Fish and Wildlife Service Region 3 Species of Concern, species tracked in the Minnesota DNR Heritage database due to experts' concerns about their status, and the National Resources Research Institute (NRRI) Breeding Bird Monitoring program.

- For birds, other lists were available to determine their inclusion in the SGCN set and, with the exception of federal- and state-listed species, were given priority over other available information sources. These were the Partners in Flight Continental and Regional Plans for land birds, Regional Shorebird Conservation Plans, and Minnesota Waterbird Conservation Plans.

- Within each assessment process, criteria for selection were determined based on the scoring used in that particular process. For example, the Partners in Flight Landbird Conservation Plans score species in six tiers based on six criteria. Only those species that were Tier 1, 2A, or 2C were included in the SGCN set (Table 3.3).

- All species identified through the above assessment processes were reviewed by the CWCS Technical Team and removed if they met any of the criteria for removal (Table 3.4).

Table 3.3. Criteria for Including Species Identified from Other Assessment Processes in the SGCN Set *

Assessment Process	Criteria
Federally listed species http://www.fws.gov/midwest/endangered/lists/minnesot-spp.html	All species automatically included unless they meet criteria for excluding species (Table 3.4)
Heritage Global Rank http://www.natureserve.org/explorer/ranking.htm	Species ranked G1, G2, or G3 (excluding bird species)
Minnesota's List of Endangered, Threatened, or Special Concern species http://www.dnr.state.mn.us/ets/index.html	All species automatically included unless they meet criteria for excluding species (Table 3.4)
Partners in Flight (PIF) Continental Watch List	Bird species that breed in Minnesota and do not meet the criteria for excluding species (Table 3.4)
Partners in Flight (PIF) Landbird Regional Plans http://www.blm.gov/wildlife/pifplans.html	Tier 1, 2A, and 2C species in at least one physiographic area that occurs in Minnesota (16, 20, 32, and 40) and breeds in the state. (PA32 covers only a small portion of Minnesota, and species were individually reviewed to determine if they meet the SGCN definition.)
Regional Shorebird Conservation Plans http://shorebirdplan.fws.gov	Species identified as Highly Imperiled (5) or High Concern (4) in at least one of bird conservation regions that occur in Minnesota (11, 12, 22, 23) and either breed or are significant migrants in Minnesota
Minnesota Waterbird Conservation Plan http://www.waterbirdconservation.org	Species identified as high or moderate concern in at least one of bird conservation regions that occur in Minnesota (11, 12, 22, 23) and breed in Minnesota
U.S. Fish and Wildlife Service Region 3 Species of Concern http://midwest.fws.gov/Endangered/lists/concern.html	Excluding bird species
Species tracked in the MN DNR Heritage Database	Excluding bird species
Convention on International Trade in Endangered Species (CITES) http://www.cites.org	Excluding bird species
The World Conservation Union (IUCN) Red List of Threatened Species http://www.iucn.org/	Excluding bird species
Natural Resources Research Institute (NRRI) Breeding Bird Monitoring Program http://www.nrri.umn.edu/mnbirds/	Bird species showing significant ($P \leq 0.05$) declines in all four sample areas (Superior, Chippewa, Chequamegon-Nicolet National Forests and the St. Croix Region of east-central Minnesota) as well as overall regionally, and are supported by corroborative information from other regional surveys (e.g. PIF regional or continental plans)

* For more detail on the individual species lists, visit the Web sites identified in this table.

Table 3.4. Criteria to Exclude Species from the Set of Minnesota Species in Greatest Conservation Need

1. Species does not meet the definition of species in greatest conservation need (Table 3.2).
2. Species has not been documented to occur in Minnesota.
3. Species is presumed extirpated from Minnesota, with no expectation of it returning as a resident in the next 10 years.
4. Species is abundant in Minnesota *and* regionally, nationally, or globally.
5. Species occurrence in Minnesota is occasional due to wandering individuals, *and* no resident populations are, or are likely to become, established in the next 10 years. Regularly migrating shorebirds that depend on habitat within Minnesota are *not* included in this group, but other migrant birds are.

The third step was to consult with individual taxa experts to obtain input about groups of species for which formalized species lists were lacking. This was done in particular for fish and aquatic insects, but some input was also sought for all other taxa.

Fourth, using the broad definition developed in step 1 (Table 3.2), the CWCS Technical Team reviewed all remaining species that occur in Minnesota to determine additional species that met the definition for inclusion.

Finally, after completion of the previous steps, all the species included in the set were sent out to the Feedback Teams (see chapter 2) for review, resulting in further additions to and removals from the set.

All told, 292 species in greatest conservation need in Minnesota were identified. This set is intended to be adaptive and change as new information about species status becomes available.

Species in Greatest Conservation Need

Minnesota's 292 species in greatest conservation need include species from all major taxonomic groups (see Figure 3.1 below; Appendix B). Birds have the greatest number of species, which reflects the fact that much more information is available about this group and that among vertebrates, birds have the most species. Thirty-one percent of birds are SGCN, compared to 26 percent of mammals, 43 percent of herptiles, 32 percent of fish, and 33 percent of mollusks. With the exception of mussels, which are relatively well studied, invertebrate species are most certainly underrepresented in the set. Thirteen percent of insects and 40 percent of spiders are identified as SGCN, but currently our documentation of the total number of insect and spider species that occur in Minnesota is probably one or more orders of magnitude less than what actually lives here, and we have little understanding of those that are rare, declining, or vulnerable. Research is clearly needed in this area.

The species in greatest conservation need include both nongame and game species (Table 3.5). While game species may be managed differently than nongame, they were identified as having conservation need through an objective and comprehensive process independent of game status.

Table 3.5. Species in Greatest Conservation Need That Are Hunted or Fished

Taxa	Scientific Name	Common Name
Birds	*Anas acuta*	Northern pintail
	Anas rubripes	American black duck
	Aythya affinis	Lesser scaup
	Falcipennis canadensis	Spruce grouse
	Gallinula chloropus	Common moorhen
	Rallus limicola	Virginia rail
	Scolopax minor	American woodcock
	Tympanuchus cupido	Greater prairie chicken
	Tympanuchus phasianellus	Sharp-tailed grouse
Fish	*Acipenser fulvescens*	Lake sturgeon
	Ictiobus niger	Black buffalo
	Lepomis gulosus	Warmouth
	Lepomis megalotis	Longear sunfish
	Moxostoma carinatum	River redhorse
	Moxostoma duquesnei	Black redhorse
	Moxostoma valenciennesi	Greater redhorse
	Scaphirhynchus platorynchus	Shovelnose sturgeon
Reptiles	*Chelydra serpentina*	Common snapping turtle

Minnesota's SGCN are distributed across the state and use a variety of habitats. Results of the species-distribution and species-habitat relationships reveal some patterns, however (see chapter 7, Methods and Analyses, for a description of the processes.) In general, more SGCN occur in the southeastern and central portions of the state (Figure 3.2; Table 3.6 a). The Blufflands and St. Paul-Baldwin Plains Subsections in particular have the most SGCN. The Blufflands Subsection also has the highest number of SGCN unique to any subsection within the Eastern Broadleaf Forest Province (Table 3.6 a). The Mississippi River and its corridor support a large diversity of species. In addition, many of the habitats most critical for SGCN have been greatly reduced or are no longer present in these subsections (see also Appendix E, Species Occurrence by Subsection, for detailed information on known occurrences of species since 1990.)

At the province level, the Eastern Broadleaf Forest Province contains both the most SGCN and the greatest number of SGCN unique to that province, while the Laurentian Mixed Forest Province has the highest percentage of unique species (Table 3.6 b.). Somewhat surprisingly, the prairie provinces contain both the fewest number of total and unique SGCN. This pattern holds true when the Tallgrass Aspen Parklands, which has only a small portion in Minnesota and is considerably smaller than the other provinces, is combined with the Prairie Parkland Province. The lower number of unique species in these provinces in part reflects that grassland habitats and their species are found in most subsections of the state, and are an important component in several of the subsections in the Eastern Broadleaf Forest Province.

Table 3.6. Species in Greatest Conservation Need Summary

a. The number of species in greatest conservation need for each subsection within the province, and the number of species unique to each subsection within the province

Province	Subsection	# Species	# Unique
Eastern Broadleaf Forest	Blufflands	156	14
	St. Paul-Baldwin Plains	149	1
	Big Woods	121	1
	Anoka Sand Plain	97	1
	Rochester Plateau	94	0
	Oak Savanna	93	1
	Hardwood Hills	85	1
Laurentian Mixed Forest	Mille Lacs Uplands	128	6
	Pine Moraines and Outwash Plains	89	1
	Agassiz Lowlands	88	1
	North Shore Highlands	84	6
	Chippewa Plains	83	1
	St. Louis Moraines	74	0
	Tamarack Lowlands	69	0
	Border Lakes	69	2
	Littlefork-Vermilion Uplands	67	0
	Nashwauk Uplands	60	0
	Laurentian Uplands	58	0
	Glacial Lake Superior Plain	55	0
	Toimi Uplands	52	0
Prairie Parkland	Minnesota River Prairie	116	1
	Red River Prairie	83	4
	Inner Coteau	78	1
	Coteau Moraines	78	0
Tallgrass Aspen Parklands	Aspen Parklands	85	2

b. The number of species in greatest conservation need in each province, and the number and percentage of species found only in that province (unique)

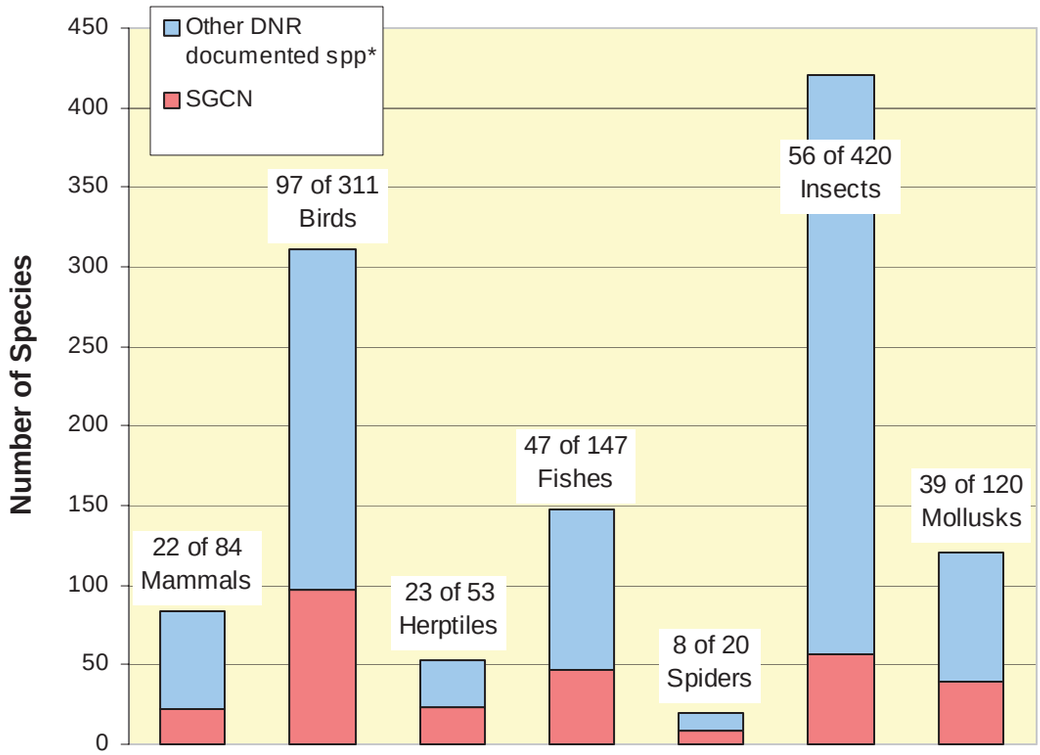
Province	# Species	# Unique	% Unique
Eastern Broadleaf Forest	205	51	25
Laurentian Mixed Forest	171	47	27
Prairie Parkland	139	13	9.3
Tallgrass Aspen Parklands	85	2	2.3
Prairie Parkland and Tallgrass Aspen Parklands combined	147	20	14

A look at statewide distributions by individual taxonomic groups also reveals that different parts of the state may be important for different taxa (Figure 3.3). For example, the greatest number of SGCN reptiles, fish, and mollusks are in the subsections in the southeastern part of Minnesota, while more SGCN birds occur in the northwest subsections and in the Minnesota River Prairie subsection.

A statewide look at the species-habitat relationships shows that prairies, rivers, and wetlands are the three habitats used by the most SGCN (Figure 3.4). These are the habitats that have also experienced some of the greatest loss and degradation in the state.

This information on the distribution and habitat use by Minnesota's species in greatest conservation need helps us prioritize, at multiple spatial scales, conservation actions designed to sustain these species' populations. Figures 3.2 to 3.3 suggest areas in the state on which to focus conservation actions, and Figure 3.4 identifies certain habitats that may be more important for species in greatest conservation need. Further analyses of species distribution and habitat use are explained in chapter 7 and have been used to craft the conservation actions in chapter 5, the subsection profiles.

Figure 3.1. Number of Species in Greatest Conservation Need Compared to All Species in Minnesota by Taxa



* Underestimates the total # of invertebrate species in Minnesota

Source: MN DNR, 2004

Figure 3.2. Number of Species in Greatest Conservation Need by ECS Subsection in Minnesota

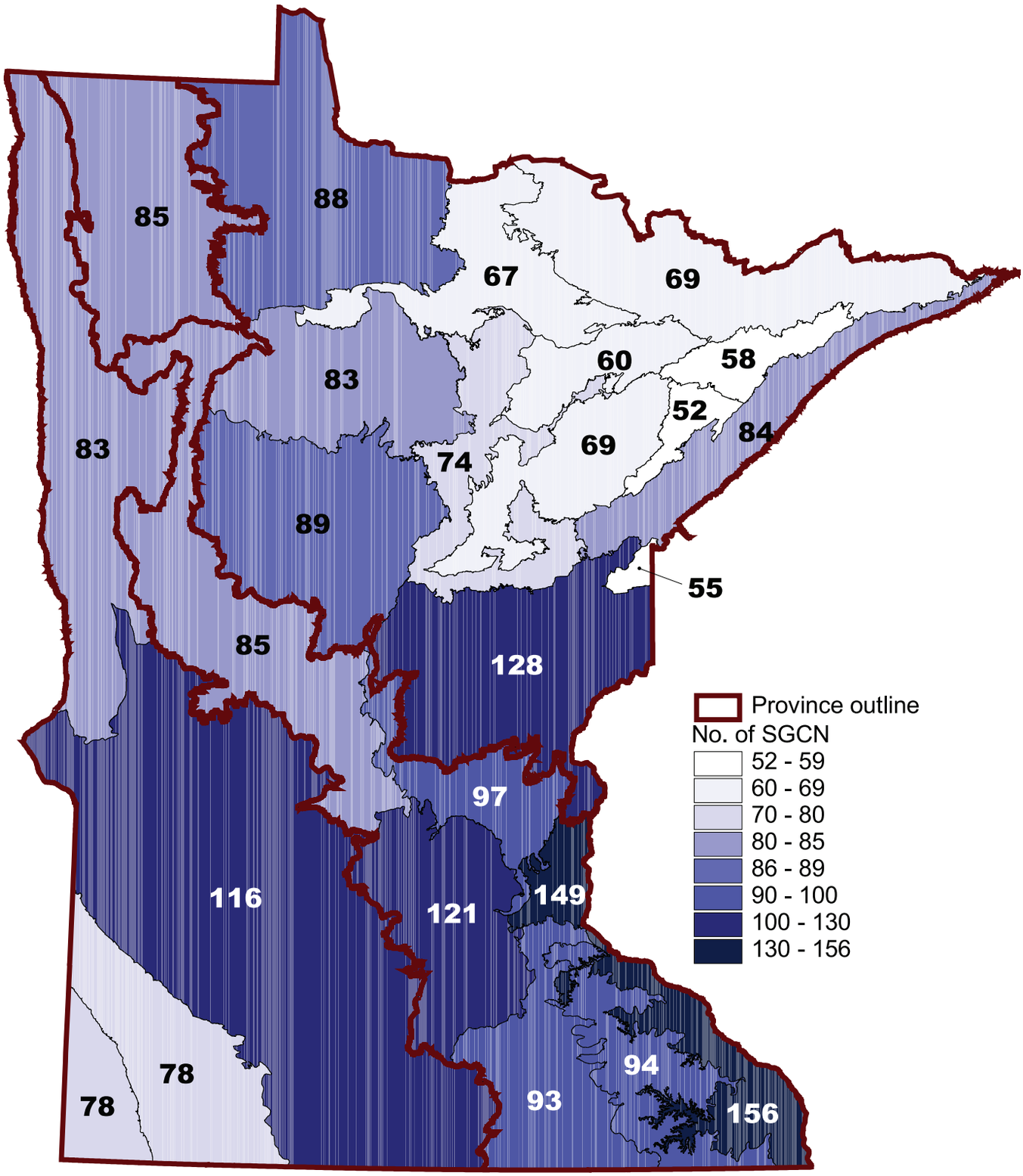


Figure 3.3. Number of Species in Greatest Conservation Need by ECS Subsection in Minnesota by Taxonomic Group: Mammal, Bird, Reptile, Amphibian, Fish, Arthropod, Mollusk

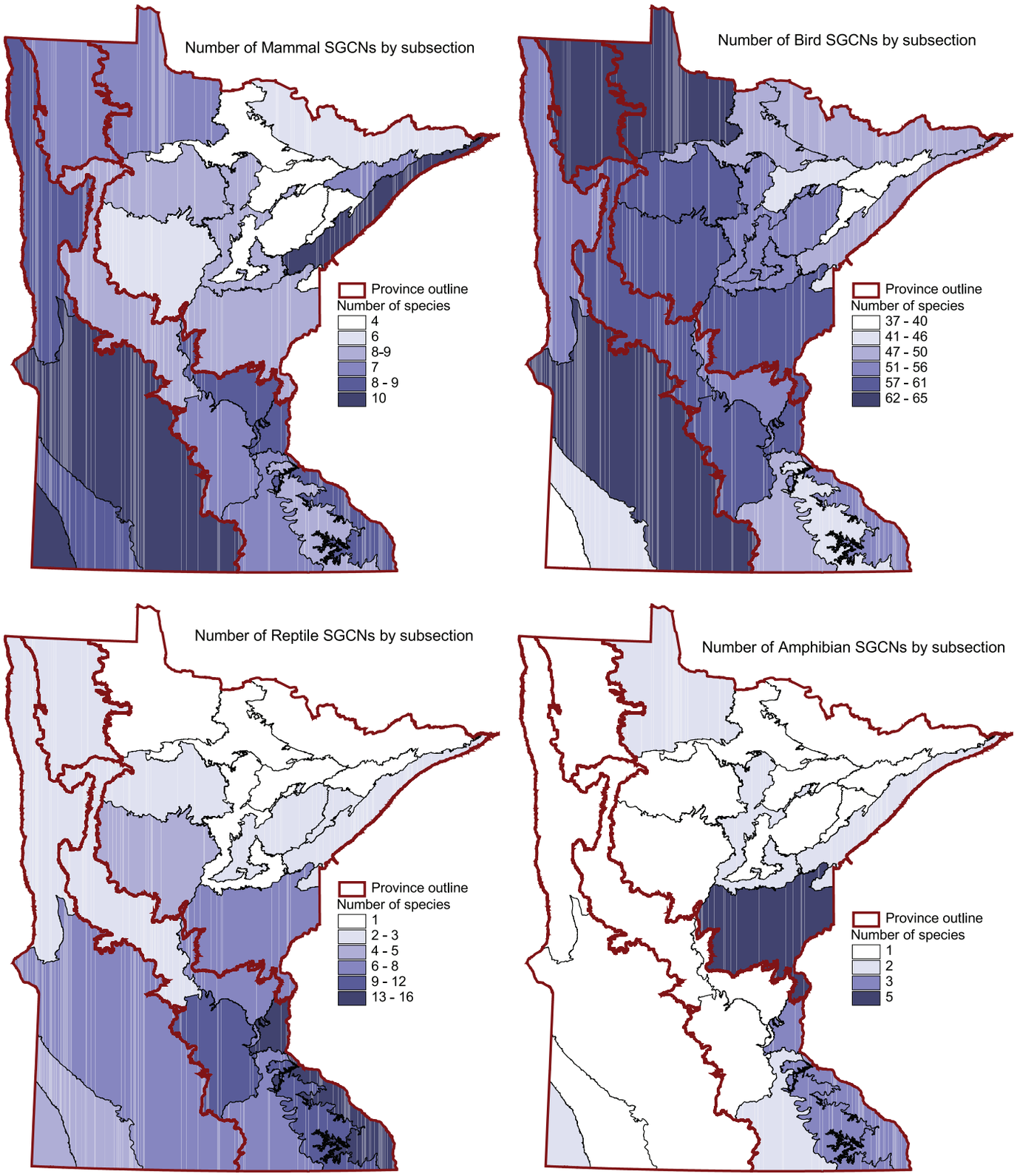
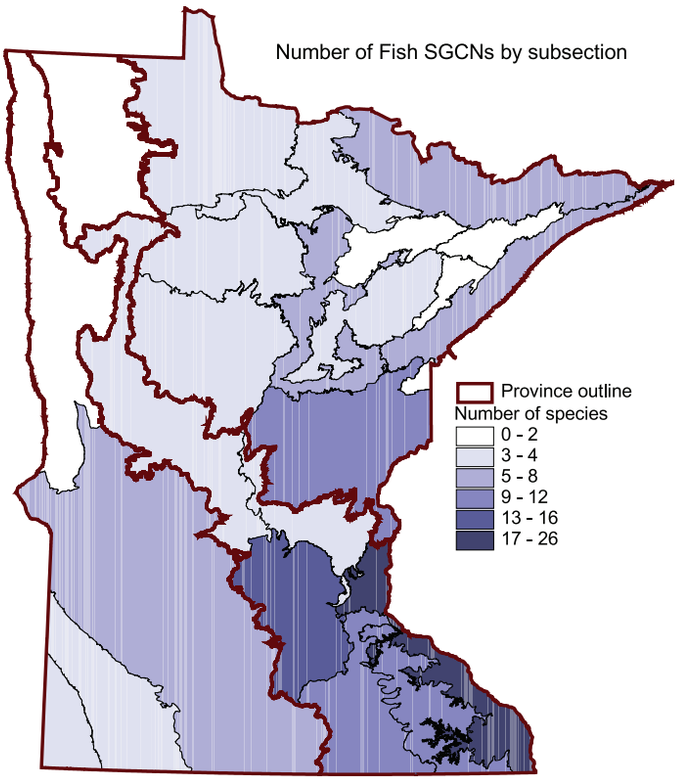
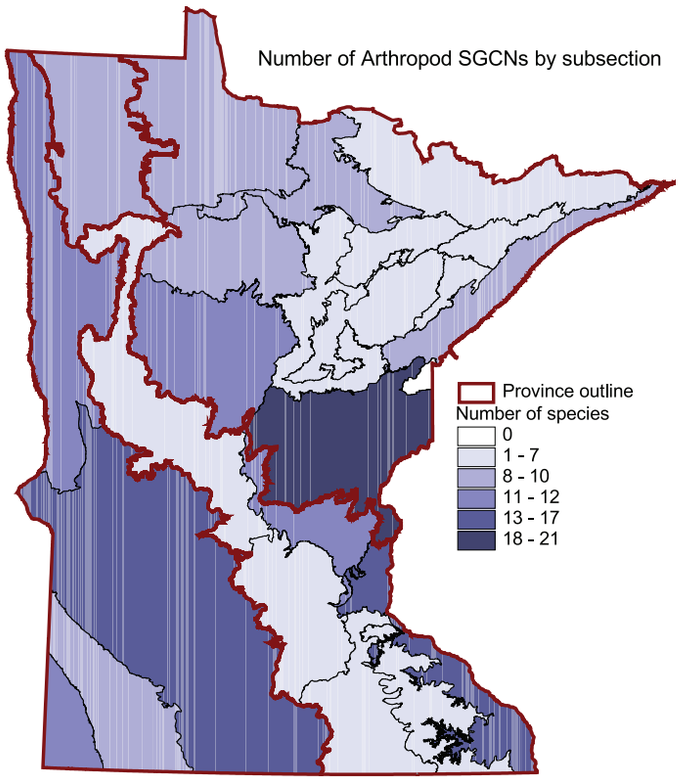


Figure 3.3, cont. Number of Species in Greatest Conservation Need by ECS Subsection in Minnesota by Taxonomic Group: Mammal, Bird, Reptile, Amphibian, Fish, Arthropod, Mollusk





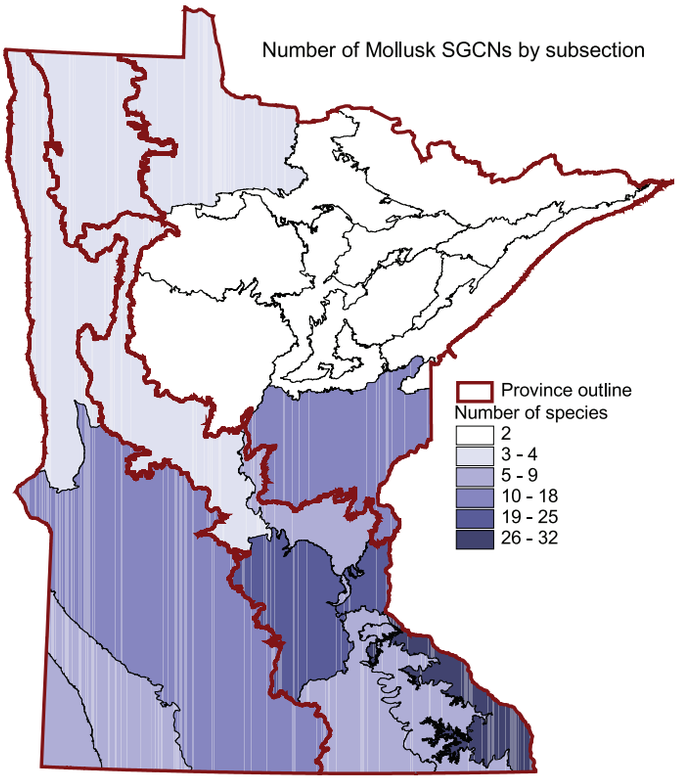
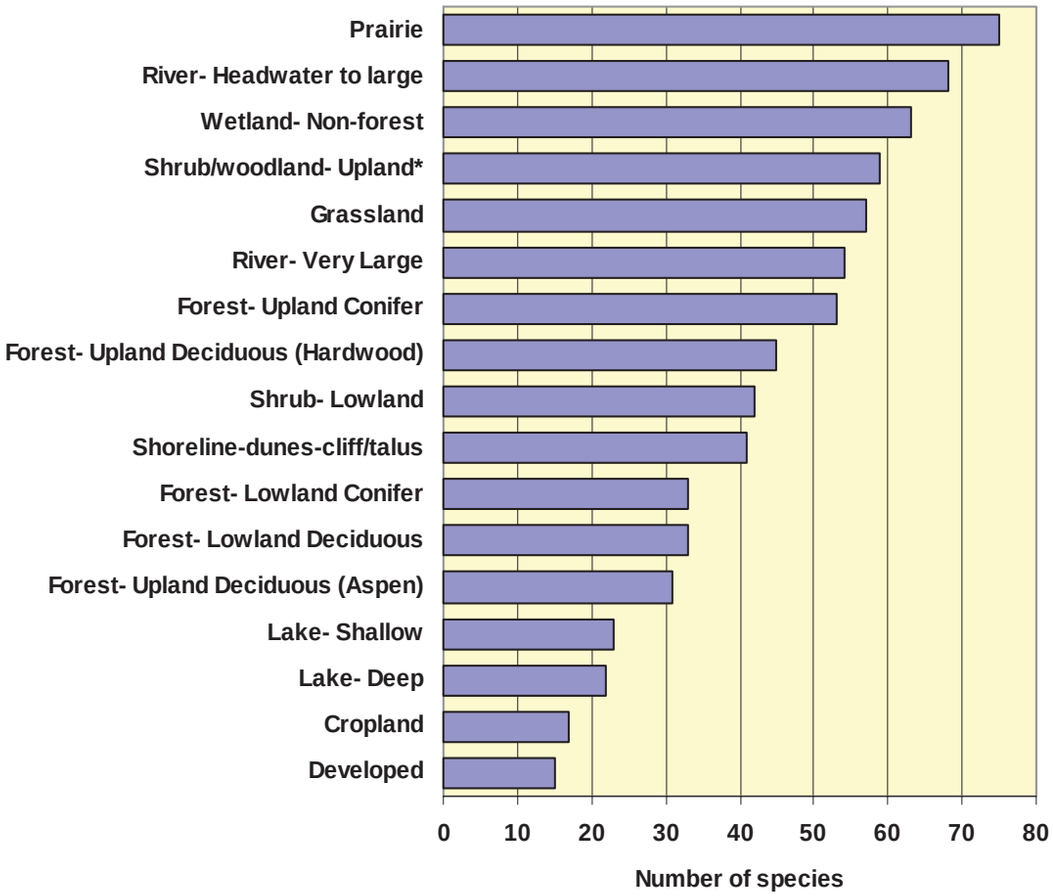


Figure 3.4. Statewide Number of Species in Greatest Conservation Need by Habitat



*** Shrub/woodland-Upland** includes oak savanna, jack pine woodland, and brush prairie.

Chapter 4

Framework: Goals, Challenges, and Priority Conservation Actions

Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS) provides a strategic framework to guide the investment of organizational and individual energy to better manage species in greatest conservation need (SGCN). We hope this framework will help practitioners focused on SGCN to identify the most important conservation actions, given their unique organizational and geographic contexts. Additionally, we hope members of the CWCS partnership (e.g., the Minnesota DNR, The Nature Conservancy, Minnesota Audubon, the U.S. Fish and Wildlife Service) will be able to use this framework as a decision-making tool when creating operational plans and annual budgets. The framework will be used to guide investment of State Wildlife Grant monies.

This chapter describes the components of the strategic framework developed by the CWCS. We discuss the planning logic and how that logic links knowledge to action. We address the progression from goals to priority conservation actions, giving background on why the various components are important to the CWCS. This strategic framework is used in each of the subsection profiles in chapter 5 of the CWCS. This chapter provides more detail about some of the priority conservation actions.

Planning Logic

Like most planning efforts, the CWCS created a logical structure to move from the big picture to discrete actions. The CWCS logical structure encompasses purpose, time frame, geographic scope, goals, management challenges and strategies, and priority conservation actions.

Purpose

The purpose of the CWCS is to maintain the species composition of Minnesota's native fauna. The CWCS defines the native fauna as those species present in the geographic area of Minnesota at the point of statehood (1858). Unfortunately, a number of native fauna have already been extirpated from the state. The purpose of the CWCS is to ensure that no more species are lost, that species with very low populations increase to self-sustaining levels, and that other SGCN populations are maintained at self-sustaining levels over time. Over the past 20 years, two species have been successfully reintroduced, trumpeter swans and peregrine falcons. The 2005 CWCS is not calling for further reintroduction efforts.

Time Frame

The 2005 CWCS is a 10-year strategy. The CWCS partnership intends to revise the CWCS in 2015. However, a longer time frame helps place this first 10 years in context. For example, the 2005 CWCS articulates action for the first 10 years of a 100-year effort to secure a sustainable future for native fauna in Minnesota. This is a more realistic time frame given the nature of conservation work. Thus, conservation stakeholders should recognize that during this initial 10 years we are taking first steps at the beginning of a 100-year journey to manage a wide array and diversity of species without as much information and experience as we would want.

Geographic Scope

There are many layers to the CWCS geographic scope. The explicit geographic scope of the CWCS is the state of Minnesota. Within that large frame the Ecological Classification System (ECS) of Minnesota delineates 4 provinces, 13 sections, 25 subsections, and many smaller land-type associations (see Figure 5.1). The 2005 CWCS uses the province and the subsection scales to present the conservation actions needed to better manage SGCN. However, many of the native fauna of Minnesota migrate to other parts of the region, continent, and world. This suggests that the geographic scope of the CWCS might include action in another part of the world to maintain the sustainability of a species "native" to Minnesota. In the 2005 CWCS, we have not explored these larger ecological scales, but perhaps the 2015 CWCS will be able to encompass them.

Goals

Three goals are articulated in the 2005 CWCS:

I. Stabilize and increase SGCN populations
II. Improve knowledge about SGCN
III. Enhance people's appreciation and enjoyment of SGCN

Each goal helps organize a series of management challenges, strategies, and priority conservation actions that can better focus investment in SGCN management. At present, State Wildlife Grant funds can be used to fund actions that accomplish Goals I and II but not Goal III. These goals set forth outcomes that can be evaluated to determine the progress (and, hopefully, the success) of the CWCS Partnership.

Management Challenges and Strategies

The management challenges articulate the central problems the partnership faces in accomplishing the goals, and the strategies establish the basic approaches to addressing the challenges. Within the subsection profiles, the goals, management challenges, and strategies provide the structure for setting the subsection-specific priority conservation actions. The management challenges and strategies, within each goal, are as follows:

Goal I	**Stabilize and increase SGCN populations**
Management Challenge 1	There has been significant loss and degradation of habitat
Strategy I A	Identify key SGCN habitats and focus management efforts on them
Management Challenge 2	Some SGCN populations require additional management attention
Strategy I B	Manage federal and state listed species effectively
Strategy I C	Manage emerging issues affecting specific SGCN populations
Goal II	**Improve knowledge about SGCN**
Management Challenge 1	More information about SGCN and SGCN management is needed
Strategy II A	Survey SGCN populations and habitats
Strategy II B	Research populations, habitats, and human attitudes/activities
Strategy II C	Monitor long-term changes in SGCN populations and habitats
Strategy II D	Create performance measures and maintain information systems
Goal III	**Enhance people's appreciation and enjoyment of SGCN**
Management Challenge 1	Need for greater appreciation of SGCN by people
Strategy III A	Develop outreach and recreation actions

Priority Conservation Actions

Priority conservation actions articulate the specific management actions that practitioners may undertake to better manage SGCN. Decision makers will be using the priority conservation actions as a framework for allocating state wildlife grant dollars to ensure successful CWCS implementation. Field practitioners can look to the priority conservation actions as a guide to setting their own SGCN-related work priorities, regardless of funding sources used. The categories of priority conservation actions are as follows: habitat management, species management, survey, research, monitoring, performance measures and information systems, and outreach and recreation. Within each of the subsection profiles found in chapter 5, the priority conservation actions articulate the work to be done in that subsection and are broadly tailored to the key habitats of each subsection.

Goal I: Stabilize and increase SGCN populations

The purpose of the CWCS is to sustain the species composition of Minnesota's native fauna. There are 292 species included in Minnesota's set of species in greatest conservation need. These are species whose populations have been determined to be rare, vulnerable, or declining. The set includes species from all the major taxa and all the geographic areas of Minnesota. It includes species that are listed as endangered, threatened, or of special concern and some species that are recreationally harvested.

The first goal of the CWCS is to stabilize and increase SGCN populations. In many cases, the first step is halting further population declines. To accomplish Goal I, it is essential to understand why SGCN populations are rare, vulnerable, and declining.

Management Challenge 1 – There has been significant loss and degradation of habitat

The CWCS examined problems that might be negatively affecting SGCN populations. Project staff reviewed the published literature (such as Partners in Flight documents, Shorebird Plan, Waterbird Plan, NatureServe Web site) and discussed the issue with taxonomic experts. Nine factors that might be creating problems for each species were assessed:

- Habitat loss in Minnesota
- Habitat degradation in Minnesota
- Habitat loss/degradation outside of Minnesota
- Invasive species and competition
- Pollution
- Social tolerance/persecution/exploitation
- Disease
- Food source limitations
- Other (e.g., peripheral species, road kills, communication towers)

Table 4.1 shows the results of the species problem assessment. The results indicate that habitat loss and degradation in Minnesota are the most serious challenges facing SGCN populations. This assessment confirmed what most managers and stakeholders have told CWCS staff: It's a habitat challenge.

Table 4.1. Results of Species Problem Assessment

Type of Problem	Percentage of SGCN for Which This Is a Problem	Percentage of SGCN for Which This May Not Be a Problem or for Which There Is No Information
Habitat loss in Minnesota	76	24
Habitat degradation in Minnesota	83	17
Habitat loss/degradation outside of Minnesota	24	76
Invasive species and competition	24	76
Pollution	32	68
Social tolerance/ persecution/ exploitation	21	79
Disease	3	97
Food source limitations	3	97
Other	18	82

These results have led the CWCS to focus this first 10-year plan primarily on habitat loss and degradation in Minnesota. By choosing this focus, the CWCS does not mean to ignore other serious problems. For example, the loss and degradation of habitat outside of Minnesota constitute a serious challenge. The CWCS Partnership hopes that efforts in other states to manage species in greatest conservation need will address some of these habitat problems. High visibility of CWCS efforts might lead to additional international focus on habitats in other countries that support Minnesota's SGCN.

Some of the problems, such as invasive species and pollution, can be viewed as habitat degradation. The CWCS identifies priority conservation actions that address invasive species, especially terrestrial invasive plants that are degrading key habitats. The CWCS also identifies priority conservation actions that address water quality in key stream habitats.

Other species problems, such as disease outbreaks or social tolerance, might demand attention. Priority conservation actions under Strategies IB and IC address how the CWCS will approach species-specific management challenges.

Strategy I A – Identify key SGCN habitats and focus management efforts on them

To address the management challenge of habitat loss and degradation in Minnesota, the CWCS identified key habitats in each subsection that are important for the SGCN that occur within that subsection. The CWCS used the following analyses to delineate key habitats:

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5 percent of 1890s or 1990s land cover and are modeled to have the most SGCN using them on a 99th percentile z-statistic;

B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5 percent of 1890s or 1990s land cover and have more than 15 species, 20 percent of which use two or fewer habitats (specialist species);

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5 percent of the 1890s land cover and have declined by more than 50 percent in the 1990s land cover. For wetlands this change was based on an analysis done by Anderson and Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a 99th percentile z-statistic of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences. (The results of Analysis E are presented as a list of key rivers/streams in Appendix I. Chapter 7, Methods and Analyses, provides a more detailed explanation of the five analyses.)

Applying these criteria in each subsection resulted in the identification of key habitats for each subsection as shown in Table 4.2.

Table 4.2. Key Habitats by Subsection

Subsection	Total habitats	Forest-Upland Deciduous (Aspen)	Forest-Upland Deciduous (Hardwood)	Forest-Upland Coniferous	Shrub/woodland-Upland	Prairie	Forest-Lowland Deciduous	Forest-Lowland Coniferous	Wetland-Nonforest	Grassland	Shoreline-dunes-cliff/talus	Lake-Shallow	Lake-Deep	River-Headwater to Large	River-Very Large
Agassiz Lowlands	4							x	x		x			x	
Anoka Sand Plain	7				x	x			x	x	x	x		x	
Aspen Parklands	6				x	x			x	x		x		x	
Big Woods	9	x	x		x				x	x	x	x		x	x
Blufflands	6				x	x			x		x			x	x
Border Lakes	5			x	x			x					x	x	
Chippewa Plains	4			x	x				x					x	
Coteau Moraines	3					x			x					x	
Glacial Lake Superior Plain	4	x	x	x										x	
Hardwood Hills	8	x	x		x	x			x	x		x		x	
Inner Coteau	3					x			x					x	
Laurentian Uplands	4			x	x			x						x	
Littlefork Vermilion Uplands	3			x				x						x	
Mille Lacs Uplands	9		x	x	x			x	x		x		x	x	x
Minnesota River Prairie	6					x			x		x	x		x	x
Nashwauk Uplands	5		x	x	x			x						x	
North Shore Highlands	5			x				x			x		x	x	
Oak Savanna	5				x	x			x	x				x	
Pine Moraines and Outwash Plains	4			x	x				x					x	
Red River Prairie	5					x	x		x					x	x
Rochester Plateau	5				x	x			x	x				x	
St. Louis Moraines	3			x									x	x	
St. Paul-Baldwin Plains	10	x	x		x	x			x	x	x	x		x	x
Tamarack Lowlands	4			x				x	x					x	
Toimi Uplands	4			x	x			x						x	
Total subsections		4	6	12	15	11	1	9	17	7	8	6	4	25	6

Priority Conservation Actions to Maintain and Enhance the Key Habitats

Within each subsection profile, the key habitats for SGCN are identified. Maintaining and enhancing these key habitats is a priority conservation action. A series of specific conservation actions that could be applied to maintain and enhance the key habitats in each subsection is delineated. For example, in the Blufflands Subsection, four priority conservation actions are identified to maintain and enhance oak savanna habitats:

a. Manage invasive species
b. Use prescribed fire and other practices to maintain savanna (keeping in mind invertebrates sensitive to fire)
c. Encourage oak savanna restoration efforts
d. Provide technical assistance to interested individuals and organizations.

In each of the subsection profiles, the phrase "actions include," precedes each series of specific actions. There may be many additional important conservation actions that could be implemented to maintain and enhance the key habitat; however, the actions listed are likely to be the most prominent over the next 10 years.

The primary audiences for the subsection profiles are field-level SGCN managers and their middle- and upper-level supervisors in the CWCS partnership organizations. Because the subsection profiles are intended to be easily accessible and useful, information is presented in a condensed fashion and the priority conservation actions listed for each key habitat are relatively terse. Therefore expanded descriptions of several priority conservation actions found in many of the subsection profiles are listed below. (Note: there are management options listed in Chapter 6 that can inform implementation of priority conservation actions for the key habitats.)

<u>Provide technical assistance to interested individuals and organizations</u>

In many ways, this is the most prominent priority conservation action to be undertaken during the first 10 years of the CWCS. This conservation action is listed for every key habitat. Most public land managers and private landowners are not experts in the management of rare wildlife. They need advice and assistance in voluntarily managing key habitats to benefit SGCN that fall within their management purview. Providing effective technical assistance is time-consuming and entails much more than simply supplying information. It requires building relationships with individual land managers and landowners to understand their needs, opportunities, and constraints. Field staff from the CWCS Partnership will offer such advice and assistance.

<u>Incorporate SGCN habitat concerns in existing forest management planning</u>

This priority conservation action is also prominent and is a special case of providing technical assistance. In Minnesota, there are several important forest management planning initiatives. Both national forests (Chippewa and Superior) have ongoing management planning activities within which SGCN habitat concerns can be addressed. The state forest system is undergoing several forest management planning processes,

such as Subsection Forest Resource Management Planning, Off Highway Vehicle Recreation Planning, and Forest Certification, through which SGCN habitat concerns also can be addressed. Subsection Forest Resource Management Planning is especially well suited to incorporate CWCS key habitat concerns because it too is structured around ECS subsections. In addition, The Nature Conservancy is leading a forest collaborative initiative in northern Minnesota, and the Minnesota Forest Resources Council is leading a landscape-level management initiative. All of these initiatives offer opportunities to incorporate key habitat concerns into larger management contexts.

Manage invasive species

Invasive species continue to expand and degrade key SGCN habitats. Notorious invasives, such as purple loosestrife, buckthorn, and zebra mussels, are being joined by numerous lesser known invasive terrestrial and aquatic plants and animals. One of the first steps in managing invasives, particularly terrestrial invasive plants, is to survey the extent of their presence in a given habitat. Once the extent of the invasive population is known, actions to remove, destroy, and/or control the invasives can be initiated.

Use prescribed fire and other practices to maintain habitat (keeping in mind invertebrates that are sensitive to fire)

Prescribed fire is an important habitat conservation action in traditionally fire-dependent systems. Savanna and prairie habitats are two prominent SGCN fire-dependent habitats in the southern and western subsections of Minnesota. Prescribed fire and other brush removal practices are essential to keep the savanna and prairie from being encroached upon by woody plants. However, prescribed fire requires special planning in places where invertebrate SGCN are present that are susceptible to fire. Other alternatives may be necessary to protect small, isolated populations of rare invertebrates.

Encourage habitat restoration efforts

A sometimes controversial priority conservation action is the restoration of key habitats. The dramatic loss of native prairie, oak savanna, and wetland habitats necessitates some level of restoration over the next 100 years. Unfortunately, restoration of these and other key habitats is difficult, expensive, and time-consuming. During the first 10 years of CWCS, some restoration work will be undertaken, but most of the effort will be focused on maintaining existing key habitats. Existing habitats harbor the raw materials (e.g., genetic material of native plants) without which successful restorations are impossible. During the next 30 to 40 years, restoration will likely become a larger component of the CWCS initiative.

Maintain stream integrity

Stream habitats are the most widely distributed key habitat in the state; they occur in every subsection. Stream integrity results from a complex combination of forces that shape stream habitat: hydrology, geomorphology, connectivity, water quality, and

biology. In any given location, these forces will need to be managed to maintain and enhance key SGCN habitat.

Enhance adjacent habitats

All the key habitats identified by the CWCS exist in a large landscape context within each subsection. They are like key pieces in the jigsaw puzzle of Minnesota's rare wildlife ecology. But just like key puzzle pieces (for example the corners), each is recognizably important in isolation but makes functional sense only when connected to adjacent pieces. Similarly, the key SGCN habitats are recognizably important in isolation, but each makes functional ecological sense only when connected to adjacent habitats. For example, wetland habitats in central and southern Minnesota can have adjacent grassland habitats. It is important to enhance the adjacent grassland habitats to increase the functional value of the wetlands. Adjacent habitats are particularly important for native prairie, wetland, and grassland habitats, and for riparian areas along identified priority stream reaches.

Enforce existing laws

A number of important laws and regulations support the conservation of key habitats. For example, there are water-quality laws, lakeshore and stream shore development regulations, local land-use development regulations, and invasive species laws and regulations that help conserve key habitats. One of the most important laws to conserve key SGCN habitats is the Wetlands Conservation Act. This law and its attendant regulations help ensure that Minnesota retains existing wetlands and mitigates unavoidable consequences of necessary land-use development.

Provide protection opportunities - selective acquisition of key habitats

Purchase of private land (either easement or fee title) for the express purpose of conserving critical natural resources is an important conservation action. The Nature Conservancy, the Minnesota DNR, and the USFWS purchase land to protect critical habitat and enhance habitat values of adjacent public lands, but this is always done with willing sellers who want the natural resource values of their land to be sustained for future generations. CWCS Partners may provide such protection opportunities to individuals and organizations to protect key SGCN habitats.

Management Challenge 2 – Some SGCN populations require additional management attention

Because there are 292 species in greatest conservation need, the 2005 CWCS promotes a habitat-oriented focus rather than a species-specific focus. Some species, however, will require specific management action. Species identified as endangered or threatened are at greater risk of extirpation than other SGCN and thus should receive particular management attention. Some SGCN populations need attention because they are recreationally or commercially harvested. Other species may require special attention

because of emerging circumstances, such as a disease outbreak or a threat from an invasive species. The following strategies and priority conservation actions respond to this management challenge.

Strategy I B – Manage federal and state listed species effectively

Species identified as endangered or threatened by the federal or state governments receive special management. Both federal and state laws protect these species and, in some cases, their habitats from destruction. In Minnesota, detailed federal recovery plans have been written for some species, such as the eastern timber wolf, the bald eagle, the piping plover, the Karner blue butterfly, and the Higgins eye and winged mapleleaf mussels. Developing these federal recovery plans is time consuming. The plans provide information about the species and specific steps needed to recover them to stable levels. A streamlined process for creating abbreviated recovery plans for other state endangered and threatened species, such as the Blanding's turtle, the wood turtle, and the timber rattlesnake, has been proposed and would provide guidance on management needs and priorities. During the first year of operational planning, a group of managers will convene to decide whether such a streamlined recovery planning process should be initiated and, if so, what species should be its focus. In addition, the DNR and other partners are already developing and delivering technical assistance to land managers for listed species management. Some priority conservation actions listed in the subsection profiles focus on listed species.

Strategy I C – Manage emerging issues affecting specific SGCN populations

Other SGCN populations that are not listed as endangered or threatened may require species-specific management. For example, several SGCN that are recreationally harvested need specific attention (e.g., northern pintail, American black duck, lesser scaup). The DNR and the USFWS have legal jurisdiction, regulations, and management plans for all waterfowl and for other SGCN that are recreationally or commercially harvested. In addition to harvesting, emerging issues, such as disease outbreaks, may require special management action directed toward specific SGCN. Priority conservation actions listed in the subsection profiles focus on these circumstances.

Goal II: Improve knowledge about SGCN

The second goal of the 2005 CWCS is to improve the scientific knowledge and management understanding of the 292 species in greatest conservation need. One of the central responsibilities of government is to provide the public with information and knowledge about natural resources held in trust for it. This requires not only the collection and creation of knowledge through survey and research work but also the maintenance, analysis, and publication of that knowledge, ensuring that residents and managers have access to and understanding of important information.

Management Challenge 1 – More information about SGCN and SGCN management is needed

As much as we know about rare wildlife, there is so much more that we do not know. Some of the species in greatest conservation need, especially the birds, are well known. For other SGCN, especially the invertebrates, little information is available. Through survey, research, and monitoring strategies, the CWCS intends to improve knowledge about SGCN over the next 10 years so that the 2015 CWCS has a greater body of knowledge to use in evaluating the first 10-year strategy and in developing the second 10-year strategy.

Strategy II A – Survey SGCN populations and habitats

Surveys are an essential tool for gaining greater knowledge about SGCN. They are generally one-time efforts to collect meaningful information about populations or habitats in a specific geographic area. Surveys provide managers with immediate information that is relevant to implementing other conservation actions. The subsection profiles contain several important priority conservation actions pertaining to surveys, including those described below.

Continue MCBS rare animal surveys

The Minnesota County Biological Survey (MCBS) is one of the most crucial SGCN-related conservation actions being undertaken in Minnesota. MCBS animal survey professionals are painstakingly surveying each county in Minnesota for rare animals and their habitats. They begin with aerial analysis to locate likely remaining habitats and then do on-the-ground surveys to locate species and habitats. Their data are maintained in the Minnesota Natural Heritage Information System Rare Features Database. Approximately two-thirds of Minnesota's 87 counties have been surveyed. It is vital that the MCBS animal surveys be completed in the remainder of the state.

Survey SGCN populations related to key habitats

It is very important over the next 10 years that surveys are directed toward SGCN using key habitats. With so much to learn, there must be a systematic approach to investing scarce resources in gathering information. The key habitats are a priority for survey work. To the extent feasible, surveys should adhere to rigorous scientific standards so that data collected can be compared with other valid information and provide better management information.

Survey wildlife taxa underrepresented by MCBS animal surveys

Some wildlife taxa (for example, terrestrial and aquatic invertebrates) are not as thoroughly surveyed by MCBS as the CWCS project desires. Scientifically rigorous surveys of these taxa should be a priority during the next 10 years.

Assess the amount and quality of key habitats and map their locations

It is vital that managers understand the quantity and quality of key habitats within their work areas. Existing data on land cover and habitat location are often more than 10 years old. Little information is available on the quality of key habitats as it relates to SGCN, especially in forest habitats. Key habitat assessments should be a high priority during the next 10 years.

Strategy II B – Research populations, habitats, and human attitudes/activities

Research is obviously a vital tool in improving knowledge about SGCN. Research allows the CWCS Partnership to investigate the intricacies of relationships between SGCN and their habitats, as well as interspecific relationships between SGCN. Research also allows managers to understand human attitudes, values, and activities related to SGCN, which are so important to blending management of SGCN with other critical resource management objectives. Some examples of priority conservation actions found under the research strategy in the subsection profiles are described below.

Research important aspects of species populations

For many SGCN, information on life history and habitat requirements is limited. Researching the life histories of some SGCN, or groups of SGCN, that are closely tied to key habitats in particular subsections may provide essential information for management.

Research important aspects of SGCN habitats

The subsection profiles list a number of important aspects of SGCN habitats that would be valuable to research, including best management practices for key habitats, patterns and distributions of key habitat to better support SGCN, and functional components within key habitats. This type of information would greatly improve the ability of natural resource managers to maintain and enhance habitats for SGCN, as well as help them provide technical assistance to other land managers.

Research important aspects of people's understanding of SGCN

Human attitudes, values, and activities are at the heart of much of SGCN management. Human beings have the capacity to change the face of the landscape, often destroying species' habitats. In most cases, humans are unaware of the impacts their land use has on wildlife. Understanding how much people know about SGCN, how they value them, and how they might want to enjoy and appreciate them is important so that SGCN management can stay in step with and help shape people's understanding and appreciation of the natural environment.

Strategy II C – Monitor long-term changes in SGCN populations and habitats

The ability to monitor long-term changes in SGCN populations and habitats is critical to the success of CWCS efforts. If the 2005 CWCS is the first in a series of 10 strategies that will span 100 years, then creating a long-term monitoring system is extremely sensible. However, it is also very difficult for a number of reasons. First, information and research technologies are changing rapidly. Compatibility of new research information and new information technologies complicates managing long-term monitoring systems. Second, political and organizational support for long-term monitoring is difficult to maintain in the face of short-term crisis management and more exciting, immediately relevant information gathering. Nonetheless, long-term monitoring information is the only way to understand the trends that are affecting SGCN and SGCN habitats. In the first year of operational planning for CWCS (2006), the Partnership will create an operational plan for a robust monitoring system for the CWCS. Some examples of priority conservation actions that will be implemented by that operational plan for monitoring are described below.

Monitor long-term trends in SGCN populations

Because the long-term population trends for rare, vulnerable, or declining species in greatest conservation need are not positive, it is essential that we monitor them. However, we cannot, practically speaking, monitor all 292 SGCN to the same degree. Several population-monitoring efforts already exist in Minnesota, including those for breeding birds, forest birds, loons, frogs and toads, and waterfowl populations. A commitment has been made to begin monitoring mussel populations, building on the statewide mussel survey work. Additional population monitoring actions might be needed to ensure that adequate information about SGCN is available to evaluate the performance of the 2005 CWCS and to develop a new CWCS in 2015.

Monitor long-term trends in SGCN habitats

SGCN habitats are a central feature of the 2005 CWCS, especially key SGCN habitats. It is therefore essential that CWCS begin to monitor SGCN habitats. Fortunately, monitoring the 16 key SGCN habitats identified in the 2005 CWCS is easier than monitoring 292 species populations. There will be a need to update the land cover information at a statewide level, as well as develop information about quantity, quality, and location of habitats at finer levels of resolution. The Minnesota DNR is collaborating on a new wetlands monitoring program related to the Wetlands Conservation Act, and this work should provide valuable information on those key habitats. The monitoring group that will convene during the first year of CWCS operational planning will consider other habitat monitoring initiatives.

Strategy II D – Create performance measures and maintain information systems

Performance evaluation is a critical feature of an effective adaptive management system. For evaluation to be feasible, the CWCS partnership needs to develop and apply a set of performance measures. Information that is germane to the performance measures (e.g., survey, research, and monitoring) needs to be collected and analyzed. All of this must be stored in a state-of-the-art information management system. The 2005 CWCS is committed to creating performance measures and maintaining investment in information management systems. Some examples of priority conservation actions for the performance measures and information systems strategy are discussed below.

Create and use performance measures

Members of the CWCS Partnership are aware of the value of performance measures. The Nature Conservancy, Audubon Minnesota, the Minnesota DNR, USFWS, and the University of Minnesota already use measures to evaluate performance to determine how well (or poorly) they are doing. This partnership must take these experiences and the information generated through survey, research and monitoring, and direct them toward developing CWCS-related performance measures. In addition, individual CWCS-related projects should have explicit performance measures that allow evaluation of the projects and of the cumulative performance of related projects. These evaluations must be incorporated in field-level and upper-level adaptive management decisions that allow the CWCS to adapt and grow over the next 10 years.

Maintain and update information management systems

As was mentioned above, information management technology continues to develop at a rapid pace. The CWCS Partnership must be willing and able to invest in updating and maintaining the information systems upon which all other aspects of the CWCS depend.

Goal III: Enhance people's appreciation and enjoyment of SGCN

It is essential that residents and visitors appreciate and enjoy Minnesota's wonderful wildlife diversity, especially the species in greatest conservation need. Such appreciation and enjoyment will breed commitment to SGCN management. Such commitment also will translate into collaboration on SGCN habitat management, SGCN-based tourism and recreation, and political support for further investment in CWCS-related actions.

Management Challenge 1 – Need for greater appreciation of SGCN by people

Recent polling data collected for a joint Nature Conservancy–International Association of Fish and Wildlife Agencies initiative suggest that average Americans do not think wildlife is in trouble. The analysis of SGCN populations and habitats suggests otherwise. Members of the CWCS partnership need to communicate effectively with people about SGCN so that they can appreciate the beauty and diversity of rare wildlife and better understand their precarious ecological situation. People need to understand the

connection between the viability of SGCN populations and the ecosystem services upon which humans depend (e.g., clean water, clean air, crop pollination,). It is also important to help them understand where and how they can personally enjoy rare wildlife species.

Strategy III A – Develop outreach and recreation actions

The 2005 CWCS articulates several priority conservation actions under this strategy. Partners will need to create new information about SGCN and communicate with people about them. The CWCS document itself represents new information about SGCN, but this document is intended for professional staff working in the field, not for average members of the public. Consequently, new and different information must be developed that is specifically targeted to other non–wildlife professional audiences. In addition, existing opportunities to enjoy SGCN-based recreation should be appropriately publicized, keeping in mind the risk of impacting scarce habitat by too much recreational activity. New opportunities to enjoy SGCN recreationally need to be developed as well. Priority conservation actions that address these ideas are included in the subsection profiles. Appendix J, Wildlife Recreation and Tourism Considerations, contains some additional ideas on how to stimulate SGCN-based recreation.

Conclusion

The Minnesota Comprehensive Conservation Strategy (CWCS) provides a strategic framework to guide the investment of organizational and individual energy in better management of species in greatest conservation need (SGCN). This framework consists of a purpose (sustain all native wildlife), a time frame and geographic scope (a 10-year strategy and subsection-level scope), goals (stabilize populations, improve knowledge, enhance appreciation), challenges (habitat and species information and awareness), strategies (key habitats, recovery plans, essential information, citizen awareness), and priority conservation actions (maintain and enhance key habitats, manage the most at-risk species, create meaningful information, communicate with residents). This framework will help practitioners identify the most important work for them to do, given their unique organizational and geographic context.

Chapter 5

An Ecological Assessment of Species in Greatest Conservation Need in Minnesota

Chapter 5 is the heart of *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS). It begins by presenting an overview of the ecology of Minnesota, then scales down to the state's four Ecological Classification System (ECS) provinces, and then down further to the 25 ECS subsections (see Figure 5.1). The statewide overview describes Minnesota's history and ecology. The province-level information provides a more detailed description and assessment of the species in greatest conservation need (SGCN), their key habitats, and the ecological patterns that arise at this level. The 25 subsection profiles, organized alphabetically within each of their respective provinces, provide similar but more detailed information about SGCN and key habitats as well as priority conservation actions.

The CWCS stakeholders—biologists, conservation planners, and other natural resource professionals—work at a variety of levels to sustain Minnesota's species in greatest conservation need. Given this fact, the information provided in this chapter is relevant to people working at multiple conservation scales and can be approached from a number of ways, ranging from interest in a particular SGCN or key habitat to information specific to a geographic location.

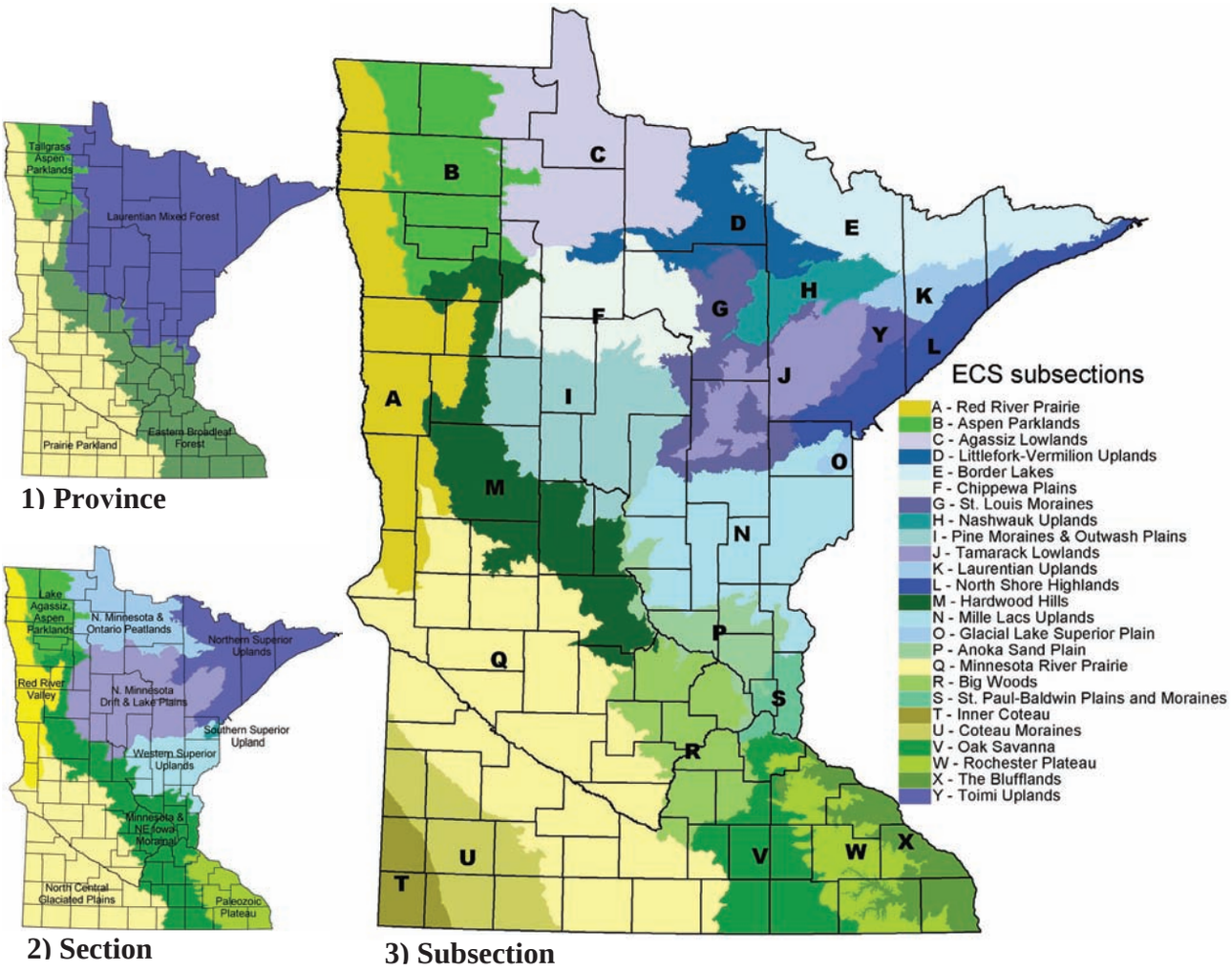
Minnesota's Ecological Classification System (ECS) was developed by the Minnesota Department of Natural Resources and the U.S. Forest Service for ecological mapping and landscape classification. This ecological land classification hierarchy is used to identify, describe and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. There are eight levels of ECS units in the United States; the CWCS focuses on two, province and subsection. Provinces are units of land defined using major climate zones, native vegetation, and biomes such as prairies, deciduous forests, or boreal forests. There are four Provinces in Minnesota. Subsections are units within the provinces that are defined using glacial deposition processes, surface bedrock formations, local climate, topographic relief and the distribution of plants, especially trees. Minnesota has 25 subsections.

Province Summaries and Assessments

Although the information used to develop conservation actions and priorities was generated at the subsection level, much of it can be scaled up to the province level to provide a different perspective. This overview of the four provinces provides summary information about SGCN by province, including the number and percentage of SGCN unique to each province and the number and percentage of SGCN using at least one key

habitat. In the CWCS, key habitats are defined as those habitats that are most important to Minnesota's SGCN. Specifically, they have been defined as those habitats (1) used by the greatest number of SGCN, (2) changed the most over the past 100 years, (3) having a high percentage of habitat specialist SGCN, or (4) having been identified as important stream segments by The Nature Conservancy.

Figure 5.1. Ecological Classification System for Minnesota – Three Levels



While the province summaries are not as detailed as the subsection profiles, they can help guide management decisions at this coarser scale. Province-level information on land use, ownership, human population, and SGCN identifies patterns unique to this scale and sets the context for the subsection information.

Province-Level Summaries of Species in Greatest Conservation Need

Information about the numbers of SGCN in each subsection and SGCN unique to the subsection are provided for each province. The subsections are ranked by number of SGCN from highest to lowest. This ranking may help conservation stakeholders prioritize work within a province. For example, the number of SGCN (128) found in the Mille Lacs Uplands Subsection is substantially higher than in the other subsections in the Laurentian Mixed Forest Province and is a large proportion of the total 171 SGCN that potentially occur in this province. Thus, conservation stakeholders may decide to focus more efforts on this important subsection.

Summaries of Key Habitats

For each province, two tables summarize the key habitats in the subsections found in that province. The first table ranks the habitats by the frequency with which they are identified in the subsections as key habitats. For example, in the Eastern Broadleaf Forest Province, three habitats are key habitats in all seven subsections found in the province: Shrub/woodland-upland, nonforested wetlands, and headwater to large rivers. The second table ranks the subsections by their number of key habitats. For example, in the Eastern Broadleaf Forest Province, the St. Paul-Baldwin Plains Subsection has 10 key habitats, the highest number in the province, while the Rochester Plateau has five, the lowest number. This information can be used to help identify priorities at the province level, such as which subsections may require more resources because they have more key habitats.

Assessment of Species in Greatest Conservation Need and Key Habitats

This assessment identifies the number of species that use at least one key habitat at the subsection, province, and statewide scales and thus the species that potentially benefit from the key habitats approach. Subsections are ranked within each province by the percentage of SGCN that use at least one key habitat in that subsection. Statewide, 92 percent of SGCN use at least one key habitat. The provinces range from 87 percent of SGCN that use at least one key habitat in Tallgrass Aspen Parklands to 96 percent in the Laurentian Mixed Forest.

Subsection Profiles Overview

There are 25 subsection profiles in the CWCS, one for each ECS subsection in the state. The CWCS Technical Team scaled the plan to this level because it believes information about the subsections is meaningful for making decisions about SGCN and their habitats. The purpose of each of the subsection profiles is to identify key habitats and conservation actions called for during the next 10 years. This part of the plan is intended to help focus and coordinate the attention of the CWCS partnership in new and innovative ways.

Many of the analyses used to produce the subsection profiles are described in greater detail in chapter 7, Methods and Analyses. Without this analytical context, the material in the subsection profiles may seem dense and challenging.

Each subsection profile is six pages long and contains four major parts:

- Subsection Overview
- Species in Greatest Conservation Need
- Key Habitats
- Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Subsection Overview and Quick Facts

The subsection overview provides a general description of the major characteristics of the subsection, as well as a brief review of the historical and existing dominant vegetation communities and current land uses in the subsection.

The quick facts and land use/land cover pie chart provide general information regarding current land ownership patterns and land uses in the subsection. The information is based on the 2000 U.S. Census data for population density, Minnesota GAP Analysis Project Stewardship data for land ownership, and GAP Land Cover data for the land use/land cover pie chart. (GAP is a nationwide project coordinated by the U.S. Geological Survey and is aimed at setting priorities for protection of critical wildlife habitat. GAP brings together three critical data elements: vegetation maps, land ownership maps, and ranges of wildlife species.)

Species in Greatest Conservation Need

SGCN by Taxonomic Group Table

This table presents the species in greatest conservation need for each subsection by taxonomic group. This information was derived using the methods developed by the Minnesota GAP project's predicted occurrence modeling for the terrestrial vertebrate species. For aquatic and invertebrate species, the information was derived by consulting with species experts (see chapter 3 for further SGCN information). This table also compares the number of SGCN by taxonomic group to the total number of SGCN in the set. For example, the 16 reptile SGCN known or predicted to occur in the Blufflands Subsection represent 95 percent of all the reptiles in the SGCN set statewide. This information helps conservation stakeholders identify whether a subsection is relatively important for certain taxa.

Subsection Highlights

This section provides summary-level interesting facts relevant to species management goals and objectives, such as wildlife viewing opportunities and unique assemblages of SGCN. By no means exhaustive, the highlights nonetheless provide the reader with an understanding of some characteristic features of the subsection.

Species Spotlight

The species spotlight provides an in-depth view of one SGCN known to occur in the subsection. The species selected are often unique representatives of the subsection, whether they are endemic to that particular subsection, facing serious population declines, or serve as a flagship for other important SGCN in the subsection. Species chosen for the spotlights are not meant to represent all SGCN occurring in the subsection but are simply used to illustrate the variety of SGCN identified in the CWCS.

SGCN Element Occurrences by Township Map

This map, on the second page of each subsection profile, depicts by township the number of validated records of species in greatest conservation need since 1990. Records are based on data from the Minnesota County Biological Survey of animal species, the DNR fish survey database, the statewide mussel survey, and other validated records in the Rare Features Database of the Natural Heritage Information System. Some caution must be used in interpreting this map because the quality of information varies by location. Most important, the County Biological Survey has not yet surveyed some areas of the state. These areas should be cautiously and carefully compared to the ones that have been surveyed because a low number of occurrences may simply be an indication that no one has looked for the species, not that the area supports fewer SGCN. The intent of these maps is to prompt discussion among conservation stakeholders about the reasons for differences in SGCN abundance between townships. Possible topics for discussion would include:

1. The amount of available habitat
2. The quality of available habitat
3. The status of biological inventories
4. The inherent biological diversity of an area

Definitive answers to detailed questions that arise in the minds of conservation stakeholders about the information presented on these maps will require more in-depth field-based examinations.

Overlaid on top of the township maps are lands owned by public agencies and conservation-based organizations (primarily, but not exclusively, The Nature Conservancy). These data are from the Minnesota GAP stewardship layer.

Species Problem Analysis

The species problem analysis provides information on the types of problems SGCN face in the subsection (see chapter 7 for more detailed discussion.) This analysis shows that the overwhelming influence on species vulnerability and decline in every subsection is the loss or degradation of habitat.

Key Habitats—For Species in Greatest Conservation Need

Key habitats are defined as those habitats most important to the greatest number of SGCN in a subsection. Considered the heart of the subsection profiles, this section provides the rationale for why and how key habitats were selected by subsection. Five individual analyses were done to arrive at the key habitats to be targeted for conservation actions over the next 10 years. These analyses are described briefly on the third page of each profile and in greater detail in chapter 7. They are:
A: Terrestrial habitat use analysis
B: Specialist terrestrial habitat use analysis
C: Terrestrial habitat change analysis
D: Aquatic habitat use analysis
E: The Nature Conservancy/SGCN occurrence analysis

Distribution of Key Habitats and Species Richness by Township Map

This map, located on the fourth page of each subsection profile, shows how the key habitats array across the subsection. The source of this information varies by subsection. Native plant community maps created by the Minnesota County Biological Survey are used where available; otherwise, key habitats are identified from the Minnesota GAP Landcover. Native plant community maps provide an indication of high-quality habitat, whereas the GAP land cover habitat information gives no indication of quality. Key habitats identified from the GAP Land Cover overrepresent the habitat that is suitable for SGCN, so caution is recommended when interpreting this information. Information other than GAP land cover was available to assess the quality of grassland habitat for some of the subsections. These included two data sources developed by the U.S. Fish and Wildlife Service Habitat and Population Evaluation Team (HAPET): Grassland Bird Conservation Areas (GBCA) and grassland in their satellite derived landuse/landcover map. Grassland identified by the Twin Cities Metro Regionally Significant Ecological Areas (RSEA) was used for the St. Paul Baldwin Plains and Moraines subsection. Information on deep lakes is from the MN DNR 24k Lakes database, and for shallow lakes it is from the MN DNR shallow lakes program. Data used for rivers and streams are from several sources, which are identified in the individual subsection profiles.

The sources of data for the maps in the subsection profiles are identified in each individual profile. Detailed map references are located in Appendix K.

Key habitats are overlaid on a map showing the number of SGCN species (species richness) by township, based on occurrence information presented in the previous map, SGCN Element Occurrences by Township. Note that this map sums the number of different species by township, whereas the previous map presents the number of documented species records by township.

Especially in areas where native plant community data are not available, these species richness maps can help to locate areas that need further investigation of possible quality key habitats identified through the GAP land cover. Like the species occurrence map,

these maps are not intended to be definitive but rather are intended to inspire further exploration.

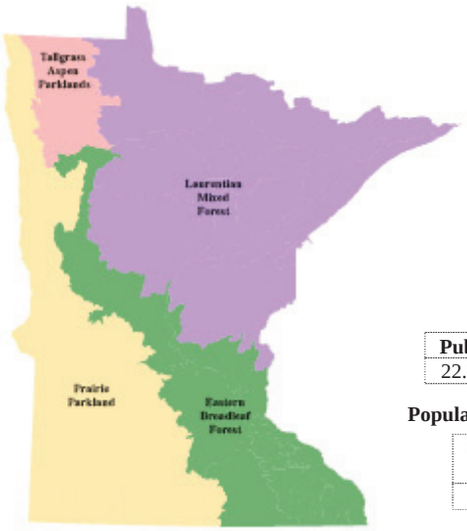
Subsection Habitat Percentages and Habitat Use by SGCN Taxa

This table describes all habitats present in the subsection, in descending order of percentage cover based on the 1990s land cover information. The habitats in boldface are the key habitats as identified by the key habitat analysis described above. The nonboldface habitats are not key habitats but are present in some amount in the subsection. In addition, SGCN use of all the habitats is described by taxonomic group, with the total of all SGCN by habitat listed in the last column.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Many of the priority conservation actions identified in this section are tailored to each subsection profile but are nevertheless quite broad in scope. These conservation actions describe the menu of possible actions for SGCN-related work. During implementation, these actions will be more clearly delineated through collaborative discussions among local managers in the CWCS partnership.

Minnesota



Quick facts

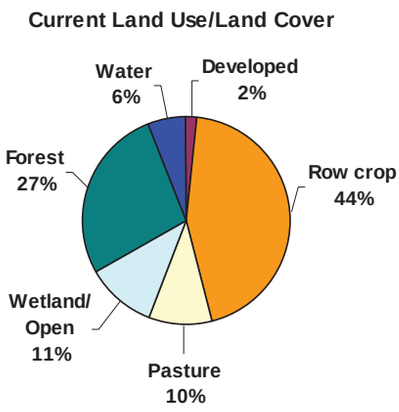
Acres: 54,006,738

Ownership

Public	Private	Tribal
22.8%	75.7%	1.5%

Population density (people/sq. mi.)

Current	Change (2000-2010)
75.0	+9.6



State Overview

Minnesota lies at the center of North America where three major biomes meet, the prairie, boreal forest and eastern deciduous forest. This unique location on the continent created a natural heritage rich in wildlife resources. From timber wolves in the north to timber rattlesnakes in the south, Minnesota's wildlife diversity is renowned. Minnesota's conservation community has been working to maintain and enhance this rich wildlife heritage that provides so many benefits to our economy, ecology, and society.

The Geology of Minnesota

Considered in geologic time, Minnesota's landscapes are dynamic and constantly changing. Long before historic human occupation, drastic changes occurred when massive sheets of ice pushed across the state. As these sheets of ice inched southward, growing as snow accumulated, they shaped Minnesota's four provinces.

When the glacial lobes began their retreat around 14,000 years ago, the resulting meltwater formed enormous rivers and lakes. The largest of these, Glacial Lake Agassiz, with a basin of almost 600,000 square miles, covered all of northwestern Minnesota at one time and was the largest glacial lake in North America. This lake began forming in the southern Red River valley 11,700 years ago and finally disappeared from the state around 9,000 years ago. During much of this period, the lake's northern outlets were barricaded by ice. Thus, its only outlet was the Glacial River Warren, which drained to the south and whose river corridor is visible today as the broad Minnesota River valley. As the ice continued to retreat, previously blocked northern drainage outlets gradually opened, and Lake Agassiz began to drain northward, as the Red River does today.

Water Resources

Minnesota is a water-rich area, where lakes, rivers, and wetlands abound. It is home to three major river basins: the Great Lakes–St. Lawrence River Drainage, the Hudson Bay Drainage, and the Gulf of Mexico Drainage. Within these three major drainage areas are 10 large watersheds. The Red River and Rainy River flow north to Hudson Bay. The Lake Superior Watershed flows east through the St. Lawrence River and then to the Atlantic Ocean. The remaining seven watersheds—the Minnesota River, Missouri River, Des Moines River, Upper and Lower Mississippi River, the St. Croix River, and the Cedar River—flow south by way of the Mississippi River to the Gulf of Mexico. Very little water enters Minnesota from streams originating in other states or Canada.

Minnesota's More Recent Past

The Native Americans encountered in the middle of the 17th century by Minnesota's first European explorers were heirs to varied cultural traditions that can be traced back at least 12,000 years. The first human inhabitants of Minnesota were most likely Paleo-Indians. These pioneers entered the state in small numbers as the lobes of the last major glacier, the Wisconsin, receded. In some areas, they seem to have been highly mobile gatherers and hunters who pursued big game such as bison, woodland caribou, mastodons, and mammoths. In more recent periods, native peoples probably relied more on farming, hunting, and harvesting wild plants.

In the past 200 years, Euro-American settlers arrived and spread throughout Minnesota, substantially changing the landscape. Increased agricultural activity in the 1800s meant the loss of vast tracts of native prairie, hardwood forests, and wetlands. On the heels of farmers came loggers, who harvested much of the northern forestland in the state by the early 1900s. Rivers and streams were dammed and channelized, altering the structure of their corridors, preventing the passage of some aquatic animals, and changing the natural rhythm of water levels. During this period, there was rapid population growth and major shifts in the settlement pattern from rural locations to urban centers.

T. Whitfield MN DNR

Dry prairie (foreground) and Minnesota's agricultural landscape (background) – Hardwood Hills Subsection

Today, Minnesota's landscape continues to change. Agriculture and forestry remain significant and important parts of the economy. Minnesota's urban centers are vibrant, and many continue to expand. The state's bountiful rivers, lakes, and wetlands continue to be pressured by development and population growth. In 2000, Minnesota's population was just under 5 million people and is projected to approach 6.3 million by 2030, a gain of 27 percent.

Amid the changes that continue across all of Minnesota's diverse landscapes are tremendous opportunities to improve the quality and diversity of habitats on both public and private lands for the benefit of people and wildlife. Working in broad partnership with residents and the conservation community, the CWCS is designed to conserve key habitats that will benefit the greatest possible number of species in greatest conservation need. With efforts like these in place, Minnesota's wildlife will continue to inhabit Minnesota's landscapes and enrich the lives of the people who live here.

Minnesota's Species in Greatest Conservation Need and the SGCN Problem Assessment

Out of almost 1,200 documented species of wildlife in Minnesota, there are 292 SGCN. Each of these 292 SGCN was evaluated to determine the factors influencing their rarity, vulnerability, or decline. Table 5.1 lists the nine problems, or factors, used in the analysis, and the percentage of SGCN for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation are the most significant challenges facing SGCN populations. An assessment of the SGCN that potentially benefit from the key habitats approach shows that a substantial number of SGCN use at least one key habitat at the subsection, province, and statewide scales. Statewide, 92 percent of SGCN use at least one key habitat, and in the provinces the range is from 87 percent in the Tallgrass Aspen Parklands Province to 96 percent in the Laurentian Mixed Forest Province. The range in the subsections is from 51 percent to 98 percent (Table 5.2). All of these results suggest that the coarse filter approach for managing key habitats is likely to benefit a great number of the 292 SGCN in Minnesota.

Table 5.1. SGCN Problem Assessment for Minnesota

Problem	Percentage of SGCN for which this is a problem
Habitat Loss in MN	76
Habitat Degradation in MN	83
Habitat Loss/Degradation Outside of MN	24
Invasive Species and Competition	24
Pollution	32
Social Tolerance/Persecution/Exploitation	21
Disease	3
Food Source Limitations	3
Other	18

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Table 5.2. Statewide Summary by Subsection of Species That Use Key Habitats

Province	Subsection	Percent of SGCN using at least 1 key habitat	Total number of SGCN	Number of SGCN using at least 1 key habitat
Eastern Broadleaf Forest	Anoka Sand Plain	85.6	97	83
	Oak Savanna	87.1	93	81
	Rochester Plateau	88.3	94	83
	The Blufflands	89.1	156	139
	Hardwood Hills	92.9	85	79
	Big Woods	95.9	121	116
	St. Paul Baldwin Plains	98.0	149	146
Laurentian Mixed Forest	St. Louis Moraines	51.4	74	38
	Glacial Lake Superior Plain	56.4	55	31
	Littlefork Vermilion Uplands	68.7	67	46
	Agassiz Lowlands	76.1	88	67
	Nashwauk Uplands	80.0	60	48
	Border Lakes	81.2	69	56
	North Shore Highlands	82.1	84	69
	Toimi Uplands	84.6	52	44
	Tamarack Lowlands	85.5	69	59
	Pine Moraines & Outwash Plains	86.5	89	77
	Laurentian Uplands	87.9	58	51
	Chippewa Plains	89.2	83	74
	Mille Lacs Uplands	97.7	128	125
Prairie Parkland	Minnesota River Prairie	87.9	116	102
	Coteau Moraines	92.3	78	72
	Inner Coteau	93.6	78	73
	Red River Prairie	94.0	83	78
Tallgrass Aspen Parklands	Aspen Parklands	87.1	85	74

Minnesota's Four Provinces and 25 Subsection Profiles

Overview

There are four major ecological provinces in Minnesota: the Eastern Broadleaf Forest, the Laurentian Mixed Forest, the Prairie Parkland, and the Tallgrass Aspen Parklands. All four are parts of much larger systems that cover major areas of central North America. The Eastern Broadleaf Forest Province, primarily made up of deciduous forest, extends eastward from Minnesota all the way to the Atlantic Ocean. The Laurentian Mixed Forest Province, largely consisting of coniferous forest, extends northward into Canada. The Prairie Parkland Province extends westward into the Dakotas and across the Central Plains of the United States. The Tallgrass Aspen Parklands Province represents the southern tip of a large province that extends north and west into the Canadian Prairie Provinces.

Tables 5.3 and 5.4 provide summary information about SGCN by province.

Table 5.3. Number of SGCN in Provinces and Number and Percentage of SGCN Unique to Provinces

Province	Number of SGCN	Number SGCN Unique to Province	Percentage of SGCN Unique to Province
Eastern Broadleaf Forest	205	51	25
Laurentian Mixed Forest	171	47	27
Prairie Parkland*	139	13	9.3
Tallgrass Aspen Parklands*	85	2	2.3
*Prairie Parkland and Tallgrass Aspen Parklands combined	147	20	14

Table 5.4. Number and Percentage of SGCN That Use Key Habitats

Province	Total number of SGCN	Number of SGCN Using At Least 1 Key Habitat	Percentage of SGCN Using At Least 1 Key Habitat
Tallgrass Aspen Parklands	85	74	87.1
Prairie Parkland	139	127	91.4
Eastern Broadleaf Forest	205	192	93.7
Laurentian Mixed Forest	171	164	95.9
State total	292	269	92.1

Eastern Broadleaf Forest Province

Quick facts

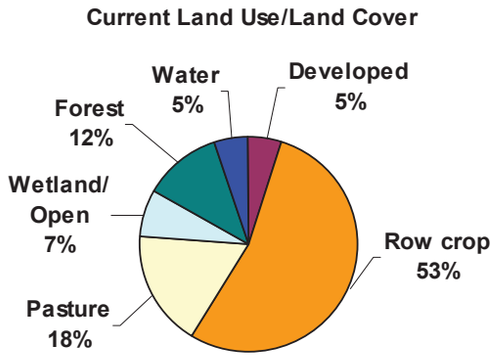
Acres: 11,839,537 (22% of state)

Ownership

Public	Private	Tribal
4.7%	95.1%	0.2%

Population density (people/sq. mi.)

Current	Change (2000-2010)
257.9	+38.4



Overview

The Eastern Broadleaf Forest Province is a transition zone between the prairie to the west and the mixed coniferous-deciduous forest to the northeast. The province can be visualized as a belt that passes diagonally across Minnesota from the southeastern forests through the prairie-coniferous transitional zone to the Tallgrass Aspen Parklands in the

B. Delaney MN DNR

A landscape view of the Eastern Broadleaf Forest Province – Morrison County – Hardwood Hills Subsection

northwest. The deciduous woods are a species-rich extension of the eastern United States deciduous forest, and numerous plant and animal species occur here at the very western edge of their range. Topography varies from level plains to the very steep blufflands that border the Mississippi River. Major landforms include lake plains, outwash plains, end moraines, ground moraines, and drumlin fields.

During Minnesota's last glacial period, the ice sheet sculpted portions of this geologically unique landscape but missed the "driftless" portion in southeastern Minnesota, northeastern Iowa, and southwestern Wisconsin. This area features caves, ravines, and sinkholes, and clear, spring-fed trout streams course through the steep and hilly countryside rich with plant and animal life. In the Twin Cities area, channels of preglacial rivers cut through rock formations, which later filled with glacial till. Once the till settled, the chains of lakes that now meander through the cities formed in the depressions.

Hardwood forests are home to many wildlife species that are enjoyed and appreciated by Minnesotans. Among the "must-see" species of this region are the wild turkey, red-shouldered hawk, cerulean warbler, Louisiana waterthrush, wood duck, and Blanding's turtle. Many people are also surprised to learn that the blufflands along the Mississippi River are home to the timber rattlesnake.

Row crop agriculture is one of the major land uses in this province. Recreation and tourism are also important industries, especially around the lakes. Many wetlands are scattered throughout this province, providing significant opportunities for wildlife recreation.

This province is home to the majority of Minnesotans. The urban and suburban areas of the Twin Cities and other regional centers like St. Cloud and Rochester continue to expand, although not quite as rapidly as in the 1990s.

Province Subsections

Anoka Sand Plain
Big Woods
Blufflands
Hardwood Hills
Oak Savanna
Rochester Plateau
St. Paul Baldwin Plains and Moraines

Summaries of Species in Greatest Conservation Need

A list of the species in the province, including identification of those unique to the province, is found in Appendix F. Table 5.5 presents the number of species in greatest conservation need in each subsection and the number unique to each subsection. Subsections are ranked from most to fewest SGCN. This ranking can help conservation stakeholders prioritize their efforts in a province. For example, the Blufflands, St. Paul-

Baldwin Plains, and Big Woods subsections have considerably more species in greatest conservation need than the other subsections in the Eastern Broadleaf Forest Province. Further investigations into the reasons for these differences should be carried out during implementation of the CWCS.

Table 5.5. Number of SGCN in and Number Unique to the Eastern Broadleaf Forest Province by Subsection

Subsection	Number of SGCN	Number of SGCN Unique to Subsection
Blufflands	156	14
St. Paul Baldwin Plains	149	1
Big Woods	121	1
Anoka Sand Plain	97	1
Rochester Plateau	94	0
Oak Savanna	93	1
Hardwood Hills	85	1
Eastern Broadleaf Forest Province	205	51

H. Texler MN DNR

Floodplain forest of the Mississippi River valley – Blufflands Subsection

SGCN Problem Assessment

The SGCN problem assessment provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the province. The following table lists the percentage of SGCN in the province influenced by nine possible factors or problems. The results of the species problem assessment indicate that habitat loss and degradation in the province are the predominant challenges facing SGCN populations.

Table 5.6. SGCN Problem Analysis for the Eastern Broadleaf Province

Problem	Percentage of SGCN for which this is a known problem
Habitat Loss in MN	82
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	26
Invasive Species and Competition	26
Pollution	35
Social Tolerance/Persecution/Exploitation	22
Disease	3
Food Source Limitations	4
Other	20

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Summaries of Key Habitats

Table 5.7 ranks the habitats by the frequency with which they are identified in the subsections as key habitats. Table 5.8 ranks the subsections by their number of key habitats.

Table 5.7. Frequency of Key Habitats in the Eastern Broadleaf Forest Province by Subsection

Key Habitats Ranked by Frequency	Number of Subsections	Percentage of Subsections
Shrub/Woodland-Upland	7	100
Wetland-Nonforest	7	100
River-Headwater to Large	7	100
Grassland	6	86
Prairie	6	86
Shoreline-dunes-cliff/talus	4	57
Lake-Shallow	4	57
Forest-Upland Deciduous (Aspen)	3	43
Forest-Upland Deciduous (Hardwood)	3	43
River-Very Large	3	43

Table 5.8. Number of Key Habitats in the Eastern Broadleaf Forest Province by Subsection

Subsection	Number of Key Habitats
St. Paul Baldwin Plains	10
Big Woods	9
Hardwood Hills	8
Anoka Sand Plain	7
Blufflands	6
Oak Savanna	5
Rochester Plateau	5

Assessment of SGCN and Key Habitats

Table 5.9 shows the number of species that use at least one key habitat at the subsection, province, and statewide scales. Subsections are ranked within each province by the percentage of SGCN that use at least one key habitat in the subsection. The percentages do not vary greatly among the subsections in the Eastern Broadleaf Forest Province.

Table 5.9. SGCN That Use Key Habitats in the Eastern Broadleaf Forest Province by Subsection

Subsection	Total Number of SGCN	Number of SGCN Using at Least 1 Key Habitat	Percentage of SGCN Using at Least 1 Key Habitat
St. Paul Baldwin Plains	149	146	98.0
Big Woods	121	116	95.9
Hardwood Hills	85	79	92.9
Blufflands	156	139	89.1
Rochester Plateau	94	83	88.3
Oak Savanna	93	81	87.1
Anoka Sand Plain	97	83	85.6
Province total	205	192	93.7
State total	292	269	92.1

Note: Subsections are ranked by the percentage of SGCN that use at least one key habitat in the subsection.

Anoka Sand Plain

SUBSECTION OVERVIEW

The Mississippi River forms the western boundary of the Anoka Sand Plain Subsection. A broad, flat, sandy lake plain dominates the majority of this area and forms the eastern and northern boundaries. Historically, the predominant vegetation was oak savanna and upland prairies surrounded by varied wetland complexes.

This subsection stretches across the northern Twin Cities metropolitan area, including St. Cloud to the west and North Branch to the east, and has the second fastest-growing population in the state. Urban development and agriculture (primarily sod and vegetable crops), which occurs in about one-third of the subsection, has resulted in the loss of prairie and savanna and drainage of peatlands.

Quick facts

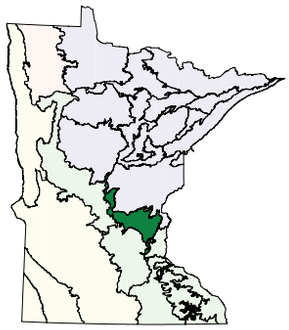
Acres: 1,199,711 (2.2% of state)

Ownership

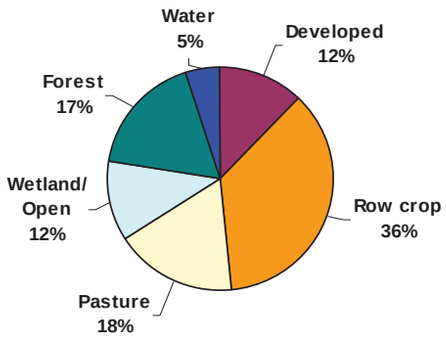
Public	Private	Tribal
9.7%	90.3%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
627	+103



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

97 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Anoka Sand Plain. These SGCN include 39 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 8 mammal SGCN are known or predicted to occur in the Anoka Sand Plain, approximately 36% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common Mudpuppy
Birds	56	57.7	Eastern meadowlark
Fish	3	6.4	Greater redhorse
Insects	9	16.1	Uncas skipper
Mammals	8	36.4	American badger
Mollusks	9	23.1	Fawnsfoot
Reptiles	8	47.1	Gopher snake
Spiders	3	37.5	*Tutelina formicaria*

HIGHLIGHTS

- This subsection is well-known for sandhill cranes, trumpeter swans, bald eagles, bobolinks, and lark sparrows. Other important species are badgers, Blanding's turtles, and gopher snakes.
- Important habitat features include dry prairie associated with scattered wetlands, rivers, and streams, which provide excellent habitat for Blanding's turtles, both species of hognose snakes, and bullsnakes.
- Some of the best examples of dry oak savanna in the state occur in this subsection.
- Carlos Avery WMA and Sherburne NWR are important stopover sites for migratory birds.

SPECIES SPOTLIGHT

Blanding's turtle *(Emydoidea blandingii)*

Distribution Found in marshes, ponds, and river bottoms of Central, East-Central, Southeastern, and Southwestern MN, especially where adjacent uplands have sandy soil suitable for nesting.

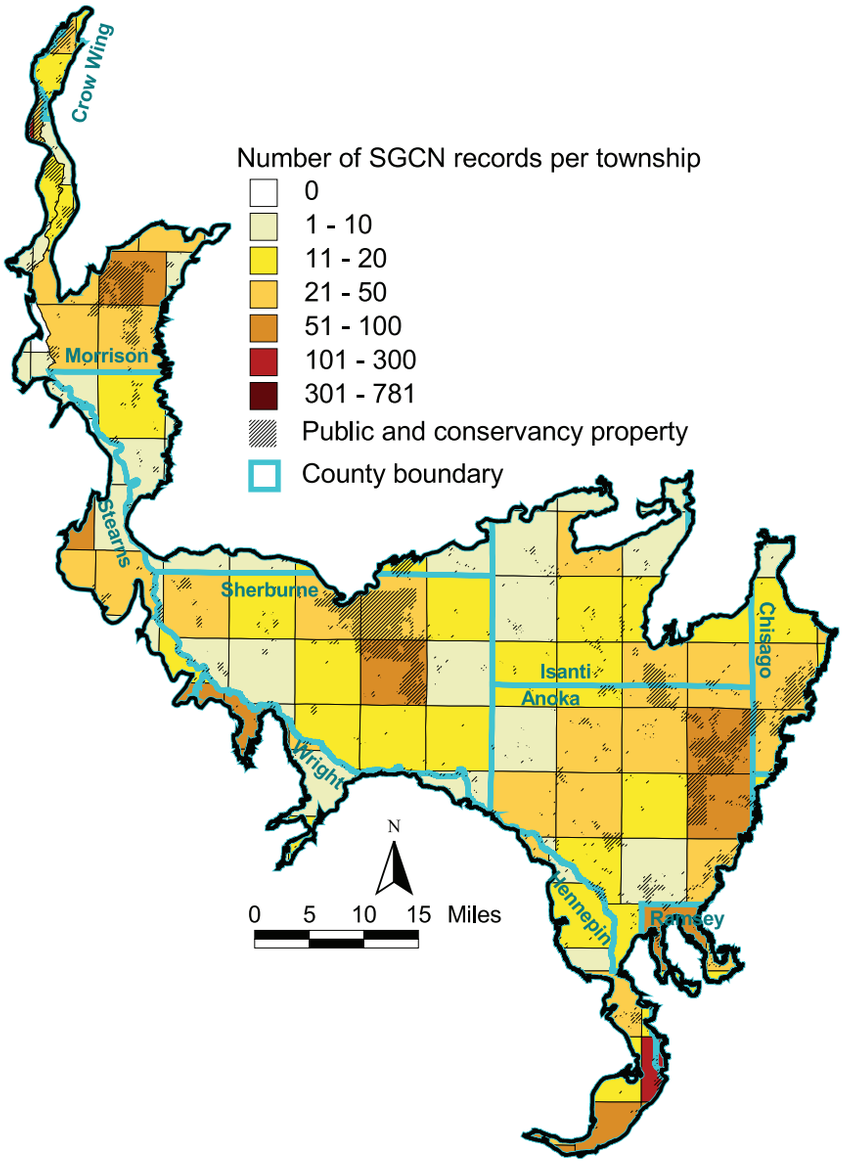
Abundance Abundant in some localized areas of SE MN, but also regularly encountered in the Anoka Sand Plain and recently found to be more common than previously known along small streams adjacent to prairies and grasslands of SW MN. Reasons for decline include changes due to land use, urban sprawl into former nesting areas, and fragmentation of remaining habitats.

Legal Status State list-Threatened.

Comments Travels up to a mile from wetlands to uplands for nesting, and moves between wetlands throughout the summer, making it vulnerable to road traffic.

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	82
Habitat Degradation in MN	87
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	26
Pollution	36
Social Tolerance/Persecution/Exploitation	24
Disease	3
Food Source Limitations	2
Other	12

Anoka Sand Plain

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Oak Savanna	X		X		
Prairie	X	X	X		
Wetland-Nonforest	X	X	*		
Grassland	X				
Shoreline-dunes-cliff/talus (Dune habitat)		X			
Lake-Shallow				X	
River-Headwater to Large					X

***Wetlands had not changed by more than 50% at the time of the 1984 Anderson & Craig study, but recent changes in this subsection indicate further wetland loss has occurred.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

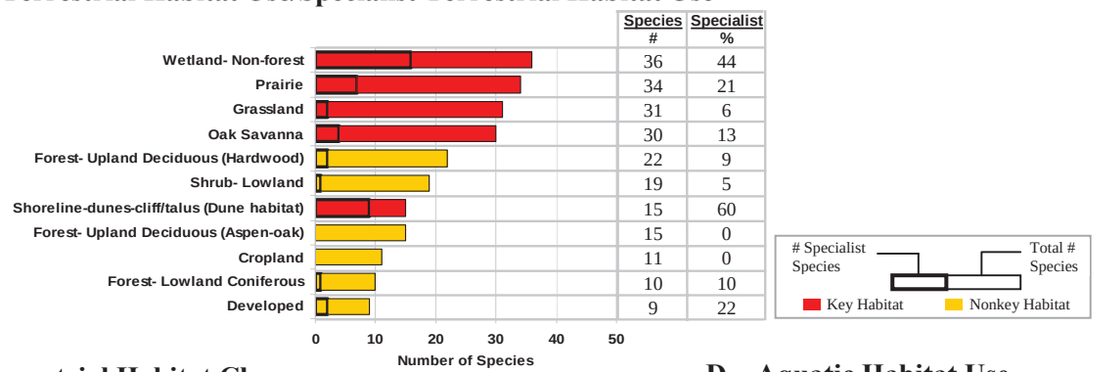
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

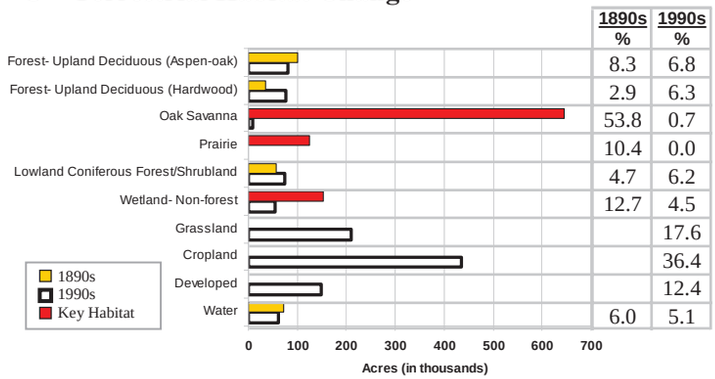
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

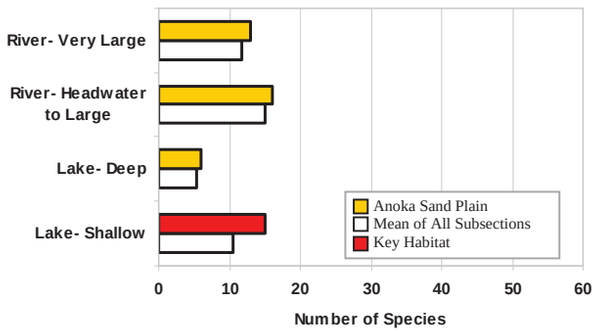
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



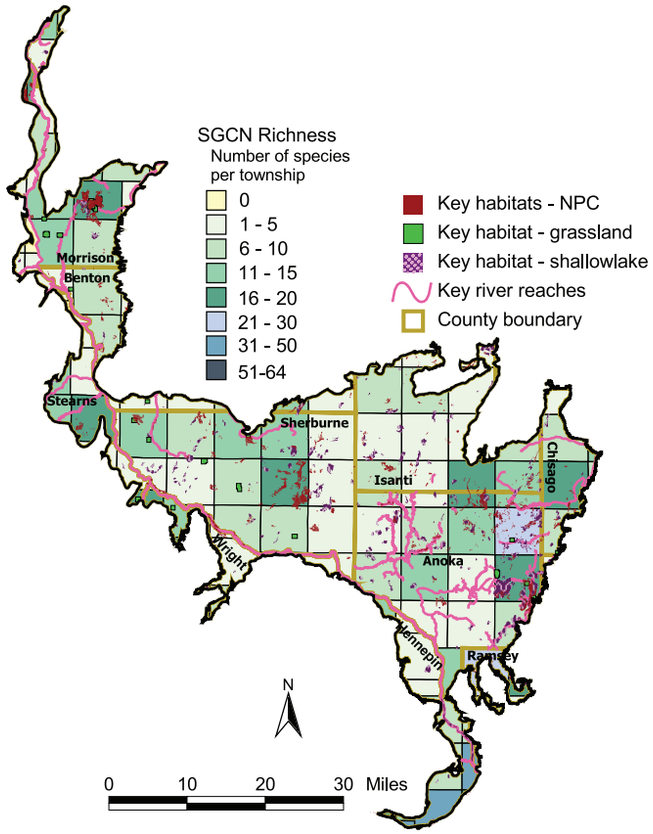
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Grassland Bird Conservation Areas (GBCA), 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Cropland	N/A	36.4		6			4		1		11
Grassland	N/A	17.6		17			8		6		31
Developed	N/A	12.4		5		1	3				9
Forest-Upland Deciduous (Hardwood)	2.9	11.0		14		2	4		2		22
Forest-Lowland Coniferous	4.7	6.2		7		1	1			1	10
Wetland-Nonforest	12.7	4.5		29		1	3		2	1	36
Lake-Shallow	N/A	2.8		12					2		14
Forest-Lowland Deciduous	1.2	2.4		13			2		2		17
Lake-Deep	N/A	2.3	1	2	2				1		6
Forest-Upland Deciduous (Aspen-oak)	8.3	2.1		13			2				15
Forest-Upland Coniferous	0.0	1.6		12		2	4		4		22
Oak Savanna	53.8	0.7		15		5	6		4		30
Prairie	10.4	0.0		15		3	7		6	3	34
Shoreline-dunes-cliff/talus (Dune habitat)	N/A	N/A		11			2		2		15
Shrub-Lowland	N/A	N/A		14		1	3		1		19
River-Headwater to Large	N/A	N/A	1	3	2	1		6	3		16
River-Very Large	N/A	N/A	1	1	1			8	2		13

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Oak savanna habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Dune habitats**, actions include:
   a. Support the protection of dune habitats from damaging development
   b. Enhance dune habitats to support SGCN
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
7. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed

Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Big Woods

SUBSECTION OVERVIEW

The Minnesota River runs through the middle of the once predominantly forested Big Woods Subsection. The Mississippi River forms the northeastern boundary. Lakes and wetlands are common; more than 100 lakes are greater than 160 acres in size, and many are groundwater-controlled with no inlets or outlets. Before settlement by people of European descent, the most common tree species of the Big Woods were red oak, sugar maple, and American elm.

Today, most of this region is farmed, and only a small fraction of the original "Big Woods" remains. Forested areas are widely separated from each other, although a good deal of edge habitat remains. The Twin Cities metropolitan area continues to expand into the subsection, and both farming and urbanization have led to dramatic changes in habitats. Water quality is also a conservation concern in this agricultural landscape.

Quick facts

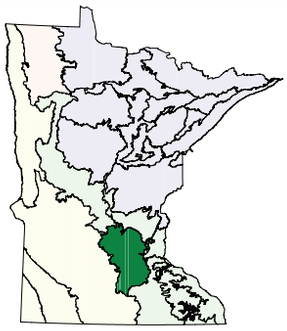
Acres: 2,211,763 (4.1% of state)

Ownership

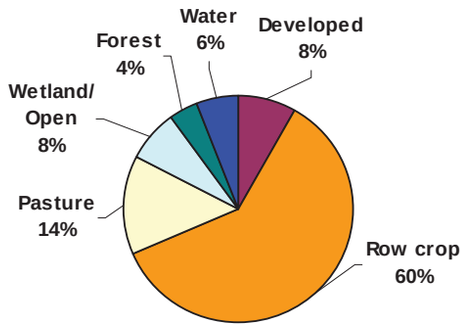
Public	Private	Tribal
3.6%	96.4%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
415	+55.7



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

121 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Big Woods, the fourth most of all subsections in Minnesota. These SGCN include 55 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 7 mammal SGCN are known or predicted to occur in the Big Woods, approximately 32% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common mudpuppy
Birds	59	60.8	Cerulean warbler
Fish	16	34.0	Least darter
Insects	3	5.4	*C. macra macra*
Mammals	7	31.8	Western Harvest Mouse
Mollusks	23	59.0	Mucket
Reptiles	10	58.8	Eastern racer
Spiders	2	25.0	*None documented since 1990*

HIGHLIGHTS

- Big Woods habitats feature woodland birds such as red-shouldered hawks and warblers, savanna species such as Blanding's turtles and red-headed woodpeckers, and wetland species such as turtles, ospreys, Forster's terns, and black terns.
- The Minnesota River also provides habitat to many species. Smooth softshell turtles utilize exposed sand bars and south-facing cut-banks as basking and nest sites. Forested river terraces are occupied by milk snakes and western foxsnakes, while bull snakes and racers live among open sandy terraces.
- Areas important for SGCN include the Minnesota Valley NWR; Three Rivers Park District's regional parks; numerous WMAs; Lake Maria SP; and Wolsfeld Woods, Whitney Island, Cannon River Trout Lily, and Kasota Prairie SNAs.

SPECIES SPOTLIGHT

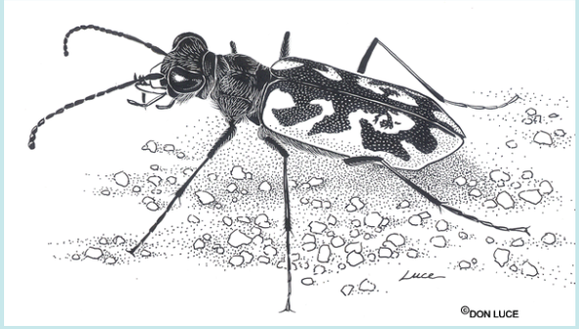
Sandy stream tiger beetle (*Cicindela macra macra)*

Distribution Known to occur on moist sandy soil sites along stream edges in widely scattered locations from Washington County, south to Fillmore, Winona, and Wabasha Counties. Recent observations have been limited to only two counties.

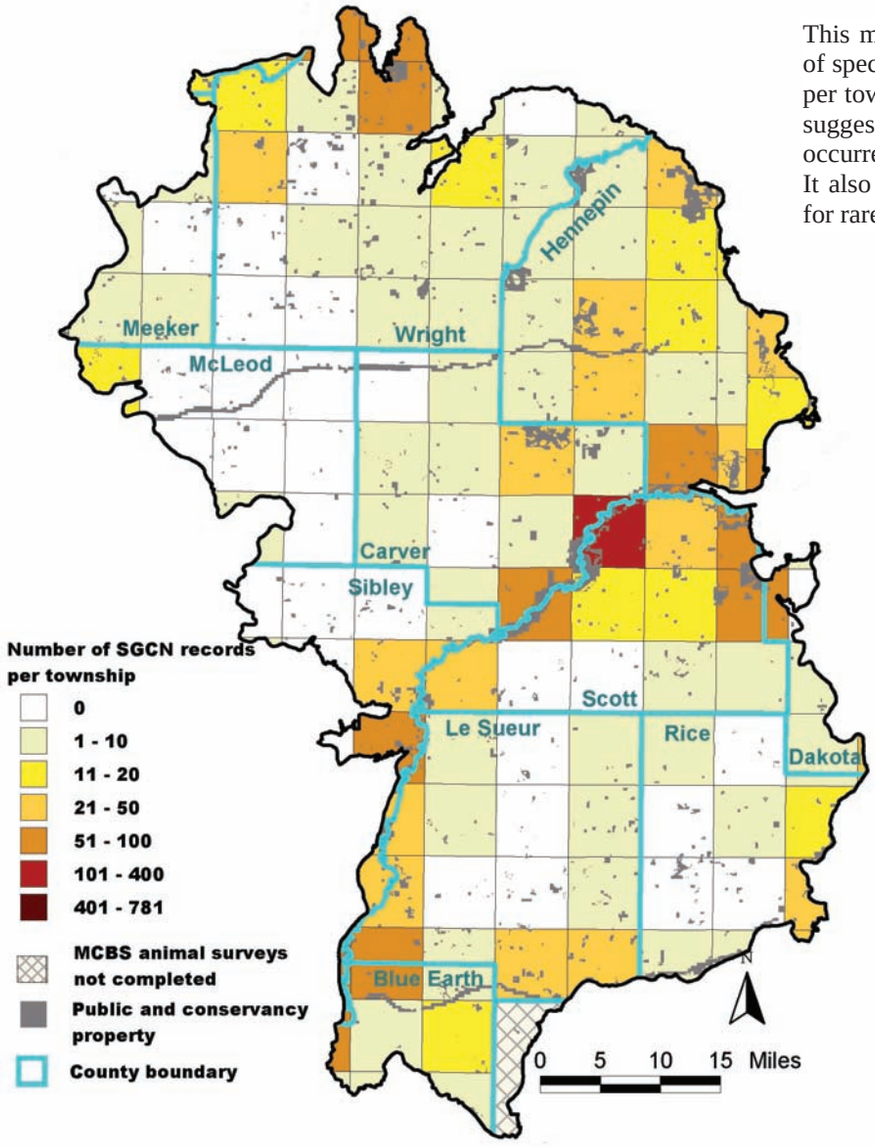
Abundance Extremely rare.

Legal Status State list-Special Concern.

Comments More surveys are needed to fully document the occupied range of this species. Streamside habitats are subject to trampling in pastures and flooding due to creation of impoundments.



SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	85
Habitat Degradation in MN	90
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	36
Pollution	40
Social Tolerance/Persecution/Exploitation	24
Disease	4
Food Source Limitations	3
Other	13

Big Woods

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Deciduous (Aspen-oak)			X		
Forest-Upland Deciduous (Hardwood)			X		
Oak Savanna			X		
Wetland-Nonforest	X	X	X		
Grassland	X				
Shoreline-dunes-cliff/talus		X			
Lake-Shallow				X	
River-Headwater to Large				X	X
River-Very Large (Minnesota River)				X	X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

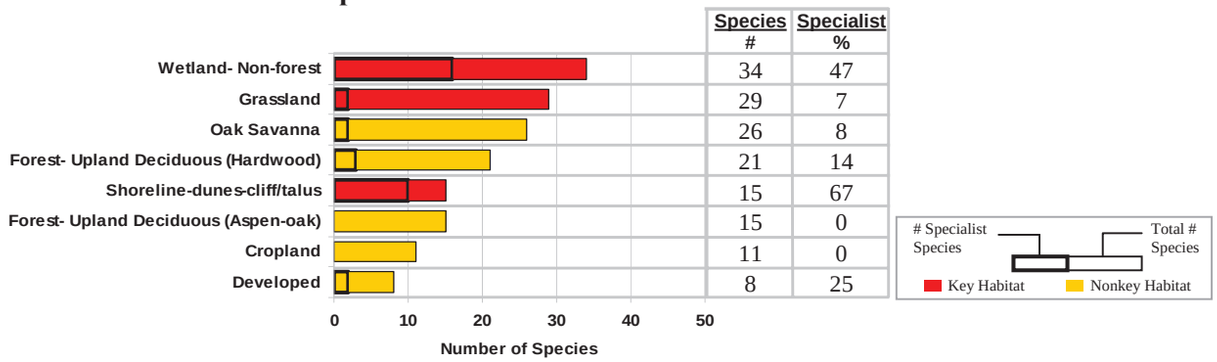
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

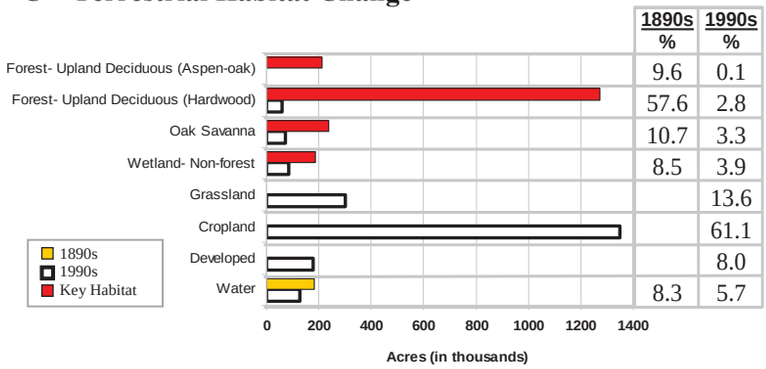
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

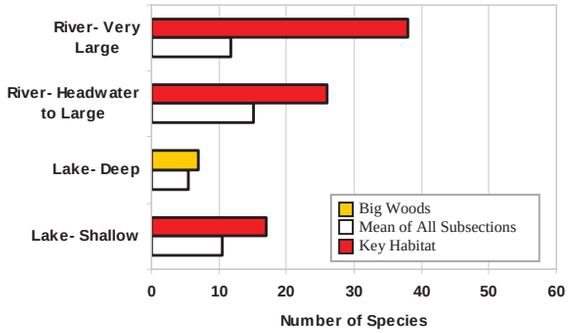
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



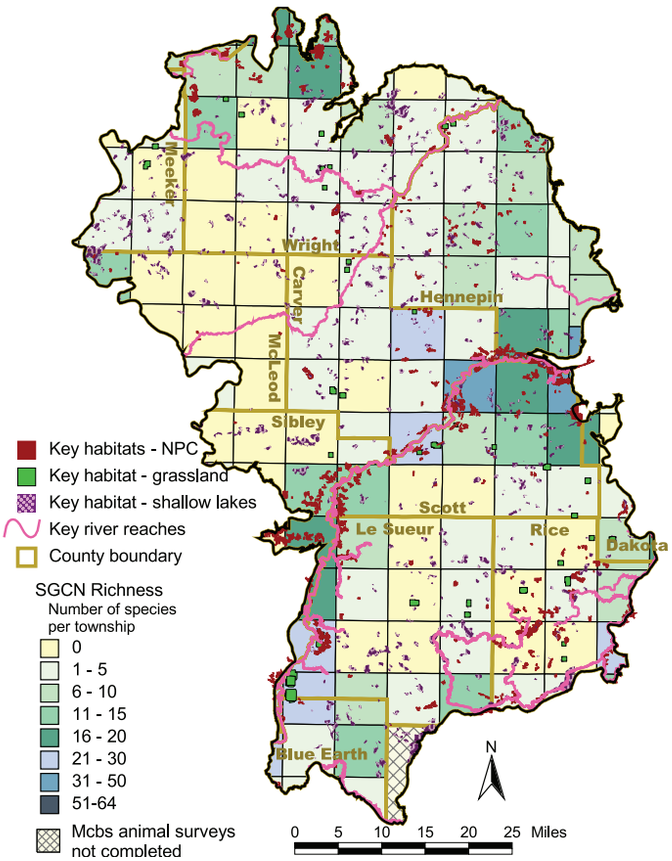
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Grassland Bird Conservation Areas (GBCA), 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Cropland	N/A	61.0		6			4		1		11
Grassland	N/A	13.6		16			7		6		29
Developed	N/A	8.0		4			3		1		8
Wetland-Nonforest	8.5	3.9		30			2		2		34
Lake-Shallow	N/A	3.7		13	1				2		16
Oak Savanna	10.7	3.3		15			6		5		26
Forest-Upland Deciduous (Hardwood)	57.6	2.8		15			4		2		21
Lake-Deep	N/A	2.0	1	2	3				1		7
Forest-Lowland Deciduous	2.0	1.0		14			2		1		17
Forest-Lowland Coniferous	0.1	0.4		6							6
Forest-Upland Coniferous	0.0	0.2		12			3		4		19
Forest-Upland Deciduous (Aspen-oak)	9.6	0.1		13			2				15
Prairie	3.2	0.0		14		2	7		7	2	32
Shoreline-dunes-cliff/talus	N/A	N/A		11		1	1		2		15
Shrub-Lowland	N/A	N/A		13			3		1		17
River-Headwater to Large	N/A	N/A	1	2	10	1		9	3		26
River-Very Large (Minnesota River)	N/A	N/A	1	1	11	1		21	3		38

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland deciduous aspen-oak forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Upland deciduous hardwood forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Oak savanna habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
7. **Shoreline habitats**, actions include:
   a. Support the protection of shoreline from damaging development
   b. Enhance SGCN habitat along the shoreline
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
8. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed

Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Blufflands

SUBSECTION OVERVIEW

The Blufflands Subsection in southeastern Minnesota, dominated by the Mississippi River, is characterized by bluff prairies, steep bluffs, and stream valleys, often 500 to 600 feet deep. Numerous cold-water trout streams feed major rivers such as the Root, Whitewater, Zumbro, and Cannon. Rich hardwood forests grow along the river valleys, and river-bottom forests grow along major streams and backwaters. There are few lakes.

Agriculture, both row crops and pastures, takes place in former savanna and prairie areas and is the most prominent land use in this subsection. Forestry is also an important land use, and outdoor recreational opportunities abound, with significant amounts of public lands along the river corridor. Retaining or restoring the health of stream systems is an important conservation objective in this subsection.

Quick facts

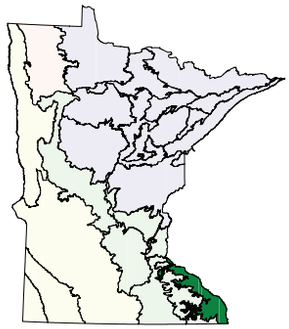
Acres: 1,287,434 (2.4% of state)

Ownership

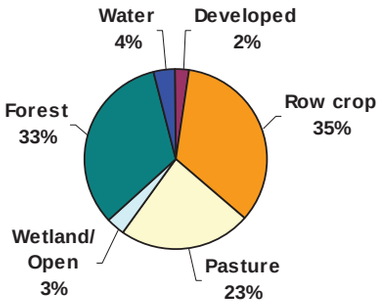
Public	Private	Tribal
11.2%	88.8%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
58.7	+3.1



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

156 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Blufflands – the most of all the subsections in Minnesota. These SGCN include 82 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 9 mammal SGCN are known or predicted to occur in the Blufflands, approximately 41% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	3	50.0	Pickerel frog
Birds	53	54.6	Blue-winged warbler
Fishes	26	55.3	Crystal darter
Insects	14	25.0	Karner blue butterfly
Mammals	9	40.9	Northern myotis
Mollusks	32	82.1	Hubricht's vertigo
Reptiles	16	94.1	Timber rattlesnake
Spiders	3	37.5	*P. apacheanus*

HIGHLIGHTS

- The Blufflands provides a critical migratory corridor for forest songbirds, raptors, and waterfowl. It is the most important subsection for reptiles and one of the most important subsections for mollusks.
- It is an important area for birds such as Henslow's sparrows, prothonotary warblers, red-shouldered hawks, Louisiana waterthrushes, and peregrine falcons. It is also an important area for Karner blue butterflies and Blanding's turtles.
- Reptiles, amphibians, snails, mussels, and fish are special features of this landscape, including timber rattlesnakes, milk snakes, paddlefish, shovelnose sturgeon, pallid shiners, American eels, pirate perch, skipjack herrings, and several Pleistocene snails.
- Areas important for SGCN include the Whitewater, Gores Pool, and McCarthy Lake WMAs; Upper Mississippi River NWR; Kellogg-Weaver Dunes, Great River Bluffs, John Latsch, Whitewater, and Frontenac SPs; and Cannon River Turtle Preserve and Mound Prairie SNAs.

SPECIES SPOTLIGHT

Timber rattlesnake *(Crotalus horridus)*

Distribution Blufflands of SE Minnesota along the Mississippi River and its tributaries.

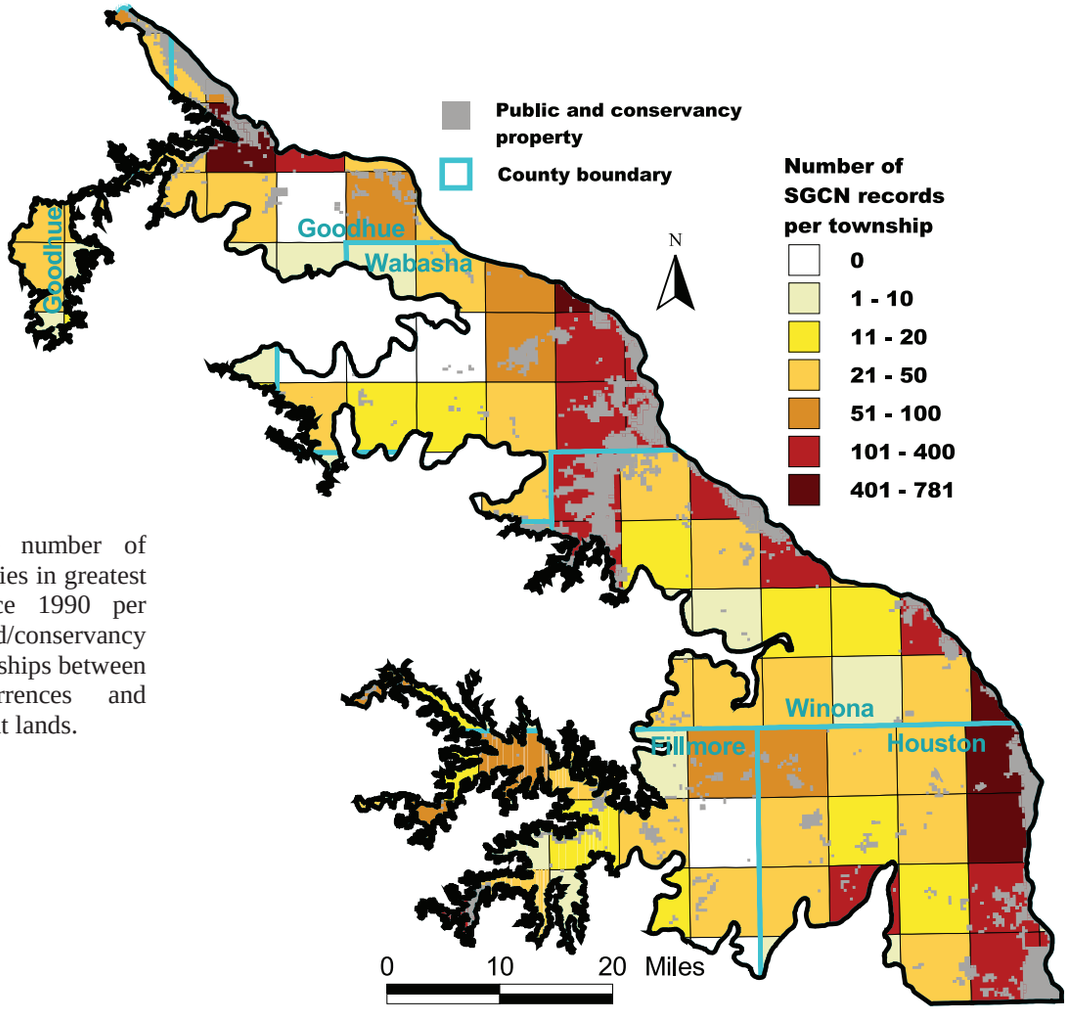
Abundance Uncommon, with spotty distribution in some DNR state parks, WMAs, and private lands.

Legal Status State list-Threatened.

Comments This snake is benefiting from legal protection, DNR education workshops for landowners and law enforcement officials, and the federal Landowner Incentive Program, a state-administered voluntary program that provides funding to private landowners to implement habitat management projects benefiting "at-risk" species.

Photo by Barney Oldfield

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	82
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	27
Invasive Species and Competition	29
Pollution	35
Social Tolerance/Persecution/Exploitation	23
Disease	1
Food Source Limitations	4
Other	21

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Oak Savanna	X		X		
Prairie	X	X	X		
Wetland-Nonforest			*		
Shoreline-dunes-cliff/talus		X			
River-Headwater to Large				X	X
River-Very Large (Mississippi River)				X	X

*Wetlands do not represent more than 5% of the 1890s or 1990s landcover, but the 1984 Anderson & Craig study indicates wetlands have declined by greater than 50% in this subsection.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

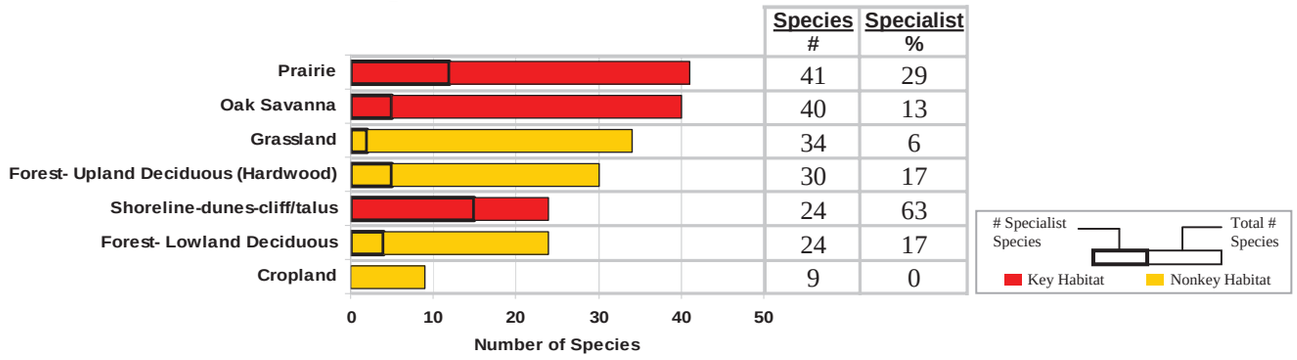
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

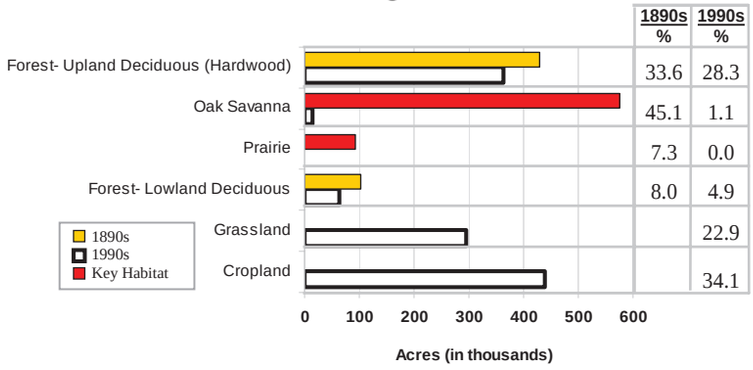
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

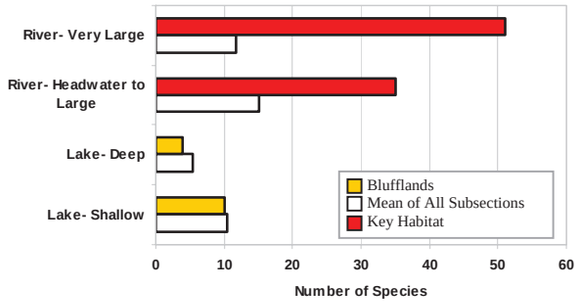
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



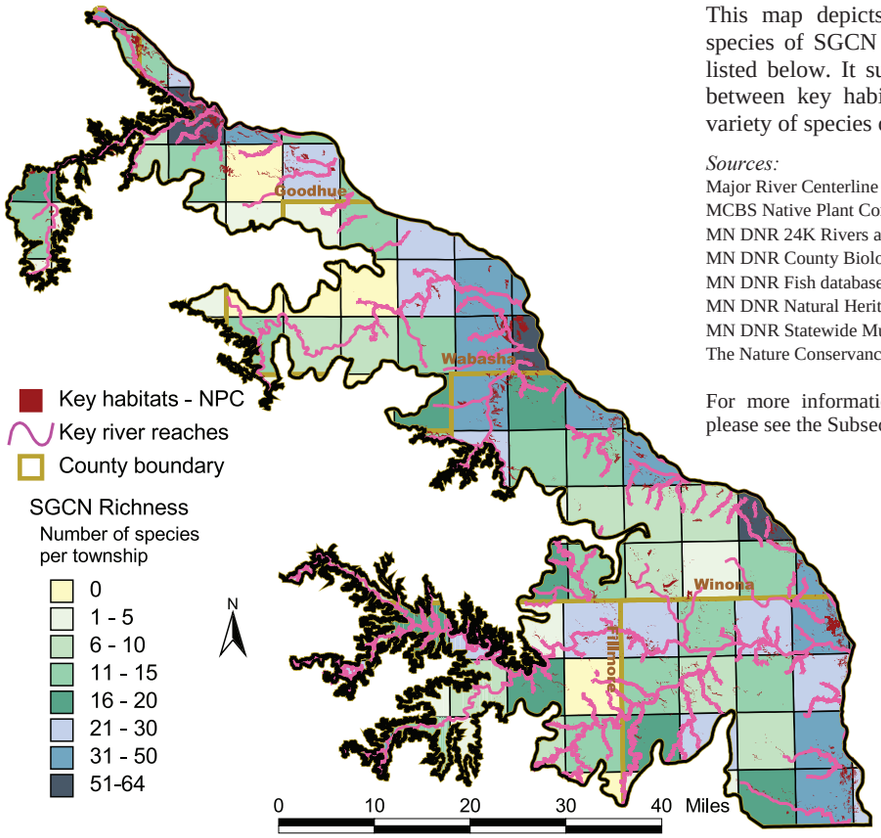
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fishes**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Cropland	N/A	34.0		5			3		1		9
Forest-Upland Deciduous (Hardwood)	33.6	28.3		15		3	5	1	6		30
Grassland	N/A	22.9		15			8		11		34
Forest-Lowland Deciduous	8.0	4.9	1	15			4		3	1	24
Developed	N/A	2.4		5		2	5		1		13
Lake-Deep	N/A	2.3	1	1	1				1		4
Lake-Shallow	N/A	1.4		7	1				2		10
Oak Savanna	45.1	1.1		16		5	8		11		40
Wetland-Nonforest	1.1	1.1	2	23		1	2		3		31
Forest-Lowland Coniferous	0.0	0.8		7			1				8
Forest-Upland Coniferous	0.0	0.8		13		2	3		7		25
Forest-Upland Deciduous (Aspen-oak)	1.6	0.0		13			3				16
Prairie	7.3	0.0		13		7	7		11	3	41
Shoreline-dunes-cliff/talus	N/A	N/A	1	11		1		5	6		24
Shrub-Lowland	N/A	N/A	1	14			2		2		19
River-Headwater to Large	N/A	N/A	2	3	14	3		9	4		35
River-Very Large (Mississippi River)	N/A	N/A	2	2	19			24	4		51

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Oak savanna habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Cliff and bluff habitats**, actions include:
   a. Support the protection of cliff and bluff habitats from damaging development
   b. Enhance cliff and bluff habitats to support SGCN
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Stream habitats**, actions include:
   a. Maintain good-water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Hardwood Hills

SUBSECTION OVERVIEW

The Hardwood Hills Subsection runs through the heart of the Mississippi River flyway and central Minnesota. The Continental Divide splits this subsection; rivers to the north flow to Hudson Bay, and rivers to the south, to the Mississippi. The subsection contains numerous lakes, more than 400 greater than 160 acres and many smaller lakes. Wetlands, prairie potholes, and kettle lakes exist throughout the area. Before settlement by people of European descent, vegetation included maple-basswood forests interspersed with oak savanna, tallgrass prairie, and oak forest.

Currently much of this subsection is farmed. While many wetlands have been drained, many potholes remain and provide habitat for waterfowl and shorebirds. Important areas of forest and prairie exist throughout the subsection, but they are small and fragmented. About 15 percent of the subsection is forested. Other significant land uses are tourism and outdoor recreation, especially around lakes. Increased lakeshore development and wetland loss are conservation concerns in this subsection.

Quick facts

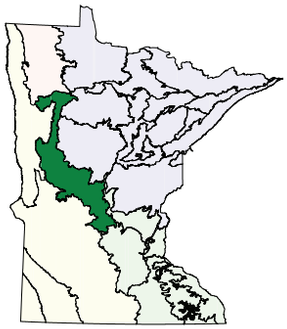
Acres: 3,496,869 (6.5% of state)

Ownership

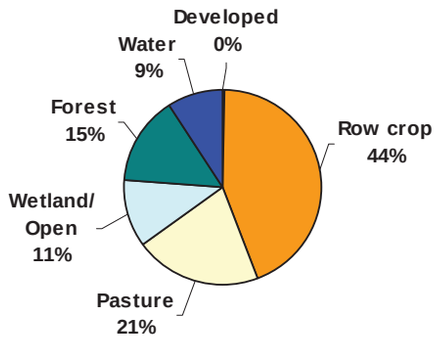
Public	Private	Tribal
4.1%	95.3%	0.6%

Population density (people/sq. mi.)

Current	Change (2000-2010)
36.6	+3.6



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

85 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Hardwood Hills. These SGCN include 28 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 6 mammal SGCN are known or predicted to occur in the Hardwood Hills, approximately 27% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common mudpuppy
Birds	61	62.9	Veery
Fish	4	8.5	Least darter
Insects	5	8.9	Caddisfly (*O. ecornuta*)
Mammals	6	27.3	Least Weasel
Mollusks	4	10.3	Fluted-shell
Reptiles	3	17.6	Smooth green snake
Spiders	1	12.5	*None documented since 1990*

HIGHLIGHTS

- This subsection is a fascinating, wetland-rich transition zone between prairies and forest, intermingled with hundreds of lakes.
- There is a mix of wildlife, including trumpeter swans, prairie chickens, sandhill cranes, western grebes, great egrets, great blue herons, Forster's terns, bald eagles, creek heelsplitters, and least darters.
- This is also a major migratory corridor for forest birds and waterfowl.
- Areas important for SGCN include Tamarac and Hamden Slough NWRs; numerous state WMAs and federal WPAs; and Lake Carlos, Glendalough, and Maplewood State Parks.

SPECIES SPOTLIGHT

Red-shouldered hawk *(Buteo lineatus)*

Distribution Widely distributed in hardwood forests from SE MN northward along the St. Croix valley and northwest to Becker County.

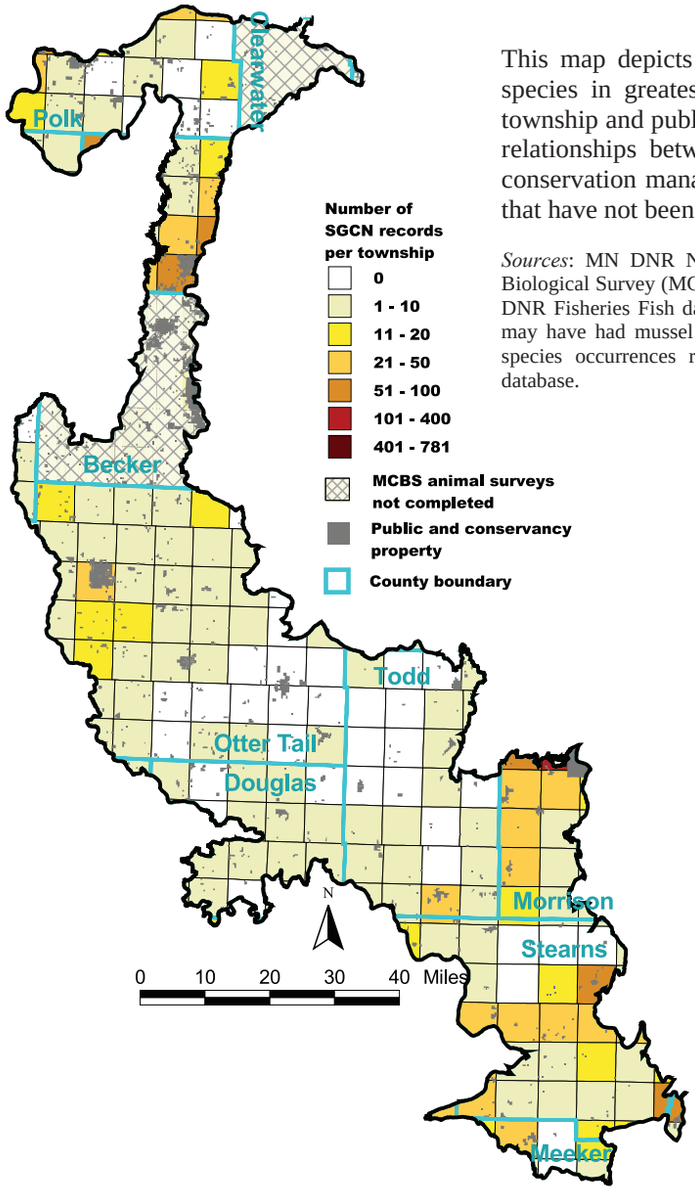
Abundance First recorded in MN in 1935, this species is uncommon throughout its range, but may have higher numbers than originally estimated in 1988 (about 200 pairs) due to the difficulties associated with surveying this species.

Legal Status State list-Special Concern

Comments In the Twin Cities Metro area this species may nest in urban backyards and overwinter by eating suet at bird feeders.

Photo by Kathy Adams Clark

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	86
Habitat Degradation in MN	89
Habitat Loss/Degradation Outside of MN	39
Invasive Species and Competition	26
Pollution	31
Social Tolerance/Persecution/Exploitation	21
Disease	5
Food Source Limitations	4
Other	9

Hardwood Hills

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Deciduous (Aspen-oak)			X		
Forest-Upland Deciduous (Hardwood)			X		
Shrub/Woodland-Upland (Oak savanna, Brush prairie)			X		
Prairie	X		X		
Wetland-Nonforest	X	X	*		
Grassland	X				
Lake-Shallow				X	
River-Headwater to Large					X

*The 1984 Anderson & Craig study indicates wetlands have declined by greater than 50% in this subsection, although the 1890s and 1990s landcover analysis indicates otherwise.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

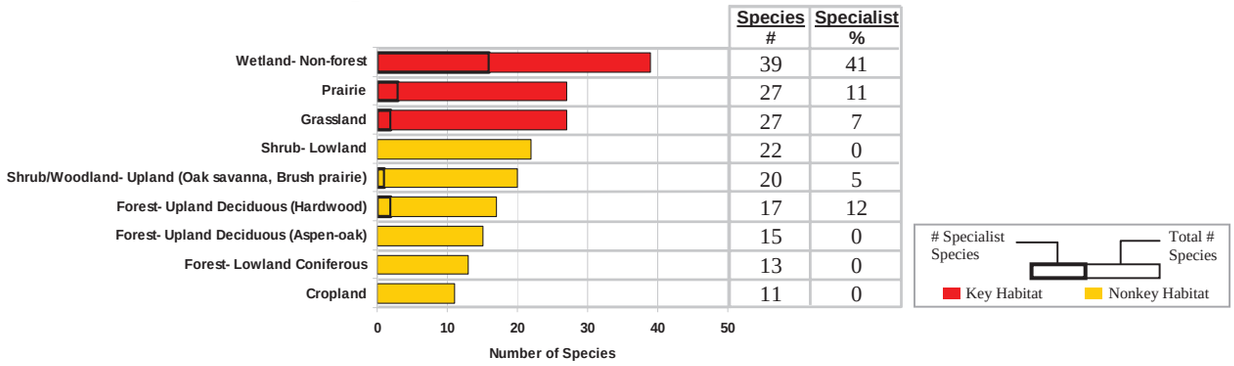
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

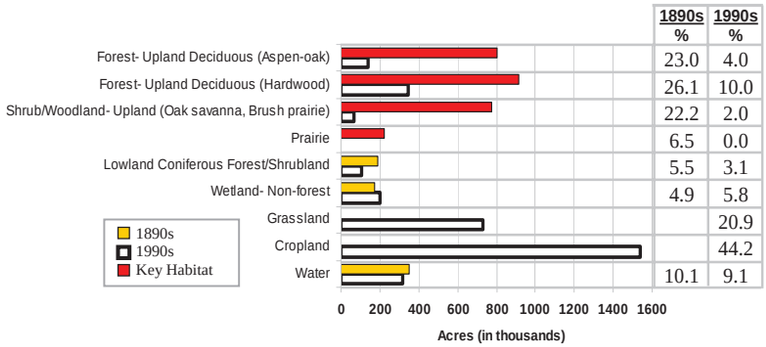
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

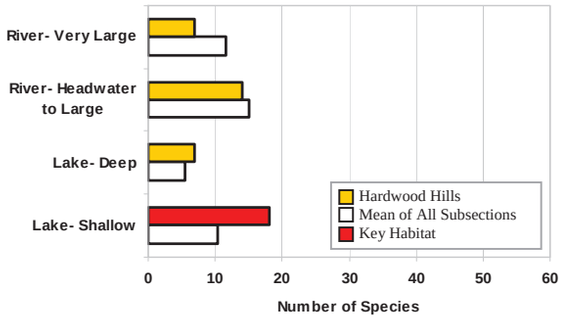
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



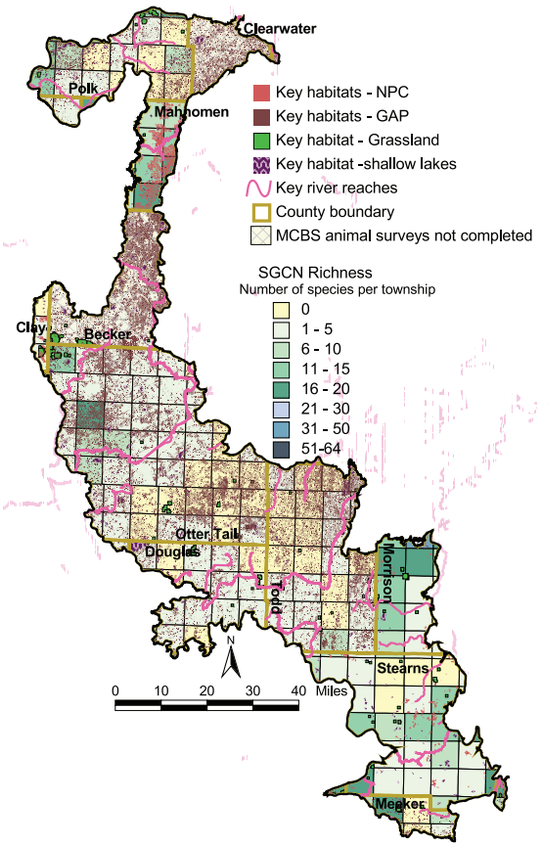
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Grassland Bird Conservation Areas (GBCA), 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	44.1		7			4				11
Grassland	N/A	20.9		18		1	6		2		27
Forest-Upland Deciduous (Hardwood)	26.1	10.0		14			3				17
Lake-Deep	N/A	6.9	1	2	3				1		7
Wetland-Nonforest	4.9	5.8		34			2		2	1	39
Forest-Upland Deciduous (Aspen-oak)	23.0	4.0		14			1				15
Forest-Lowland Coniferous	5.5	3.1		12						1	13
Lake-Shallow	N/A	2.2		14					2		16
Shrub/Woodland-Upland (Oak savanna, Brush prairie)	22.2	2.0		14			5		1		20
Developed	N/A	0.4		4			2				6
Forest-Lowland Deciduous	0.1	0.4		15			1				16
Forest-Upland Coniferous	1.6	0.2		13			3		1		17
Prairie	6.5	0.0		16		2	6		2	1	27
Shoreline-dunes-cliff/talus	N/A	N/A		10		1	1				12
Shrub-Lowland	N/A	N/A		18			3		1		22
River-Headwater to Large	N/A	N/A	1	2	3	2		4	2		14
River-Very Large	N/A	N/A	1		1			3	2		7

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland deciduous aspen-oak forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Upland deciduous hardwood forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Oak savanna-brush prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna-brush prairie restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
7. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
8. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people
Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Oak Savanna

SUBSECTION OVERVIEW

The Oak Savanna Subsection, located in southeastern Minnesota, consists largely of gently rolling hills. Bur oak savanna was the primary vegetative community, but areas of tallgrass prairie and maple-basswood forest were also common. Historically, fire was the most important disturbance here and maintained oak openings rather than forest. Several medium-size rivers occur in this subsection, including the Zumbro, Straight, and Cedar. Wetlands, a critical component of oak savanna habitat, were once plentiful throughout, and along with shallow lakes provided critical habitat for a variety of wildlife.

Today most of this subsection is farmed. Increasing intensity of agricultural production has led to further wetland deterioration and loss, water-quality concerns, and sediment loading in streams. Residential and associated development from the Twin Cities is accelerating in the northern part of this area. This subsection has numerous state parks, wildlife management areas, and scientific and natural areas.

Quick facts

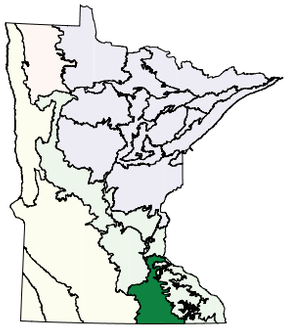
Acres: 1,819,571 (3.4% of state)

Ownership

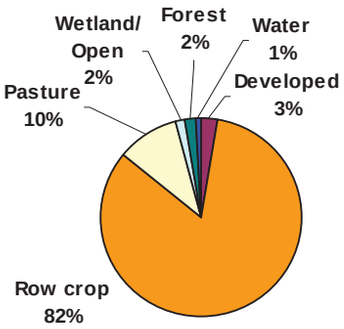
Public	Private	Tribal
1.8%	98.2%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
117	+19.5



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

93 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Oak Savanna. These SGCN include 36 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 7 mammal SGCN are known or predicted to occur in the Oak Savanna, approximately 32% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	2	33.3	Common Mudpuppy
Birds	48	49.5	Bobolink
Fish	12	25.5	Slender madtom
Insects	7	12.5	*None documented since 1990*
Mammals	7	31.8	Western harvest mouse
Mollusks	9	23.1	Spike
Reptiles	8	47.1	Eastern fox snake
Spiders	0	0	NA

HIGHLIGHTS

- Oak savanna is one of Minnesota's rarest wildlife habitats. The scattered trees in a grassy landscape are home to Swainson's hawks, red-headed woodpeckers, regal fritillaries, bobolinks, sandhill cranes, wood turtles, Blanding's turtles, trumpeter swans, northern harriers, dickcissels, Ozark minnows, and redfin shiners.
- Areas important for SGCN include Sakatah, Myre-Big Island, Rice Lake, and Nerstrand Woods SPs; Iron Horse, Wild Indigo, Cannon River, Shooting Star, and Hastings SNAs; and state WMAs.

SPECIES SPOTLIGHT

Red-headed woodpecker *(Melanerpes erythrocephalus)*

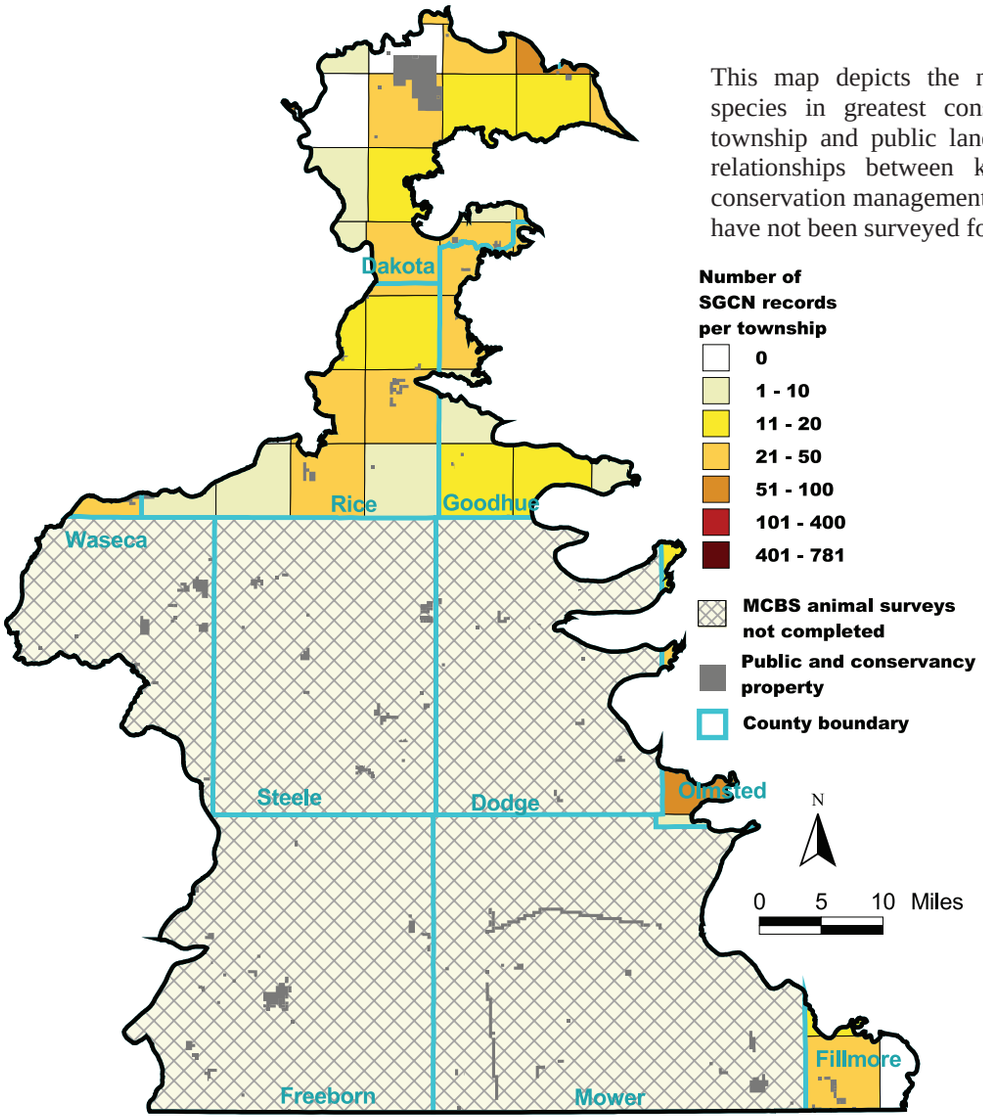
Distribution Broadly but sparsely distributed throughout agricultural lands and hardwood forests of MN, with particular abundance in oak savanna habitats of southeastern and central MN.

Abundance Numbers are greatly reduced since a population spike that occurred in the 1960s when Dutch elm disease killed American elms and created an abundance of trees suitable for nesting and feeding. This woodpecker has also decreased due to loss of mixed forest and savanna-type habitat, forestry and landscape practices that include removal of dead trees, and use of treated telephone poles and fence posts that are unsuitable for nesting.

Legal Status Federally protected migratory bird.

Comments Management and restoration of oak savannas are of particular benefit to red-headed woodpeckers.

Photo by Carrol Henderson



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	86
Habitat Degradation in MN	91
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	30
Pollution	32
Social Tolerance/Persecution/Exploitation	20
Disease	2
Food Source Limitations	5
Other	18

Oak Savanna

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Oak Savanna			X		
Prairie	X	X	X		
Wetland-Nonforest (Wet prairie)	X	X	X		
Grassland	X				
River-Headwater to Large				X	X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

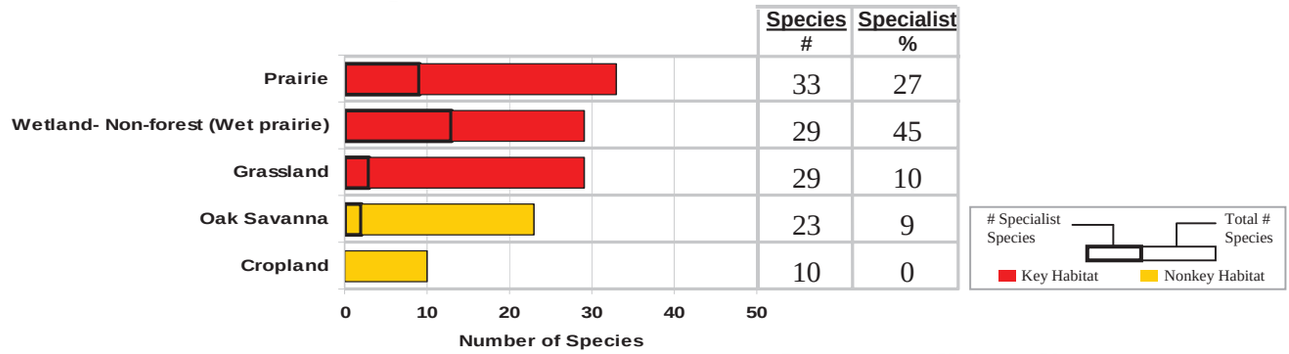
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

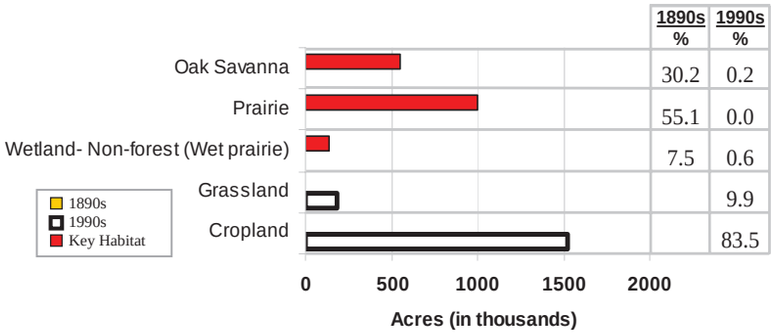
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

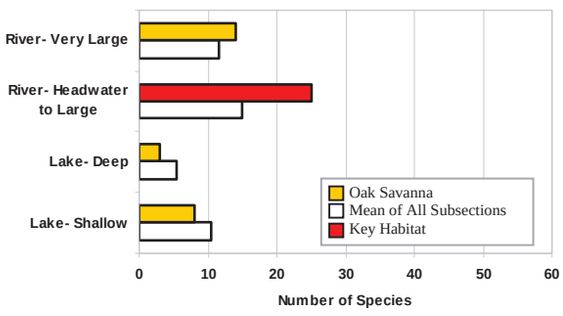
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



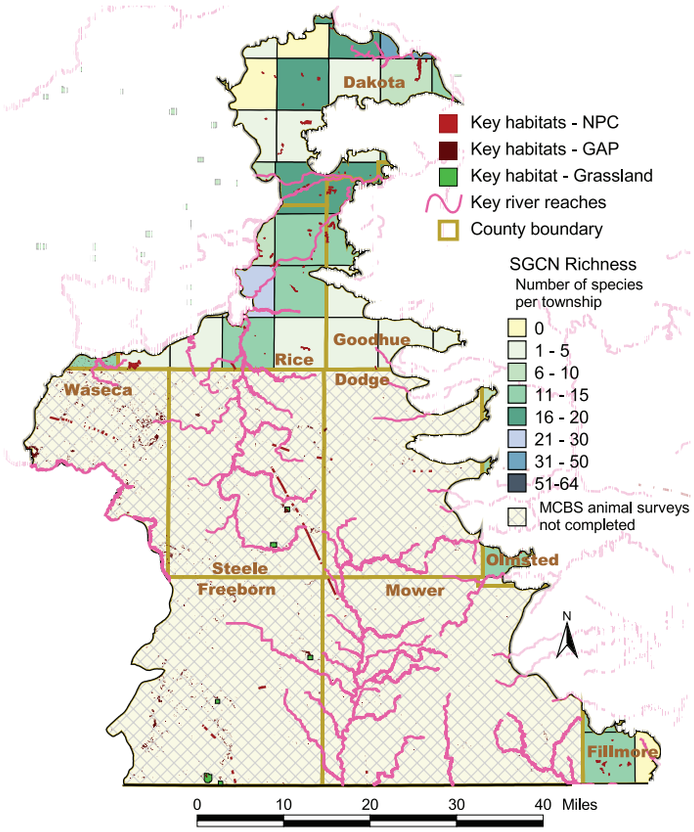
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Grassland Bird Conservation Areas (GBCA), 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Cropland	N/A	83.6		5			4		1		10
Grassland	N/A	9.9		16			7		6		29
Developed	N/A	2.6		4			3				7
Forest-Upland Deciduous (Hardwood)	2.2	1.3		12			4		1		17
Forest-Lowland Coniferous	0.0	0.6		6							6
Wetland-Nonforest (Wet prairie)	7.5	0.6	1	23		1	2		2		29
Lake-Shallow	N/A	0.6		6					2		8
Forest-Lowland Deciduous	0.1	0.4		12			2		1		15
Lake-Deep	N/A	0.2	1		1				1		3
Oak Savanna	30.2	0.2		13			6		4		23
Forest-Upland Coniferous	0.0	0.0		9			3		4		16
Forest-Upland Deciduous (Aspen-oak)	3.4	0.0		11			2				13
Prairie	55.1	0.0		14		6	7		6		33
Shoreline-dunes-cliff/talus	N/A	N/A	1	9			1		1		12
Shrub-Lowland	N/A	N/A		13			3		1		17
River-Headwater to Large	N/A	N/A	1	1	12			8	3		25
River-Very Large	N/A	N/A	2	1	2			7	2		14

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Oak savanna habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Rochester Plateau

SUBSECTION OVERVIEW

The Rochester Plateau Subsection is an area of level to gently rolling terrain. The subsection contains several headwaters, including the Root, Whitewater, Zumbro, and Cannon rivers, as well as some cold-water trout streams in the eastern portion. Before conversion to agriculture, the predominant vegetation was tallgrass prairie and bur oak savanna.

Today, agriculture dominates the landscape, with 69 percent in cropland and 21 percent in pasture. Water quality is a concern in the subsection because of agricultural and urban development. In the center of the subsection, the city of Rochester and the corridor to the Twin Cities metropolitan area are projected to grow rapidly over the next decade.

Quick facts

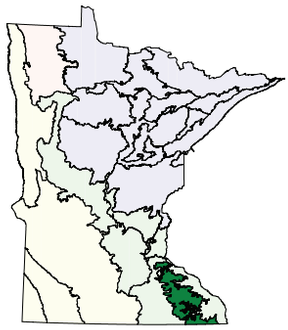
Acres: 1,359,429 (2.5% of state)

Ownership

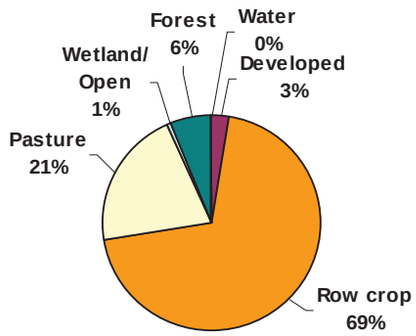
Public	Private	Tribal
0.9%	99.1%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
240	+41



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

94 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Rochester Plateau. These SGCN include 36 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 6 mammal SGCN are known or predicted to occur in the Rochester Plateau, approximately 27% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	3	50.0	Pickerel frog
Birds	46	47.4	Loggerhead shrike
Fish	11	23.4	Gravel chub
Insects	7	12.5	*None documented since 1990*
Mammals	6	27.3	Eastern pipistrelle
Mollusks	9	23.1	Ellipse
Reptiles	12	70.6	Six-lined racerunner
Spiders	0	0	NA

HIGHLIGHTS

- Significant portions of this subsection have been developed for agriculture, but publicly owned forests and associated streams, rivers and wetlands support a diversity of wildlife.
- Wildlife present in this subsection includes a variety of reptiles, such as timber rattlesnakes, western foxsnakes, racers, Blanding's turtles and wood turtles; birds, including Louisiana waterthrushes, prothonotary warblers, cerulean warblers, blue-winged warblers, peregrine falcons; fish, including American brook lampreys and suckermouth minnows; and mussels, such as ellipse mussels.
- Areas important for SGCN include the Richard J. Dorer Memorial Hardwood SF; Oronoco Prairie, Racine Prairie, and Cherry Grove Blind Valley SNAs; and Carley and Forestville Mystery Cave SPs.

SPECIES SPOTLIGHT

Gravel chub *(Erimystax x-punctata)* – Formerly *Hypobopsis x-punctata*

Distribution Spotty distribution in only a few locations of the Root River in Fillmore and Houston counties and the Upper Iowa River.

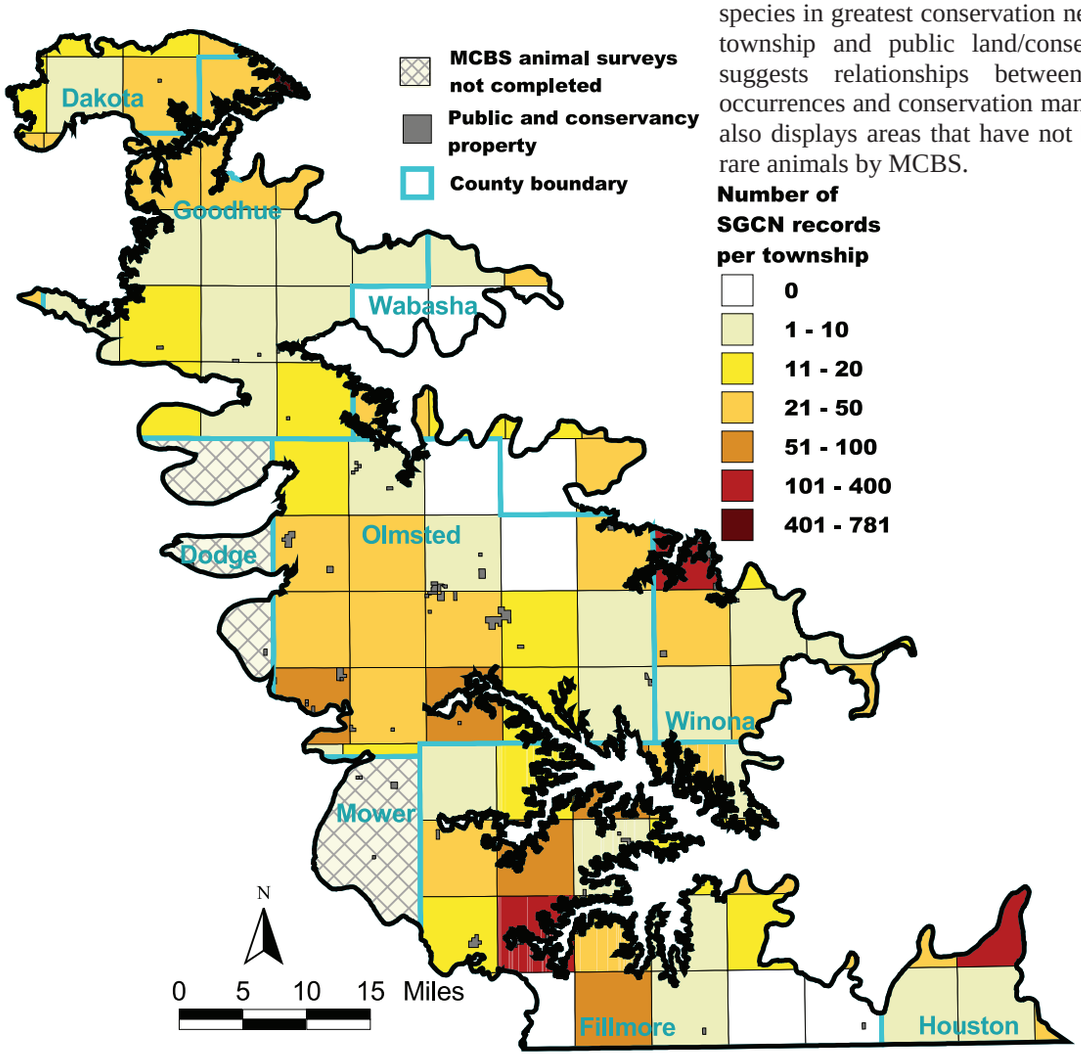
Abundance Rare. Extirpated from other areas of its former range in MN and other states.

Legal Status State list-Special Concern.

Comments This minnow is negatively affected by runoff and siltation in small streams where it needs riffles over small pea-sized gravel, as well as good levels of water quality.

Photo by Konrad Schmidt

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	86
Habitat Degradation in MN	90
Habitat Loss/Degradation Outside of MN	32
Invasive Species and Competition	29
Pollution	30
Social Tolerance/Persecution/Exploitation	21
Disease	1
Food Source Limitations	2
Other	18

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Shrub/Woodland-Upland (Oak savanna, Brush prairie)	X		X		
Prairie	X	X	X		
Wetland-Nonforest			*		
Grassland	X				
River-Headwater to Large				X	X

*Wetlands do not represent more than 5% of the 1890s or 1990s landcover, but the 1984 Anderson & Craig study indicates wetlands have declined by greater than 50% in this subsection.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

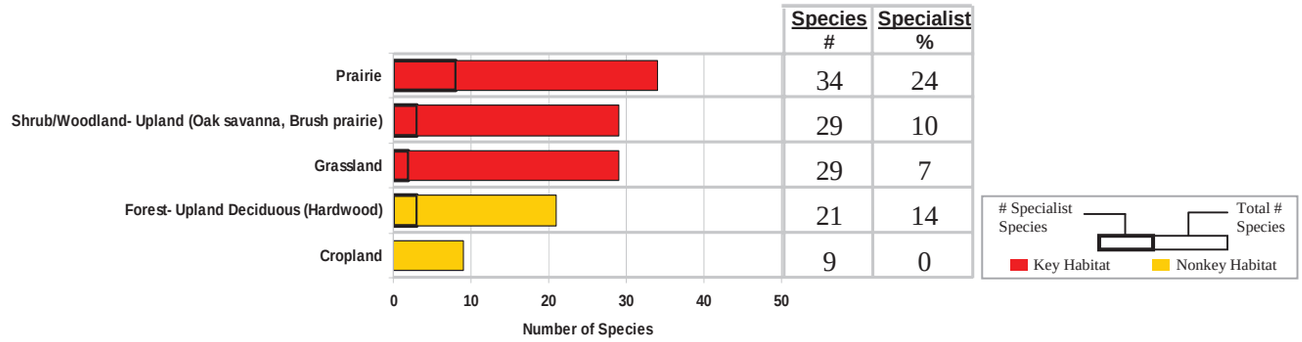
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

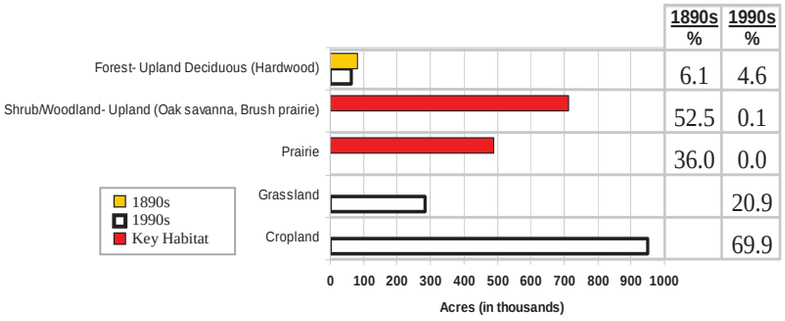
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

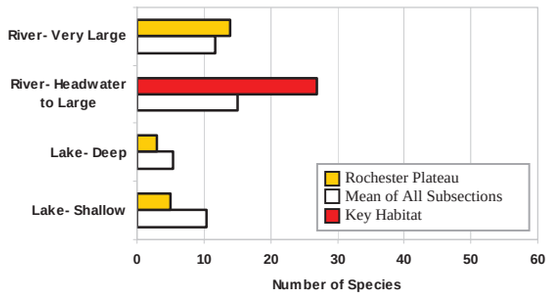
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



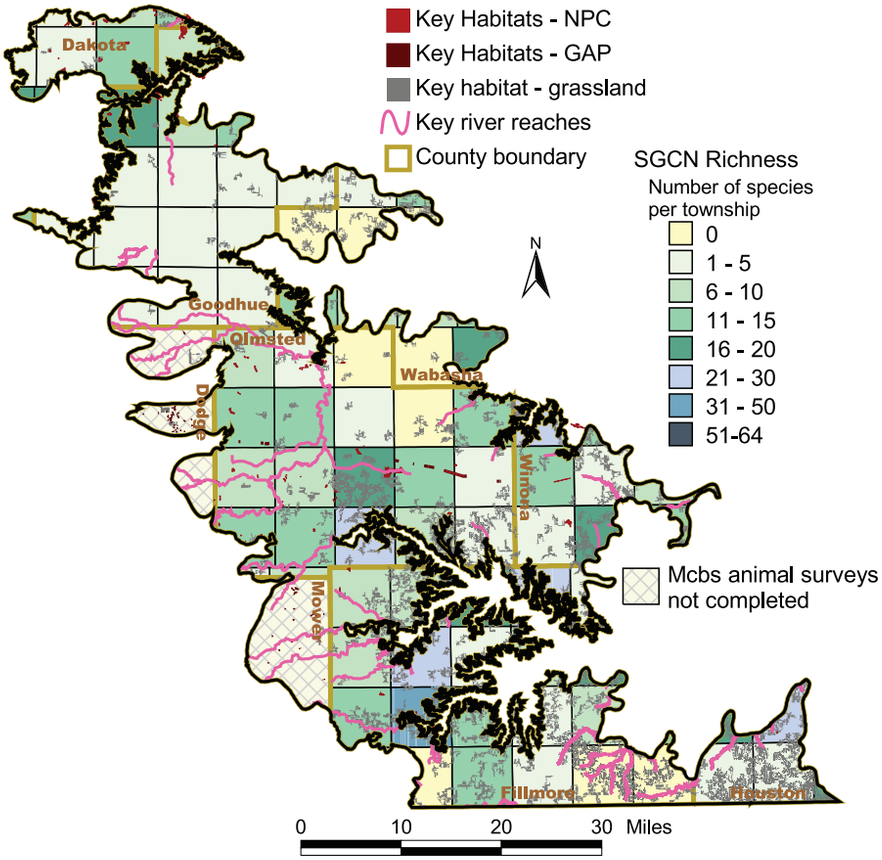
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
HAPET Landcover Classification, 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Cropland	N/A	69.8		5			3		1		9
Grassland	N/A	20.9		14			6		9		29
Forest-Upland Deciduous (Hardwood)	6.1	4.6		14			3		4		21
Developed	N/A	2.7		4			3		1		8
Forest-Lowland Deciduous	0.9	1.2	1	13			2		2		18
Forest-Lowland Coniferous	0.0	0.3		5							5
Wetland-Nonforest	0.2	0.2	2	19		1	1		2		25
Shrub/Woodland-Upland (Oak savanna, Brush prairie)	52.5	0.1		14		1	6		8		29
Lake-Deep	N/A	0.1	1		1				1		3
Forest-Upland Coniferous	0.0	0.1		11			2		6		19
Lake-Shallow	N/A	0.0		3					2		5
Forest-Upland Deciduous (Aspen-oak)	4.3	0.0		12			2				14
Prairie	36.0	0.0		12		6	6		10		34
Shoreline-dunes-cliff/talus	N/A	N/A	1	9					4		14
Shrub-Lowland	N/A	N/A	1	11			2		1		15
River-Headwater to Large	N/A	N/A	2	2	11			9	3		27
River-Very Large	N/A	N/A	2	1	2			7	2		14

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Oak savanna and brush prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

St. Paul Baldwin Plains and Moraines

SUBSECTION OVERVIEW

The St. Paul Baldwin Plains and Moraines encompass much of the eastern half of the Twin Cities metropolitan area, including St. Paul and its suburbs. The Mississippi River flows through the center of this subsection, and the St. Croix River forms the eastern boundary. Both of these rivers have a profoundly vital role for wildlife. Oak and aspen savanna were the primary plant communities before settlement by people of European descent, but tallgrass prairie and maple-basswood forest were also common.

Urban land uses dominate this subsection, although small, forested areas remain, especially in parts of northern Washington County. While there is significant interest in preserving open space, the area continues to expand rapidly, diminishing the opportunities to conserve habitat. Protection of existing wetlands is important for flood control and filtering of stormwater runoff, and water quality remains a significant concern throughout the subsection. There are many recreational opportunities, especially along the large rivers and in state parks, scientific and natural areas, regional parks, and nature centers.

Quick facts

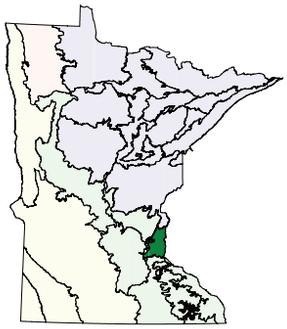
Acres: 463,563 (0.9% of state)

Ownership

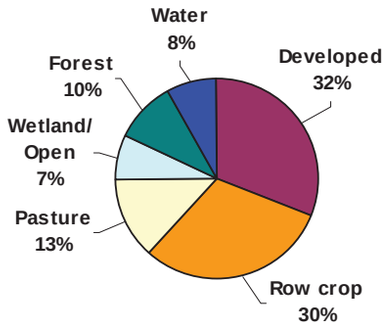
Public	Private	Tribal
6.5%	93.5%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
1,382	+216



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

149 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the St. Paul Baldwin Plains and Moraines, the second most of all subsections in Minnesota. These SGCN include 74 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 8 mammal SGCN are known or predicted to occur in the St. Paul Baldwin Plains and Moraines, approximately 36% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	3	50.0	Northern cricket frog
Birds	59	60.8	Eastern wood pewee
Fish	25	53.2	Paddlefish
Insects	12	21.4	St. Croix snaketail
Mammals	8	36.4	American badger
Mollusks	25	64.1	Wartyback
Reptiles	14	82.4	Smooth softshell
Spiders	3	37.5	*M. grata*

HIGHLIGHTS

- This subsection is highlighted not only as a significant migratory corridor for birds but also for the great diversity of mussels and small stream fishes that depend on clear, unpolluted waters of the St. Croix River, including the spike, elephant-ear, snuffbox, ebonyshell, and federally endangered Higgins' eye pearly mussel.
- Featured species also include bald eagles, peregrine falcons, red-shouldered hawks, Blanding's turtles, trumpeter swans, hooded warblers, and bobolinks.
- Areas important for SGCN include Battle Creek Park, Warner Nature Center, Lost Valley Prairie, Pig's Eye Island Heron Rookery, Gray Cloud Dunes, and Pine Bend Bluffs SNAs; Square Lake Park; and William O'Brien SP.

SPECIES SPOTLIGHT

Spike mussel *(Elliptio dilatata)*

Distribution Found only in the St. Croix River and its tributaries, Rose Creek, and the outlet of Lake Pepin on the Mississippi River.

Abundance Rare. Now found only in a small number of drainages.

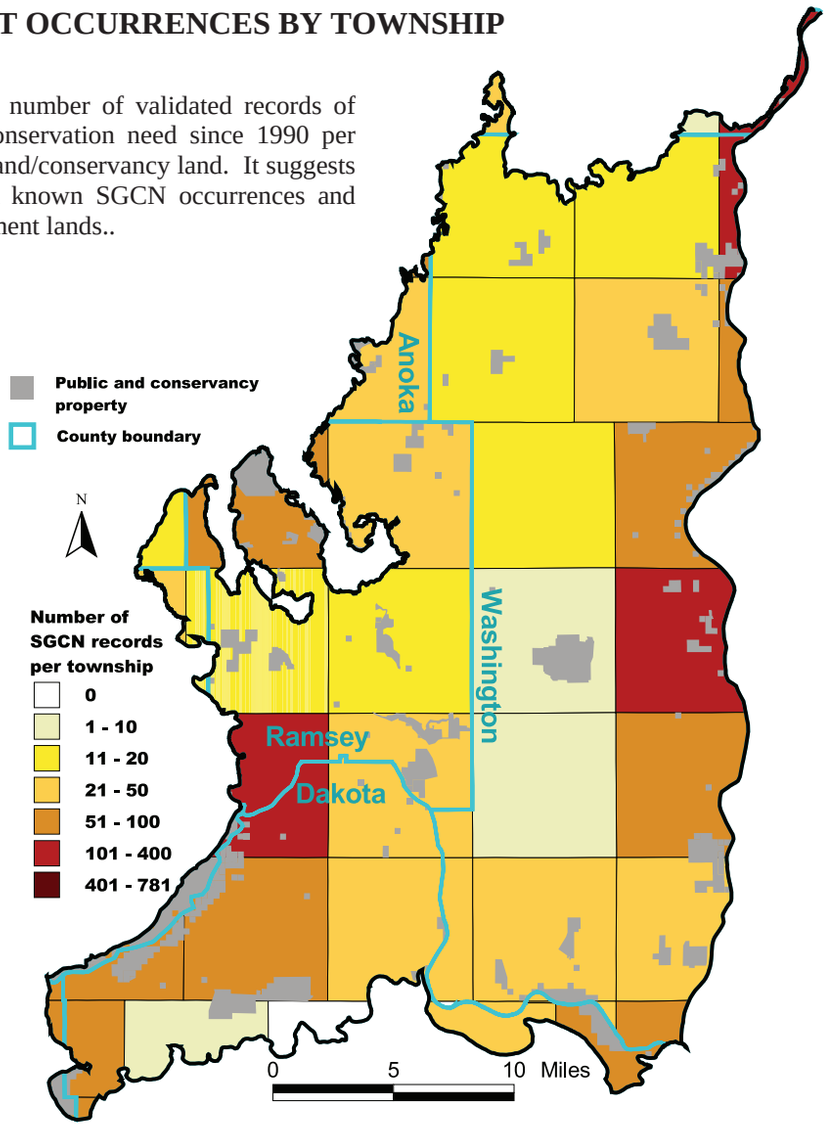
Legal Status State list-Special Concern.

Comments Significant decline has occurred after being historically widespread and abundant in MN. This mussel has declined due to degradation of water quality, sedimentation, and alteration of streams and rivers for navigation and impoundment purposes.

Photo by Deb Rose

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands..



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	81
Habitat Degradation in MN	87
Habitat Loss/Degradation Outside of MN	28
Invasive Species and Competition	32
Pollution	38
Social Tolerance/Persecution/Exploitation	21
Disease	2
Food Source Limitations	3
Other	17

St. Paul Baldwin Plains and Moraines

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Deciduous (Aspen-oak)			X		
Forest-Upland Deciduous (Hardwood)			X		
Oak Savanna	X		X		
Prairie	X	X	X		
Wetland-Nonforest			*		
Grassland	X				
Shoreline-dunes-cliff/talus		X			
Lake-Shallow				X	
River-Headwater to Large				X	X
River-Very Large (Mississippi River)				X	X

*Wetlands do not represent more than 5% of the 1890s or 1990s landcover, but the 1984 Anderson & Craig study indicates wetlands have declined by greater than 50% in this subsection.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

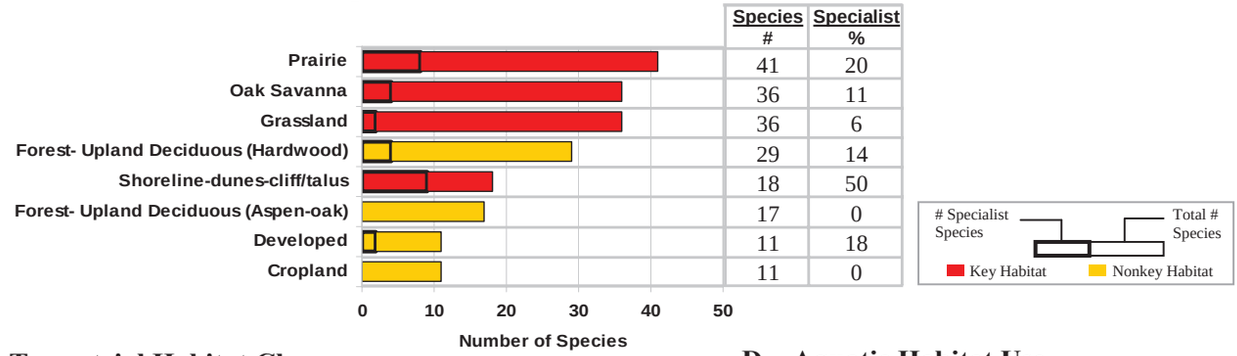
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

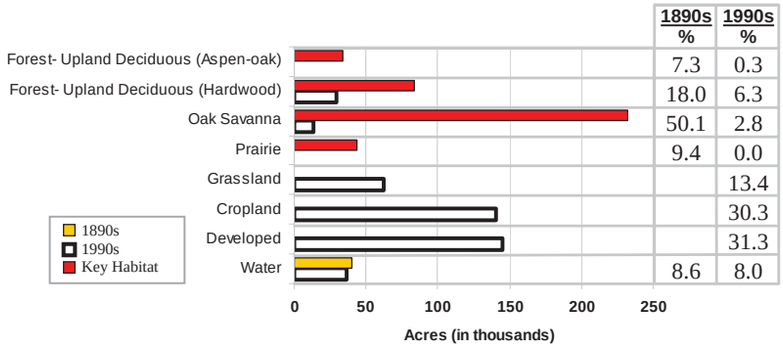
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

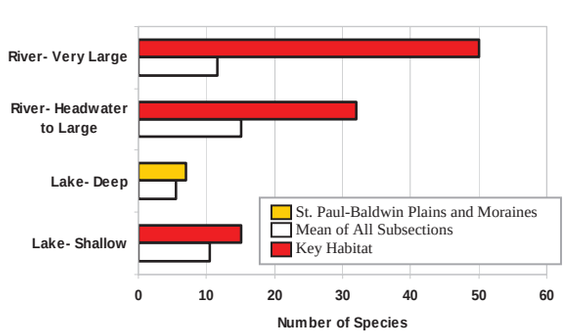
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



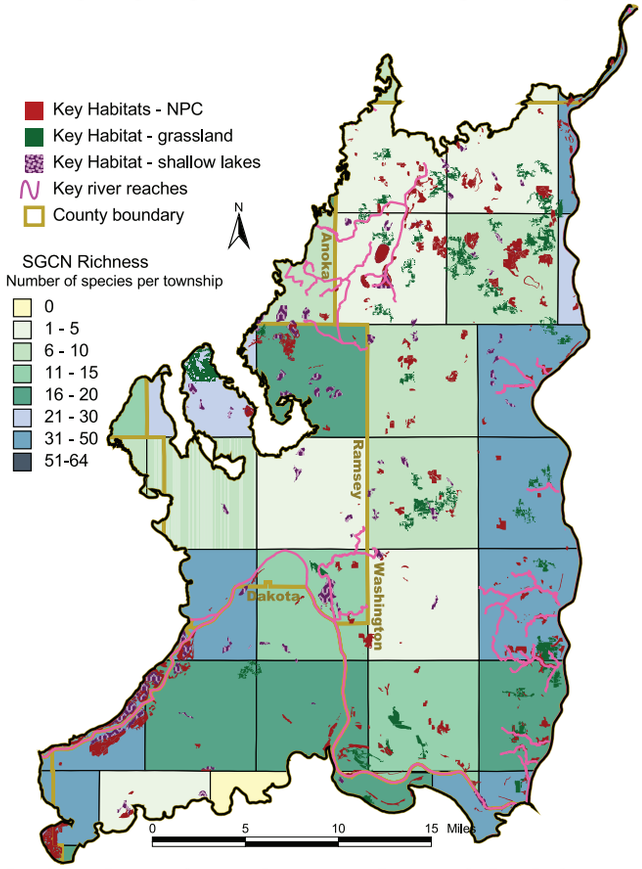
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005
Twin Cities Metro Regionally Significant Ecological Areas (RSEA), 2000

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Developed	N/A	31.3		5		1	4		1		11
Cropland	N/A	30.3		6			4		1		11
Grassland	N/A	13.4		17			8		10	1	36
Forest-Upland Deciduous (Hardwood)	18.0	6.3	1	16		2	5		5		29
Lake-Deep	N/A	6.3	1	2	3				1		7
Wetland-Nonforest	2.7	3.5	1	28		1	3		2	2	37
Oak Savanna	50.1	2.8	1	16		3	7		9		36
Forest-Upland Coniferous	0.0	2.0	1	13		2	4		6		26
Lake-Shallow	N/A	1.7		11	1				2		14
Forest-Lowland Deciduous	2.2	1.4		16		1	3		2		22
Forest-Lowland Coniferous	1.8	0.7		8		1	1			1	11
Forest-Upland Deciduous (Aspen-oak)	7.3	0.3	1	13			3				17
Prairie	9.4	0.0		15		5	7		11	3	41
Shoreline-dunes-cliff/talus	N/A	N/A	1	10			1		6		18
Shrub-Lowland	N/A	N/A	1	14		1	3		1		20
River-Headwater to Large	N/A	N/A	1	3	14	3		8	3		32
River-Very Large (Mississippi River)	N/A	N/A	2	2	19			24	3		50

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland deciduous aspen-oak forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Upland deciduous hardwood forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Oak savanna habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
7. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
8. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
9. **Shoreline, dune, cliff/talus habitats**, actions include:
   a. Support the protection of these habitats from damaging development
   b. Enhance SGCN habitat along the shoreline
   c. Enhance SGCN habitat within dune communities
   d. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulation

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed

Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

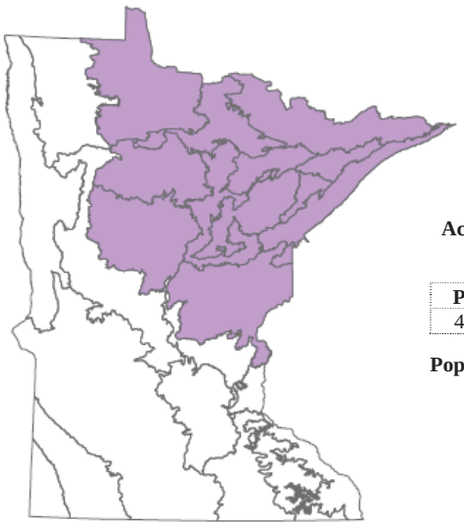
Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Laurentian Mixed Forest Province



Quick facts

Acres: 23,166,417 (43% of state)

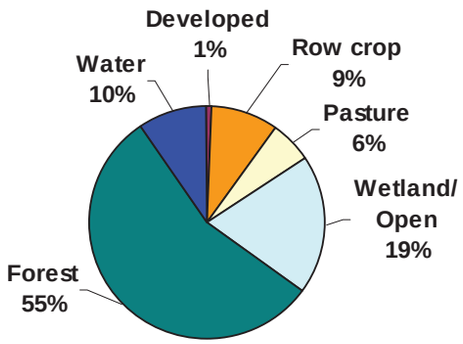
Ownership

Public	Private	Tribal
47.4%	49.3%	3.3%

Population density (people/sq. mi.)

Current	Change (2000-2010)
22.7	+2.5

Current Land Use/Land Cover



Overview

When people imagine the northwoods of Minnesota, more than likely they are thinking about the Laurentian Mixed Forest Province. It is the largest of Minnesota's four provinces, covering two-fifths of the state. The Laurentian Mixed Forest Province traverses northern Minnesota, Wisconsin, and Michigan, southern Ontario, and the less mountainous parts of New England. In Minnesota, the Province is characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and

L. Gerdes MN DNR

A landscape view of the Laurentian Mixed Forest Province – Subsection

swamps. The landscape ranges from rugged lake-dotted terrain with thin glacial deposits over bedrock, to hummocky or undulating plains with deep glacial drift, to large, flat, poorly drained peatlands. Both the highest and lowest elevation points in the state occur in this province.

A distinctive suite of boreal forest species inhabits this province, contributing to the diversity of Minnesota's wildlife. The state has become nationally known for the wildlife-watching opportunities in this region because of the presence of such species as great gray owls, Connecticut warblers, boreal owls, northern hawk-owls, and boreal chickadees. Other wildlife in this province includes moose, forest salamanders, and northern brook lamprey.

Today this area supports many industries, including recreation, tourism, mining, and forestry. Every summer, the area swells in population as people flock to the bountiful recreational opportunities provided by the lakes and forests. While the majority of this province remains forested, the age and composition of the forest has changed. These changes have affected key habitats available to Minnesota's wildlife.

Province Subsections

Agassiz Lowlands
Border Lakes
Chippewa Plains
Glacial Lake Superior Plain
Laurentian Uplands
Littlefork Vermilion Uplands
Mille Lacs Uplands
Nashwauk Uplands
North Shore Highlands
Pine Moraines and Outwash Plains
St. Louis Moraines
Tamarack Lowlands
Toimi Uplands

Summaries of Species in Greatest Conservation Need

A list of the species in the province, including identification of those unique to the province, is found in Appendix F. Table 5.10 presents the number of species in greatest conservation need in each subsection and the number unique to each subsection. Subsections are ranked from most to fewest SGCN. This ranking can help conservation stakeholders prioritize their efforts in a province. For example, the 128 SGCN found in the Mille Lacs Uplands Subsection is substantially higher than the other subsections and is a large proportion of the total of 171 SGCN that potentially occur in the Laurentian Mixed Forest Province. Thus, conservation stakeholders may want to focus more attention on the Mille Lacs Uplands than on other subsections. Further investigations into the reasons for these differences should be carried out during implementation of the CWCS.

Table 5.10. Number of SGCN in and Number Unique to the Laurentian Mixed Forest Province by Subsection

Subsection	Number of SGCN	Number of SGCN Unique to Subsection
Mille Lacs Uplands	128	6
Pine Moraines and Outwash Plains	89	1
Agassiz Lowlands	88	1
North Shore Highlands	84	6
Chippewa Plains	83	1
St. Louis Moraines	74	0
Tamarack Lowlands	69	0
Border Lakes	69	2
Littlefork Vermilion Uplands	67	0
Nashwauk Uplands	60	0
Laurentian Uplands	58	0
Glacial Lake Superior Plain	55	0
Toimi Uplands	52	0
Laurentian Mixed Forest Province	171	47

SGCN Problem Assessment

The SGCN problem assessment provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the province. The following table lists the percentage of SGCN in the province influenced by nine possible factors or problems. The results of the species problem assessment indicate that habitat loss and degradation in the province are the predominant challenges facing SGCN populations.

Table 5.11. SGCN Problem Analysis for the Laurentian Mixed Forest Province

Problem	Percentage of SGCN for which this is a known problem.
Habitat Loss in MN	75
Habitat Degradation in MN	83
Habitat Loss/Degradation Outside of MN	28
Invasive Species and Competition	31
Pollution	33
Social Tolerance/Persecution/Exploitation	21
Disease	3
Food Source Limitations	4
Other	11

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Summaries of Key Habitats

Table 5.12 ranks the habitats by the frequency with which they are identified in the subsections as key habitats. Table 5.13 ranks the subsections by their number of key habitats.

Table 5.12. Frequency of Key Habitats in the Laurentian Mixed Forest Province by Subsection

Key Habitat Ranked by Frequency	Number of Subsections	Percentage of Subsections
River-Headwater to Large	13	100
Forest-Upland Conifer	12	92
Forest-Lowland Conifer	10	77
Shrub/Woodland-Upland	6	46
Wetland-Nonforest	5	38
Lake-Deep	4	31
Forest-Upland Deciduous (Hardwood)	3	23
Shoreline-dunes-cliff/talus	3	23
Forest-Upland Deciduous (Aspen)	1	8
River-Very Large	1	8

Table 5.13. Number of Key Habitats in the Laurentian Mixed Forest Province by Subsection

Subsection	Number of Key Habitats
Mille Lacs Uplands	9
Border Lakes	5
North Shore Highlands	5
Nashwauk Uplands	5
Agassiz Lowlands	4
Chippewa Plains	4
Glacial Lake Superior Plain	4
Laurentian Uplands	4
Pine Moraines and Outwash Plains	4
Tamarack Lowlands	4
Toimi Uplands	4
St. Louis Moraines	3
Littlefork Vermilion Uplands	3

Assessment of SGCN and Key Habitats

Table 5.14 provides the number of species that use at least one key habitat at the subsection, province, and statewide scales. Subsections are ranked within each province by the percentage of SGCN that use at least one key habitat in the subsection. The number of SGCN that benefit from the key habitats varies greatly among the subsections in the Laurentian Mixed Forest Province. Nearly 50 percent of the species in the St. Louis Moraines and the Glacial Lake Superior Plains subsections do not use the key habitats identified in these subsections. Further investigations into the reasons for these differences and appropriate actions necessary to address them should be carried out during implementation of the CWCS.

Table 5.14. SGCN That Use Key Habitats in the Laurentian Mixed Forest Province by Subsection

Subsection	Total Number of SGCN	Number of SGCN Using at Least 1 Key Habitat	Percentage of SGCN Using at Least 1 Key Habitat
Mille Lacs Uplands	128	125	97.7
Chippewa Plains	83	74	89.2
Laurentian Uplands	58	51	87.9
Pine Moraines and Outwash Plains	89	77	86.5
Tamarack Lowlands	69	59	85.5
Toimi Uplands	52	44	84.6
North Shore Highlands	84	69	82.1
Border Lakes	69	56	81.2
Nashwauk Uplands	60	48	80.0
Agassiz Lowlands	88	67	76.1
Littlefork Vermilion Uplands	67	46	68.7
Glacial Lake Superior Plain	55	31	56.4
St. Louis Moraines	74	38	51.4
Province total	171	164	95.9
State total	292	269	92.1

Note: Subsections are ranked by the percentage of SGCN that use at least one key habitat in the subsection.

D. Luce

Peatlands of the Agassiz Lowlands Subsection – Red Lake Peatland SNA

Agassiz Lowlands

SUBSECTION OVERVIEW

The Agassiz Lowlands Subsection, located in extreme north-central Minnesota next to Canada, is a large, very flat, poorly drained area named after Glacial Lake Agassiz. The subsection's three large lakes, Lower and Upper Red Lakes and Lake of the Woods, are remnants of this ancient water body. This area contains the Northwest Angle, the only part of Minnesota and the United States, with the exception of Alaska, that extends beyond the 49th Parallel. The Rainy River, the subsection's largest river, forms the northern boundary of both the subsection and Minnesota. Much of the area is peatland, including forested peatland dominated by black spruce and tamarack in the canopy, and sedge-dominated fens. The uplands are primarily sand ridges left by the receding glacial lake and are dominated by aspen-birch and jack pine. Tracts of land in public and tribal ownership provide large blocks of undeveloped areas for wildlife.

Major land uses in the subsection include forestry and tourism. Most tourism involves hunting and fishing around the large lakes and in Beltrami Island and Pine Island state forests, and motorized recreation. The peatlands were extensively ditched, and some of the area was settled during the early 1900s for agriculture, but these attempts failed, and much of the subsection today remains uninhabited. A small amount of the peatlands in this subsection is mined for horticultural peat.

Quick facts

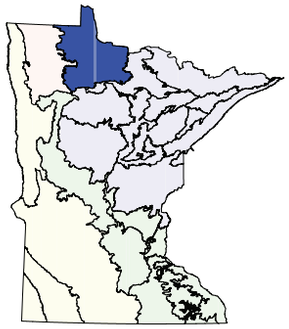
Acres: 3,653,654 (6.8% of state)

Ownership

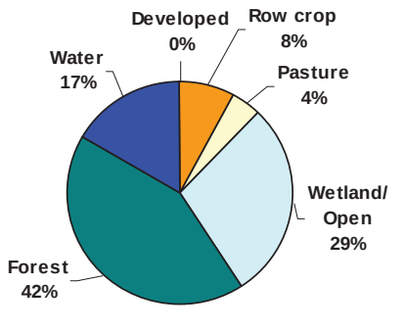
Public	Private	Tribal
51.4%	34.4%	14.2%

Population density (people/sq. mi.)

Current	Change (2000-2010)
3.5	+0.4



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

88 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Agassiz Lowlands. These SGCN include 28 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 7 mammal SGCN are known or predicted to occur in the Agassiz Lowlands, approximately 32% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	2	33.3	Common Mudpuppy
Birds	63	64.9	Connecticut warbler
Fish	3	6.4	Northern brook lamprey
Insects	9	16.1	Caddisfly (*O. itascae*)
Mammals	7	31.8	Northern bog lemming
Mollusks	3	7.7	Fluted-shell
Reptiles	1	5.9	Common Snapping Turtle
Spiders	0	0	NA

HIGHLIGHTS

- This subsection contains extensive peatland complexes, including much of the largest patterned peatland complex in the U.S.
- There is a diversity of northern wetland birds particularly associated with Lake of the Woods, including white pelicans, common terns, American bitterns, migratory waterfowl, migratory shorebirds, and an abundance of mammals like beaver and otter.
- Forest wildlife includes spruce grouse, great gray owls, short-eared owls, sharp-tailed grouse, and bog coppers.
- Areas important for SGCN include Lost River, Red Lake, Northwest Angle, and Beltrami Island SFs; Pine and Curry Island, Red Lake, Pine Creek, Luxemberg, Mulligan Lake, Norris Camp, Sprague Creek, and Winter Road Lake Peatland SNAs; Red Lake WMA; Hayes Lake and Zippel Bay SPs; and Big Bog State Recreation Area.

SPECIES SPOTLIGHT

Boreal chickadee (*Poecile hudsonica*)

Distribution Limited mostly to spuce-fir forests of northern MN from northern Aitkin County north through the Arrowhead region, and northwest to Lake of the Woods.

Abundance Rare and confined to northern boreal forest habitats. The rarity of this species prevents an adequate assessment of population trends.

Legal Status Federally protected migratory bird.

Comments Highly sought after by avid birders in areas like the Sax-Zim bog.

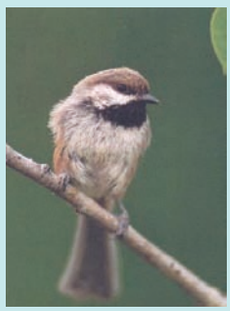
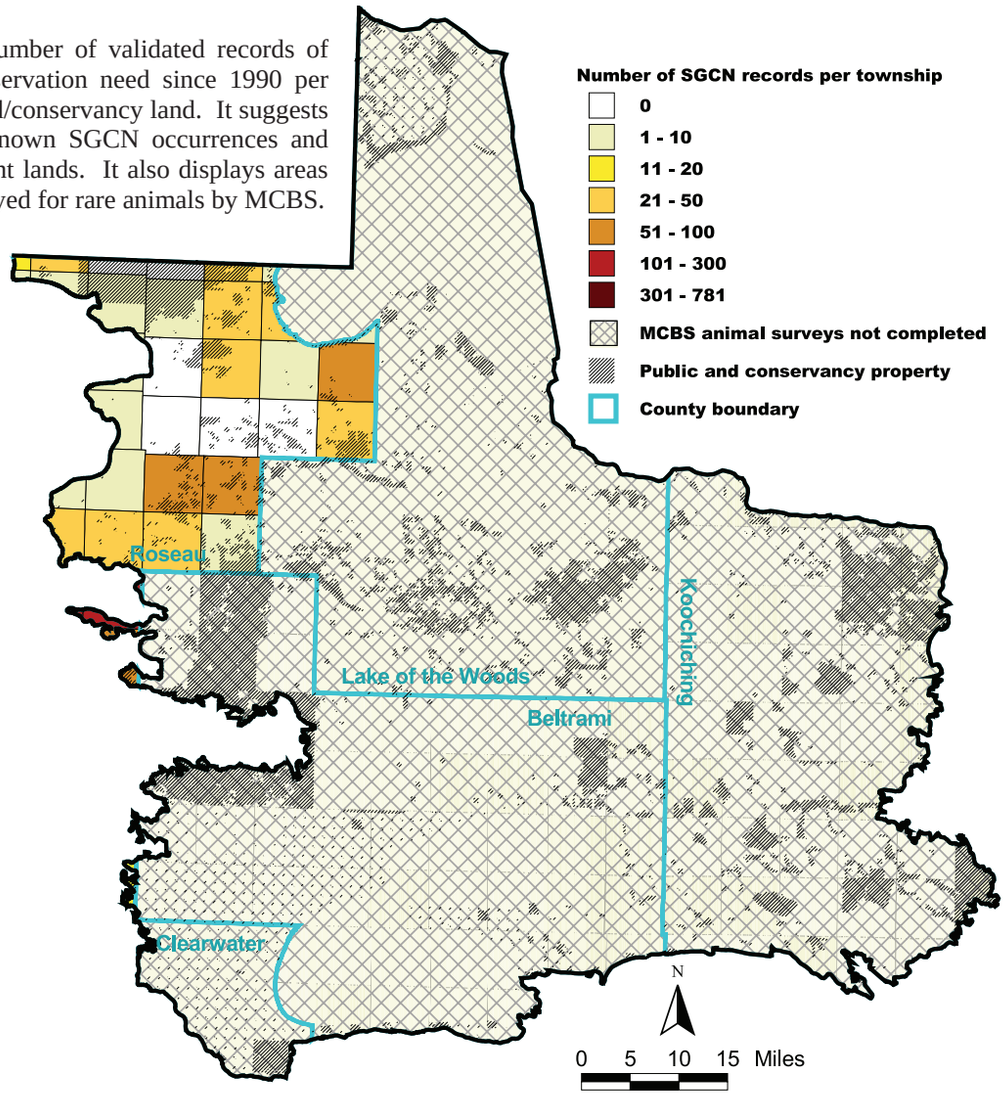


Photo by Myrna Pearman

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	83
Habitat Degradation in MN	90
Habitat Loss/Degradation Outside of MN	42
Invasive Species and Competition	25
Pollution	30
Social Tolerance/Persecution/Exploitation	23
Disease	3
Food Source Limitations	5
Other	5

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Lowland Coniferous		X			
Wetland-Nonforest	X	X			
Shoreline-dunes-cliff/talus (Lake of the Woods Shoreline)		X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

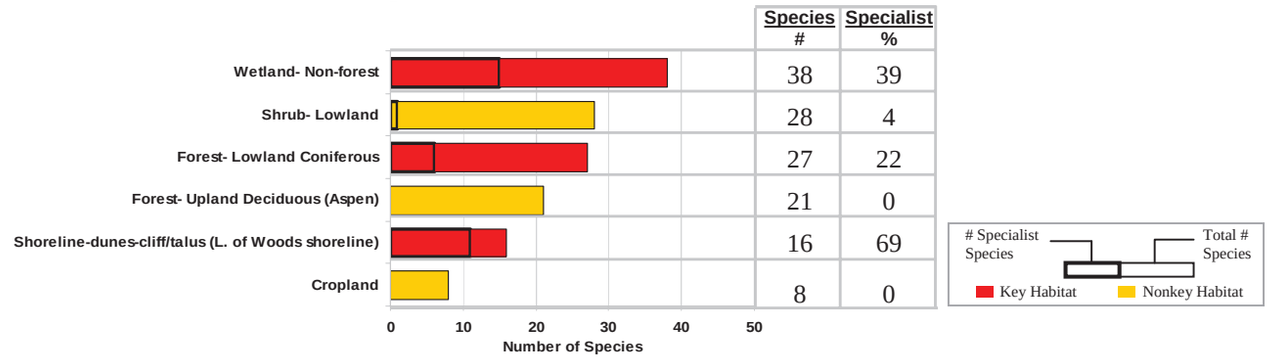
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

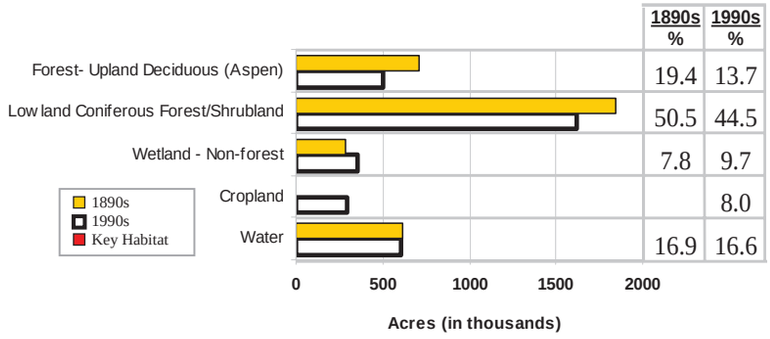
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

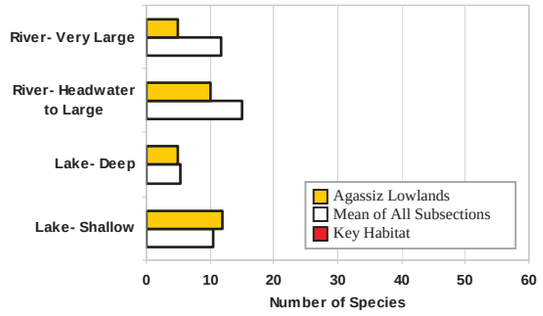
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



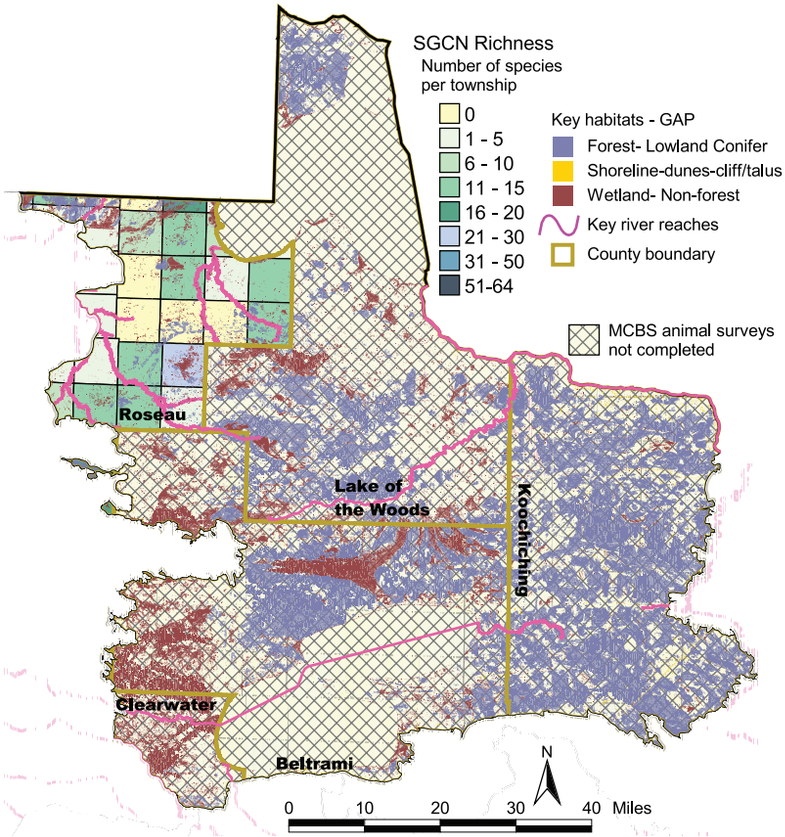
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid-to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Lowland Coniferous	50.5	44.5		22		2	3				27
Lake-Deep	N/A	14.3	1	2	1				1		5
Forest-Upland Deciduous (Aspen)	19.4	13.7	1	16		1	3				21
Wetland-Nonforest	7.8	9.7		32			5		1		38
Cropland	N/A	8.0		5			3				8
Grassland	N/A	4.2		15			5				20
Lake-Shallow	N/A	2.3		10					1		11
Forest-Upland Coniferous	0.2	1.1	1	22		4	4				31
Forest-Lowland Deciduous	0.5	0.8		12			1				13
Forest-Upland Deciduous (Hardwood)	0.3	0.8	1	14			4				19
Shrub/Woodland-Upland	3.9	0.6		14		4	5				23
Developed	N/A	0.0		4		1	1				6
Prairie	0.3	0.0		12		1	5				18
Shoreline-dunes-cliff/talus (Lake of the Woods)	N/A	N/A		13		1	2				16
Shrub-Lowland	N/A	N/A		21		1	6				28
River-Headwater to Large	N/A	N/A	1	2	2	1		3	1		10
River-Very Large	N/A	N/A	1		1			2	1		5

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Shoreline habitats of Lake of the Woods**, actions include:
   a. Support the protection of shoreline habitats from damaging development
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
   c. Enhance SGCN habitat along the shoreline
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures to evaluate management actions, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Border Lakes

SUBSECTION OVERVIEW

Much of the Border Lakes Subsection is made up of the Boundary Waters Canoe Area Wilderness, Superior National Forest, and Voyageurs National Park. Water dominates this area, which has more than 300 lakes larger than 160 acres and many rivers, including the Vermilion, Sioux, Moose, Portage, Kawishiwi, and Brule. The topography is largely rolling hills and includes Eagle Mountain, the highest point in Minnesota, at 2,301 feet. Most of the subsection is forested, and the major forest communities are jack, white, and red pine, and hardwood-conifer.

Recreation, tourism, and forestry are the predominant land uses in this subsection, and second-home ownership appears to be on the rise. Some areas here have never been logged, and this subsection contains some of the largest blocks of essentially unfragmented forest habitat in the state. The forest habitats in this subsection depend on fire, which is much less common than it was historically.

Quick facts

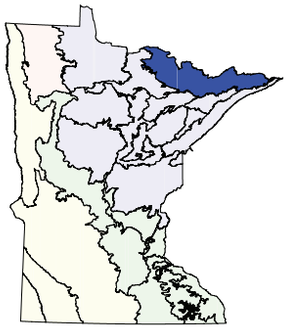
Acres: 2,771,462 (5.1% of state)

Ownership

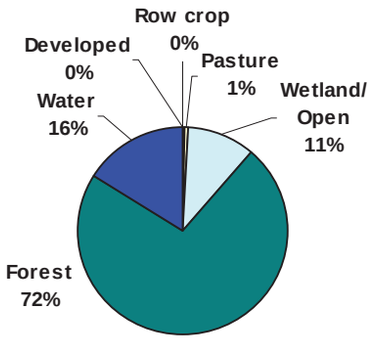
Public	Private	Tribal
81.7%	17.8%	0.5%

Population density (people/sq. mi.)

Current	Change (2000-2010)
3.3	+0.4



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

69 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Border Lakes. These SGCN include 15 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 5 mammal SGCN are known or predicted to occur in the Border Lakes, approximately 23% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	47	48.5	Bald eagle
Fishes	7	14.9	Nipigon cisco
Insects	6	10.7	Nabokov's blue
Mammals	5	22.7	Smoky shrew
Mollusks	2	5.1	Creek heelsplitter
Reptiles	1	5.9	Common Snapping Turtle
Spiders	0	0	NA

HIGHLIGHTS

- This region is a great location for unique fish of Lake Superior and some deep inland lakes and gray wolves, spruce grouse, Connecticut warblers, great gray owls, shortjaw ciscoes, boreal owls, boreal chickadees, spoonhead sculpins, bald eagles, black-backed woodpeckers, and Canada lynx.
- Areas important for SGCN include the Boundary Waters Canoe Area Wilderness; Voyageurs NP; Superior NF; Big Island and Burntside Island SNAs; and Burntside, Kabetogama, and Grand Portage SFs.

SPECIES SPOTLIGHT

Shortjaw cisco *(Coregonus zenithicus)*

Distribution Deepwater levels of Lake Superior, from 60 to 450 feet deep. Also found in Gunflint and Saganaga Lakes of northern Minnesota.

Abundance Rare.

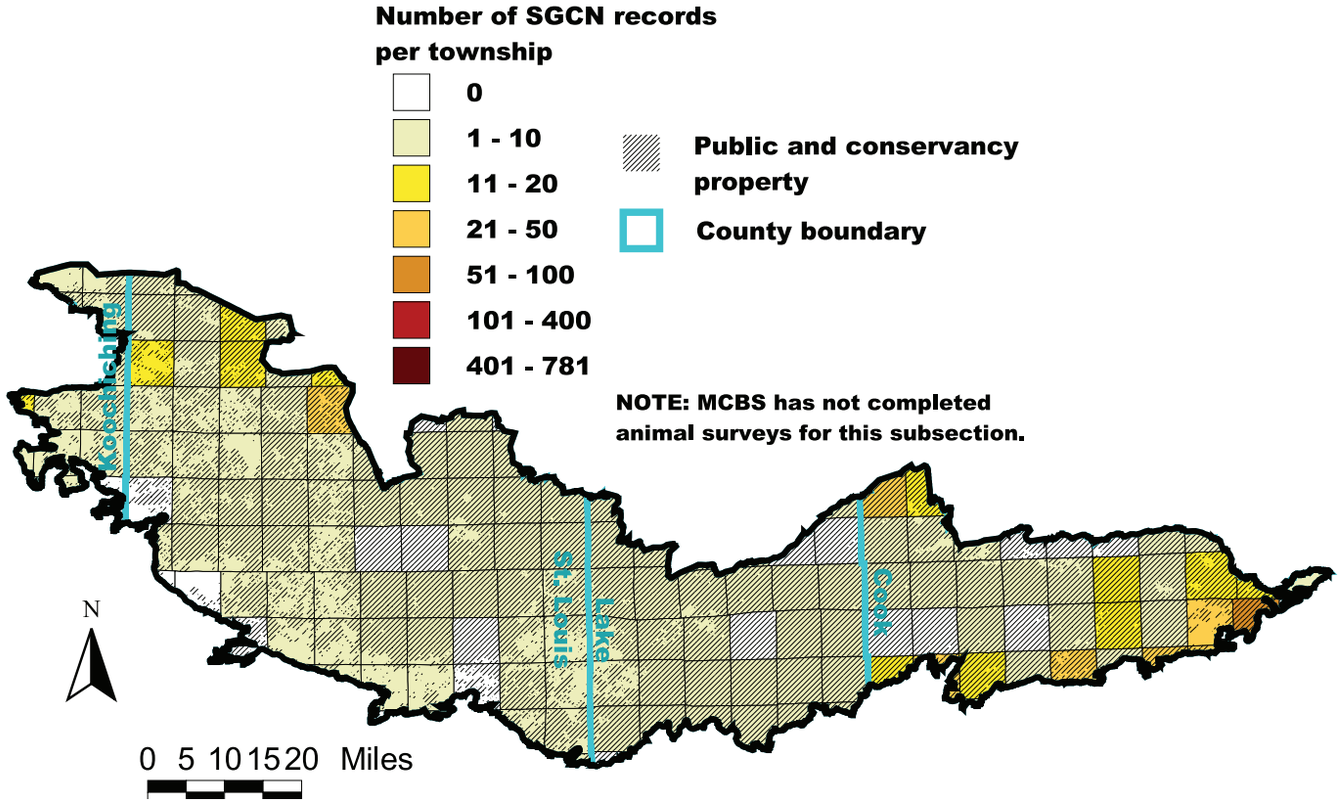
Legal Status State list-Special Concern.

Comments This species is possibly extirpated from Lake Huron and Lake Michigan, making Lake Superior the last major habitat occupied by this species. It may be reduced in numbers by other non-native fish present. More status assessment is needed.

Photo by Konrad Schmidt

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. Please note that MCBS has not begun surveying for rare animals in this subsection.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	75
Habitat Degradation in MN	84
Habitat Loss/Degradation Outside of MN	42
Invasive Species and Competition	22
Pollution	23
Social Tolerance/Persecution/Exploitation	20
Disease	0
Food Source Limitations	3
Other	7

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous	X	X			
Shrub/Woodland-Upland (Jack pine woodland)		X	X		
Forest-Lowland Coniferous		X			
Lake-Deep				X	
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

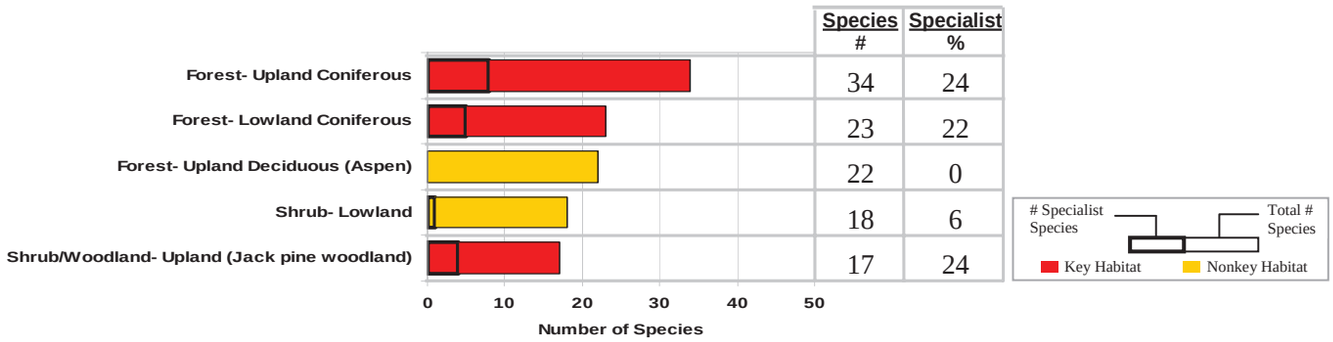
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

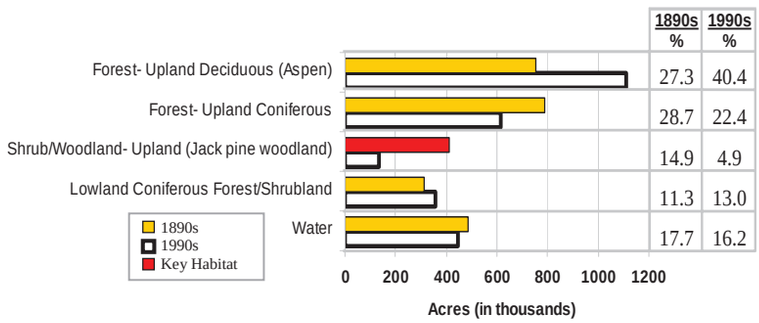
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

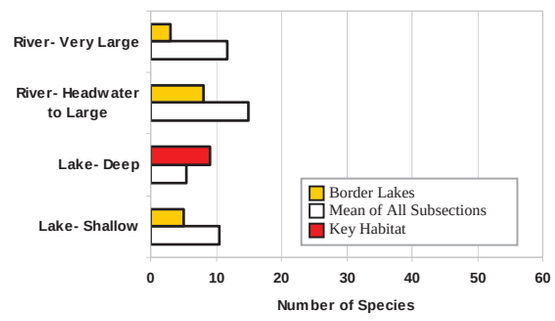
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



D – Aquatic Habitat Use

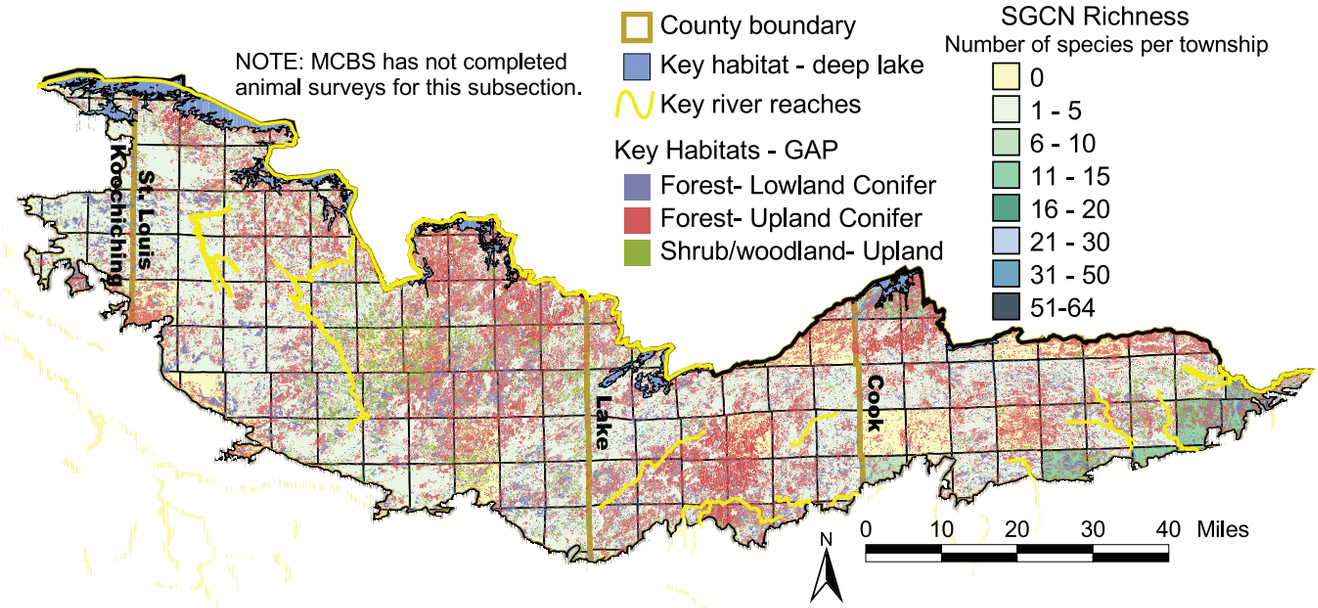


E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP

This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).



Sources:
Major River Centerline Traces in Minnesota, 1984; MN DNR 24K Lakes, 1990; MN DNR 24K Rivers and Streams, 2005; MN DNR Fish database, 2005; MN DNR Natural Heritage database, 2005; MN DNR Statewide Mussel Survey, 2005; MN GAP Landcover, 1993; The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fishes	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	27.3	40.4	1	17		1	3				22
Forest-Upland Coniferous	28.7	22.4	1	24		4	5				34
Lake-Deep	N/A	14.8		2	6				1		9
Forest-Lowland Coniferous	11.3	13.0		18		1	4				23
Shrub/Woodland-Upland (Jack pine woodland)	14.9	4.9		11		3	3				17
Wetland-Nonforest	0.2	1.4		15			2		1		18
Lake-Shallow	N/A	1.4		3					1		4
Grassland	N/A	0.7		10			1				11
Forest-Lowland Deciduous	0.0	0.6		11			2				13
Cropland	N/A	0.2		2			1				3
Developed	N/A	0.1		3		1					4
Forest-Upland Deciduous (Hardwood)	0.1	0.1	1	15			2				18
Shoreline-dunes-cliff/talus	N/A	N/A		8		1	4				13
Shrub-Lowland	N/A	N/A		14			4				18
River-Headwater to Large	N/A	N/A		2	3			2	1		8
River-Very Large	N/A	N/A			1			1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Deep lakes habitats**, actions include
   a. Maintain good water quality in deep lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN

Priority Conservation Actions for Research (continued)

2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Chippewa Plains

SUBSECTION OVERVIEW

The Chippewa Plains Subsection borders the Agassiz Lowlands and Littlefork Vermilion Uplands subsections to the north and includes Lake Winnibigoshish, Cass Lake, and hundreds of other smaller lakes of various sizes. The Mississippi River flows through a large part of this subsection and has its headwaters at Lake Itasca. Wetlands exist throughout the area. Before being settled by people of European descent, this area was heavily timbered with a diverse mixture of deciduous and coniferous trees.

This subsection includes the Chippewa National Forest, and much of the subsection is forested, most commonly by aspen. Recreation, tourism, and forestry are the predominant land uses. Most of the shorelines are developed with summer homes, and marginal shorelines once determined unsuitable for residential development are now being developed.

Quick facts

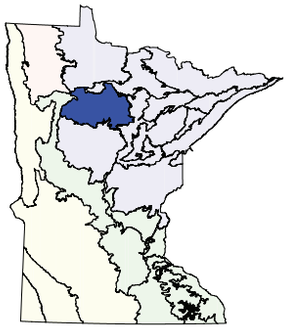
Acres: 2,202,497 (4.1% of state)

Ownership

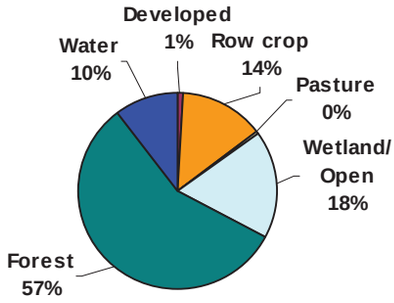
Public	Private	Tribal
44.9%	52.1%	3.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
32.7	+2.8



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

83 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Chippewa Plains. These SGCN include 22 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 6 mammal SGCN are known or predicted to occur in the Chippewa Plains, approximately 27% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	60	61.9	Northern goshawk
Fish	4	8.5	Pugnose shiner
Insects	8	14.3	Vertree's ceraclean caddisfly
Mammals	6	27.3	Gray wolf
Mollusks	2	5.1	Black sandshell
Reptiles	2	11.8	Smooth Green Snake
Spiders	0	0	NA

HIGHLIGHTS

- The exceptional mix of forests and lakes in this subsection provides prime habitats for numerous featured species such as great gray owls, yellow rails, common loons, black-backed woodpeckers, red-shouldered hawks, red-necked grebes, ospreys, bald eagles, northern goshawks, gray wolves, and smooth green snakes.
- Areas important for SGCN include the Chippewa NF; Hole in the Bog, Pennington Bog, Lake Bemidji, Iron Springs Bog, and Lost 40 SNAs; Blackduck, Buena Vista, Mississippi Headwaters, Paul Bunyan, Welsh Lake, Bowstring, and Big Fork SFs; Lake Bemidji and Schoolcraft SPs; and Mud-Goose and Carmen Borgerding WMAs.

SPECIES SPOTLIGHT

Northern goshawk *(Accipiter gentilis)*

Distribution Primarily inhabits northern hardwood forests and mixed hardwood-coniferous forests of northern and northeastern MN. Distribution is broad but spotty.

Abundance Uncommon. Statewide surveys over the past few years document typically fewer than 30 nests per year.

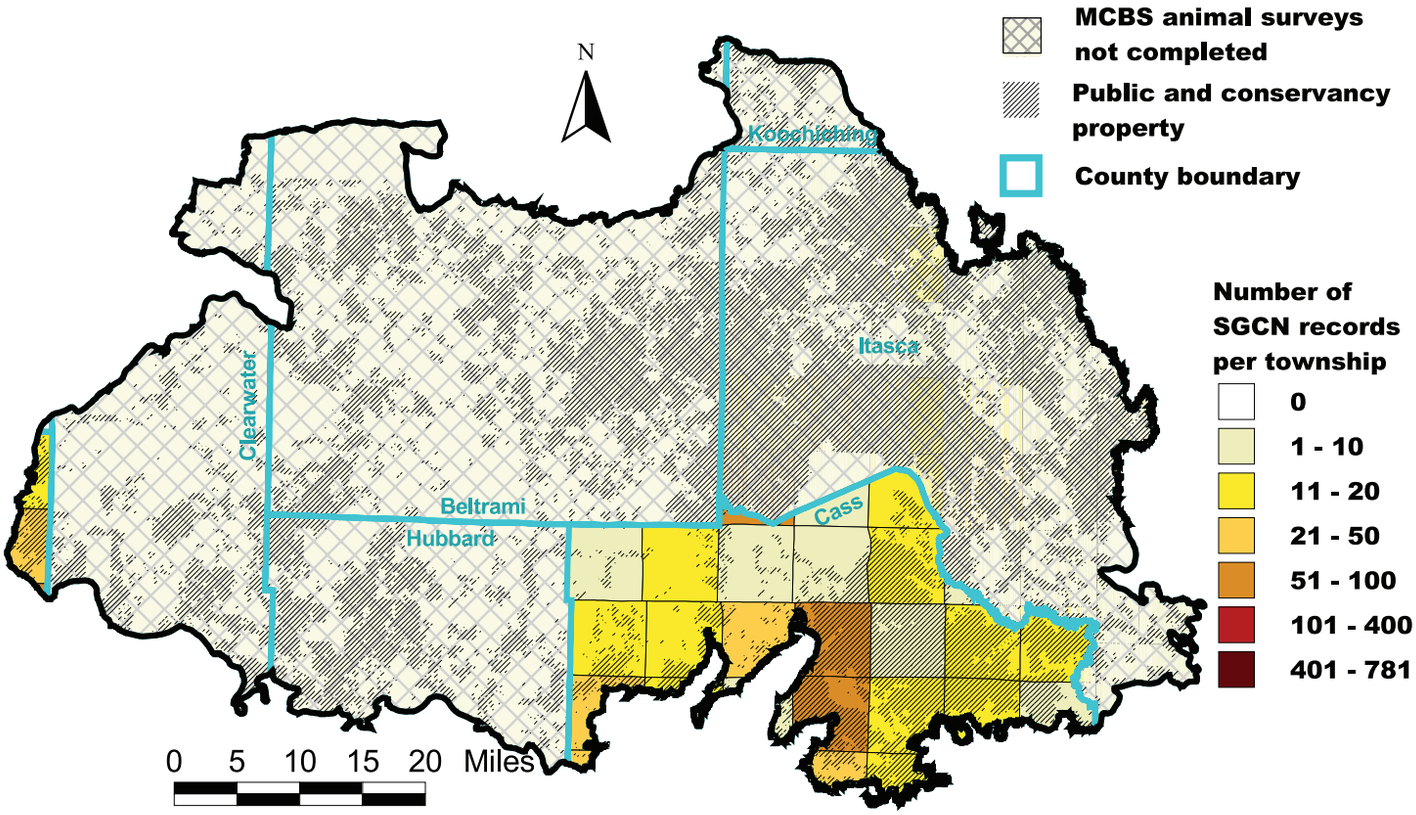
Legal Status Federally protected migratory bird.

Comments Concerns have been raised about the rangewide status of this bird and of the need to include its habitat needs in forest management prescriptions.

Photo by Carrol Henderson

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	84
Habitat Degradation in MN	89
Habitat Loss/Degradation Outside of MN	42
Invasive Species and Competition	23
Pollution	29
Social Tolerance/Persecution/Exploitation	22
Disease	2
Food Source Limitations	2
Other	8

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous	X	X			
Shrub/Woodland-Upland (Jack pine woodland)			X		
Wetland-Nonforest	X	X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

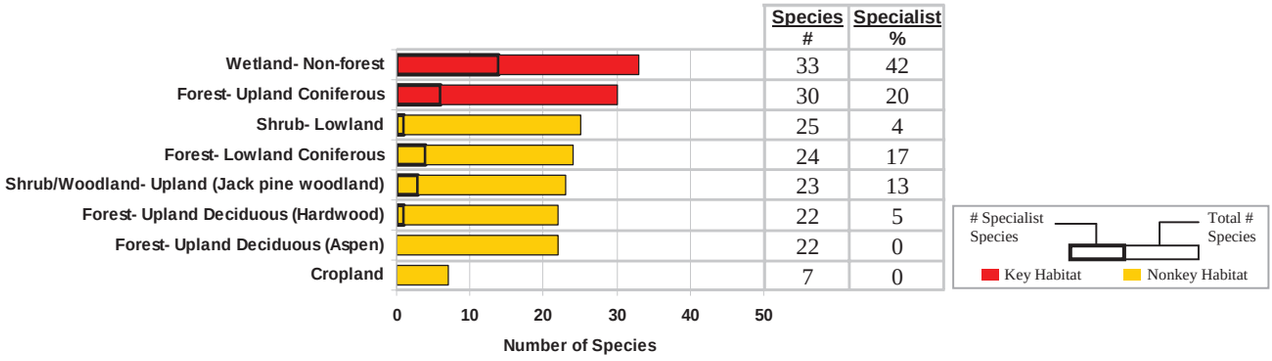
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

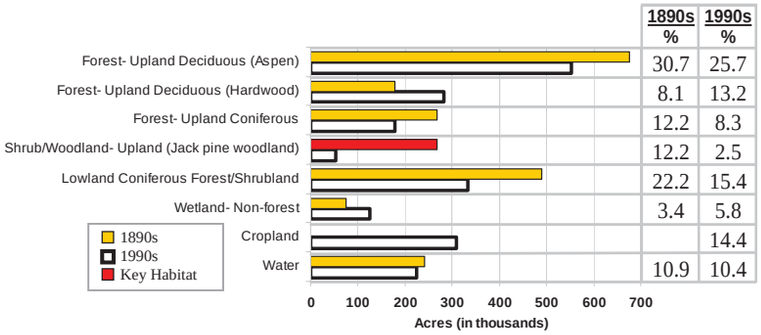
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

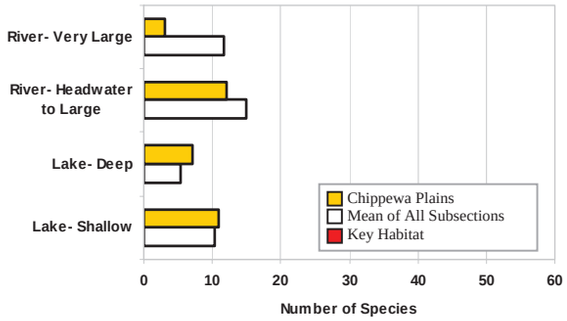
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



D – Aquatic Habitat Use

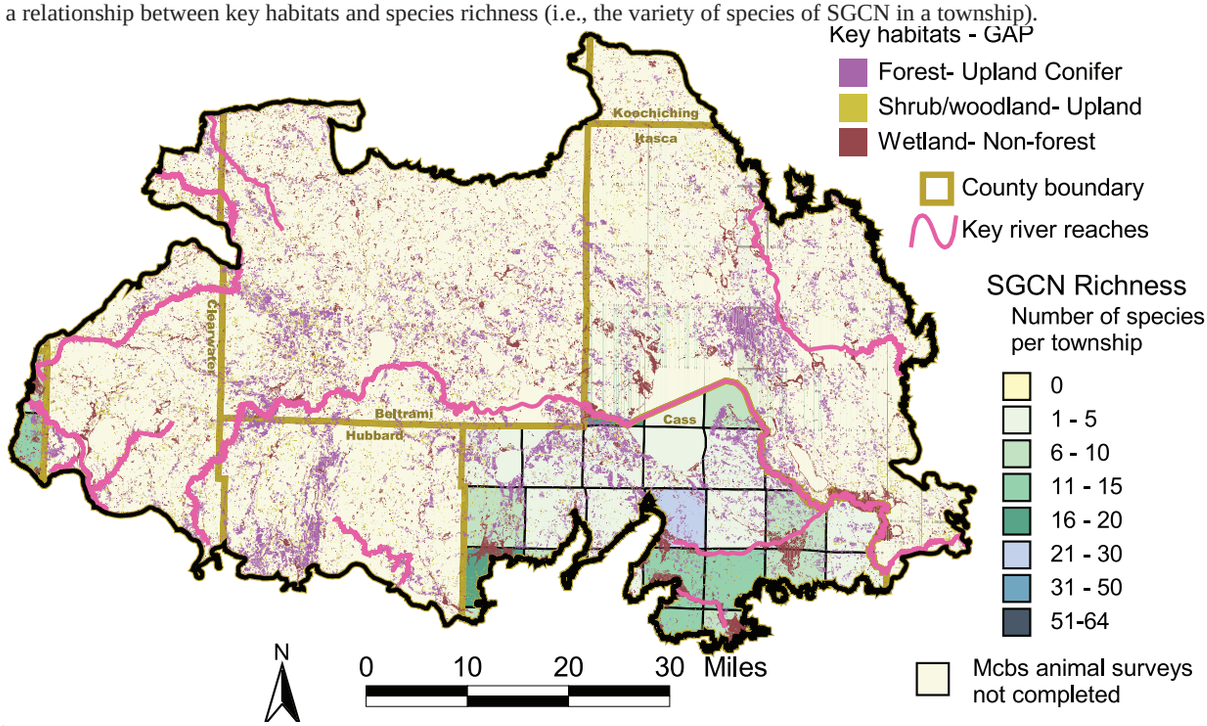


E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP

This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).



Sources: Major River Centerline Traces in Minnesota, 1984; MN DNR 24K Rivers and Streams, 2005; MN DNR County Biological Survey (MCBS), 2005; MN DNR Fish database, 2005; MN DNR Natural Heritage database, 2005; MN DNR Statewide Mussel Survey, 2005; MN GAP Landcover, 1993; The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	30.7	25.8	1	17			4				22
Forest-Lowland Coniferous	22.2	15.4		20		1	3				24
Cropland	N/A	14.4		5			2				7
Forest-Upland Deciduous (Hardwood)	8.1	13.2	1	16			5				22
Forest-Upland Coniferous	12.2	8.3	1	21		2	5		1		30
Lake-Deep	N/A	7.2		2	3	1			1		7
Wetland-Nonforest	3.4	5.8		29			3		1		33
Forest- Lowland Deciduous	0.3	3.2		13			3				16
Lake- Shallow	N/A	3.2		9					1		10
Shrub/Woodland-Upland (Jack pine woodland)	12.2	2.5		14		2	6		1		23
Developed	N/A	0.7		4			3				7
Grassland	N/A	0.3		15			5		1		21
Shoreline-dunes-cliff/talus	N/A	N/A		10			1				11
Shrub-Lowland	N/A	N/A		20		1	4				25
River-Headwater to Large	N/A	N/A		2	4	3		2	1		12
River-Very Large	N/A	N/A				1		1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Glacial Lake Superior Plain

SUBSECTION OVERVIEW

The Glacial Lake Superior Plain Subsection occupies a small area just south Duluth, Minnesota, but it is part of a larger unit in Wisconsin. Topography is level to gently rolling except along rivers and streams where the Nemadji River and its tributaries have worn gorges up to 150 feet deep. There are no natural lakes found here. Before settlement by people of European descent, the forest was mostly white spruce, white pine, and aspen-birch. Following logging, today's forest is largely quaking aspen.

Forestry is the most predominant land use, and significant portions of this area remain undeveloped. Natural erosion of the predominantly red clay soils by rivers, which deposit extensive clay sediments into Lake Superior, is a significant problem.

Quick facts

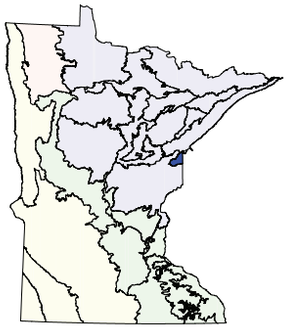
Acres: 109,673 (0.2% of state)

Ownership

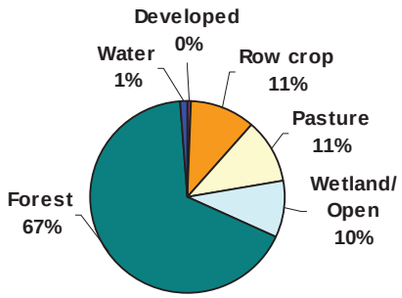
Public	Private	Tribal
29.1%	70.9%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
42.4	+2.7



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

55 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Glacial Lake Superior Plain. These SGCN include 10 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 4 mammal SGCN are known or predicted to occur in the Glacial Lake Superior Plain, approximately 18% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	2	33.3	*None documented since 1990*
Birds	44	45.4	Ovenbird
Fish	1	2.1	Northern brook lamprey
Insects	0	0	NA
Mammals	4	18.2	*None documented since 1990*
Mollusks	2	5.1	Creek heelsplitter
Reptiles	2	11.8	Wood turtle
Spiders	0	0	NA

HIGHLIGHTS

- This subsection has a mixed representation of forest and riparian habitats that are home to wood turtles, gray wolves, bald eagles, common ravens, and northern brook lampreys.
- In some winters there are significant numbers of boreal migrants in the region including crossbills, pine siskins, redpolls, and great gray owls.
- Areas important for SGCN include Jay Cooke State Park and the Nemadji State Forest.

SPECIES SPOTLIGHT

Wood turtle *(Clemmys insculpta)*

Distribution Have been documented in 15 counties in eastern MN. Associated with midsize rivers flowing through forested areas, with nesting habitat (sandbars, riverbanks, open hillsides, railroad grades) nearby.

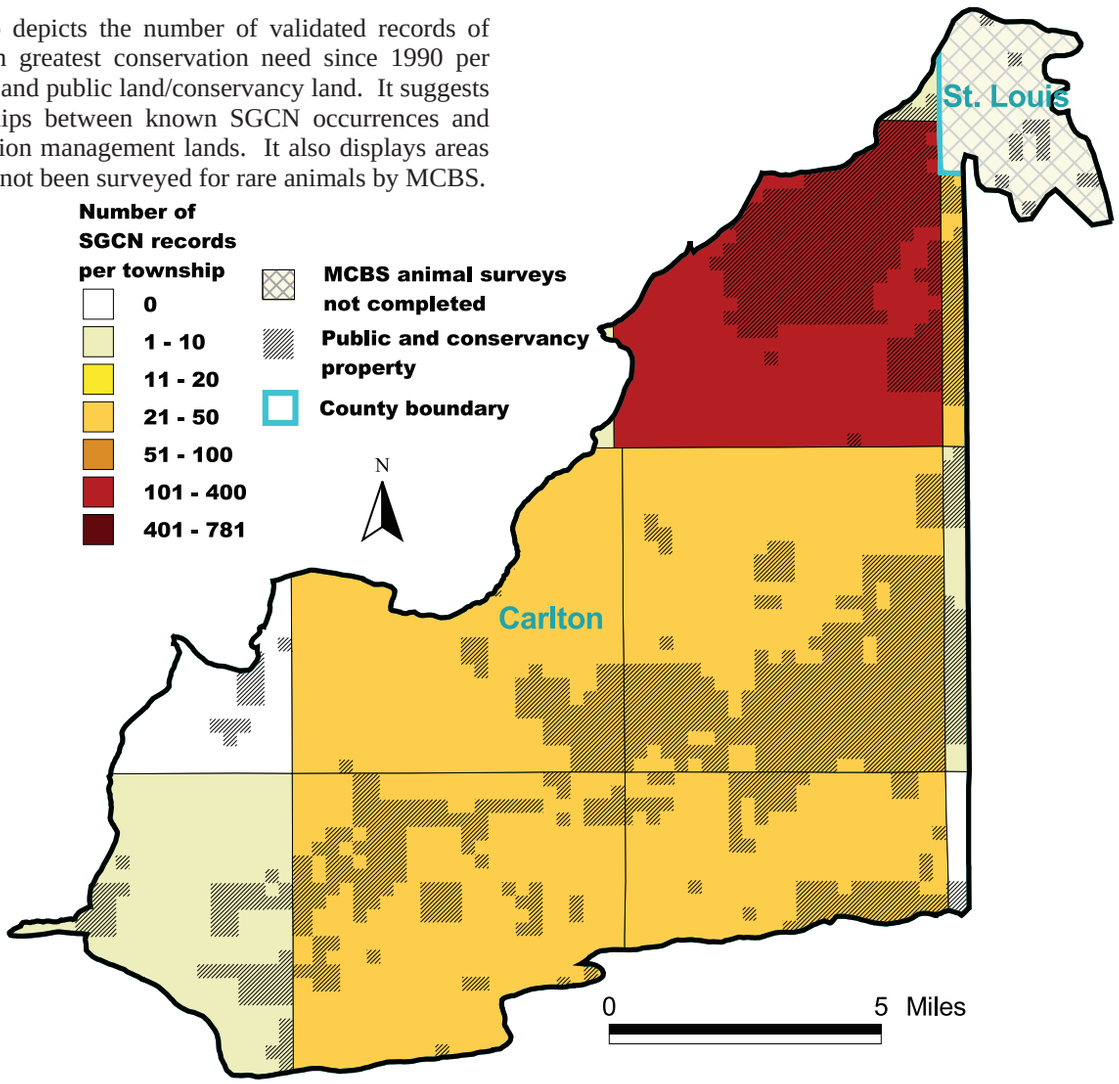
Abundance Uncommon, even in suitable habitat.

Legal Status State list-Threatened.

Comments The most terrestrial of MN turtles, but studies of radioed turtles have shown that they generally stay within 100 miles of river. Preservation of this species depends on collaboration with private and public landowners to protect riparian habitat and water quality.

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	84
Habitat Degradation in MN	93
Habitat Loss/Degradation Outside of MN	49
Invasive Species and Competition	31
Pollution	31
Social Tolerance/Persecution/Exploitation	24
Disease	2
Food Source Limitations	2
Other	4

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Deciduous (Aspen)	X				
Forest-Upland Deciduous (Mixed hardwood-pine)	X		X		
Forest-Upland Coniferous (Pine flats)	X		X		
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

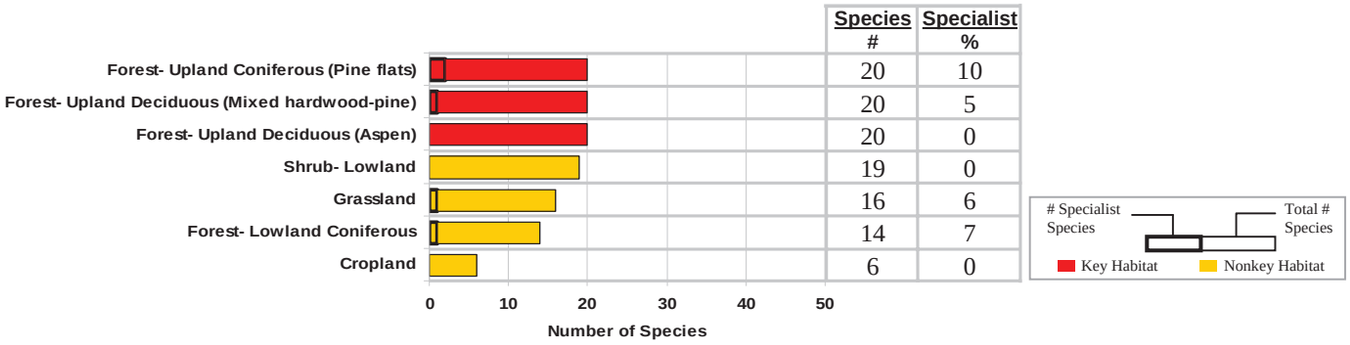
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

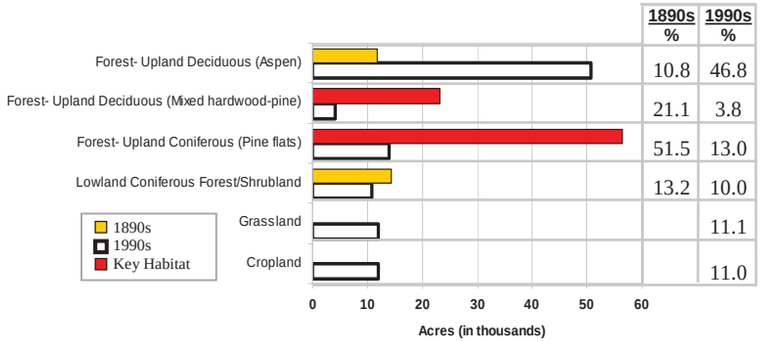
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

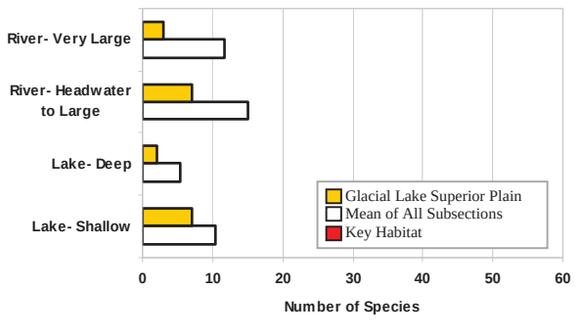
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



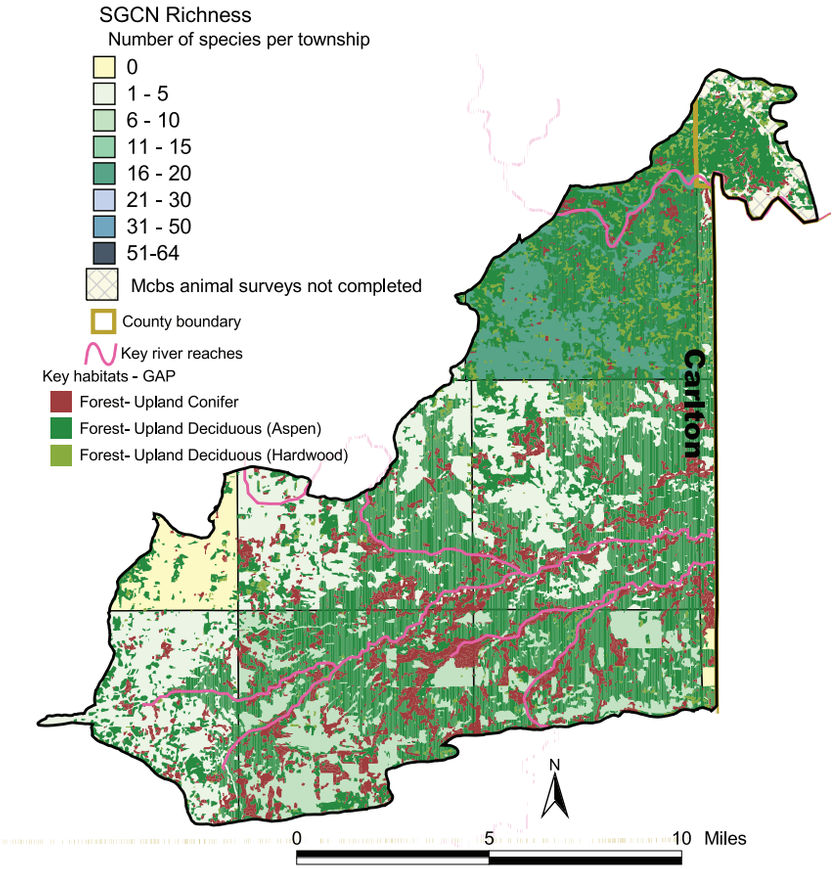
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	10.8	46.6	2	16			2				20
Forest-Upland Coniferous (Pine flats)	51.5	13.0	1	16			3				20
Grassland	N/A	11.1		12			4				16
Cropland	N/A	11.0		4			2				6
Forest-Lowland Coniferous	13.2	10.0		13			1				14
Forest-Upland Deciduous (Mixed hardwood-pine)	21.1	3.8	2	15			3				20
Forest-Lowland Deciduous	0.0	1.7		12			1				13
Lake-Deep	N/A	0.9		1					1		2
Shrub/Woodland-Upland (Jack pine woodland)	2.3	0.9		11			4				15
Wetland-Nonforest	0.0	0.8		19			2		1		22
Lake-Shallow	N/A	0.1		5					1		6
Developed	N/A	0.1		5			2				7
Shoreline-dunes-cliff/talus	N/A	N/A		8			1				9
Shrub-Lowland	N/A	N/A		16			3				19
River-Headwater to Large	N/A	N/A		2	1			2	2		7
River-Very Large	N/A	N/A		1				1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, Protect the Key Habitats

1. **Upland deciduous aspen forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Upland deciduous mixed hardwood-pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Upland coniferous pine flats habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Laurentian Uplands

SUBSECTION OVERVIEW

The Laurentian Uplands Subsection, sandwiched between the North Shore Highlands and Border Lakes subsections, is dominated by rolling hills running southwest to northeast. The subsection's high elevation serves as the source of many rivers, including the St. Louis, Cloquet, and Whitefish. Lakes and wetlands are also numerous. Before settlement by people of European descent, the major upland forest types were aspen-birch, jack, and red and white pine. The lowland areas between the hills contained conifer swamps and bogs.

Forestry is the most important land use in this subsection, and quaking aspen is now the dominant tree species. Forest harvest patch size is a concern for wildlife dependent on large, contiguous blocks of habitat. The many public lands, including lakes and rivers, are readily accessible and provide ample recreational opportunities.

Quick facts

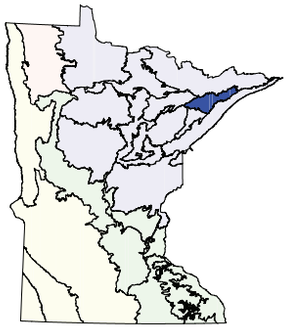
Acres: 567,280 (1.1% of state)

Ownership

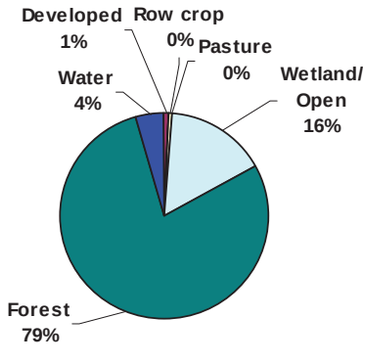
Public	Private	Tribal
82.7%	17.3%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
4.5	0.0



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

58 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Laurentian Uplands. These SGCN include 12 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 7 mammal SGCN are known or predicted to occur in the Laurentian Uplands, approximately 32% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	40	41.2	Black-throated blue warbler
Fish	0	0	NA
Insects	7	12.5	Disa alpine
Mammals	7	31.8	Rock vole
Mollusks	2	5.1	Creek heelsplitter
Reptiles	1	5.9	Common Snapping Turtle
Spiders	0	0	NA

HIGHLIGHTS

- This subsection offers excellent representations of northern forest wildlife and significant amounts of public lands.
- Featured species include bald eagles, gray wolves, Canada lynx, spruce grouse, black-throated blue warblers, Connecticut warblers, common loons, gray jays, and rare heather voles.
- Areas important for SGCN include the Superior NF; Sand Lake Peatland SNA; and Cloquet Valley, Finland, and Pat Boyle SFs.

SPECIES SPOTLIGHT

Heather vole *(Phenacomys intermedius)*

Distribution Limited distribution in coniferous forest habitats of northeastern Minnesota along the Canadian border.

Abundance Extremely rare.

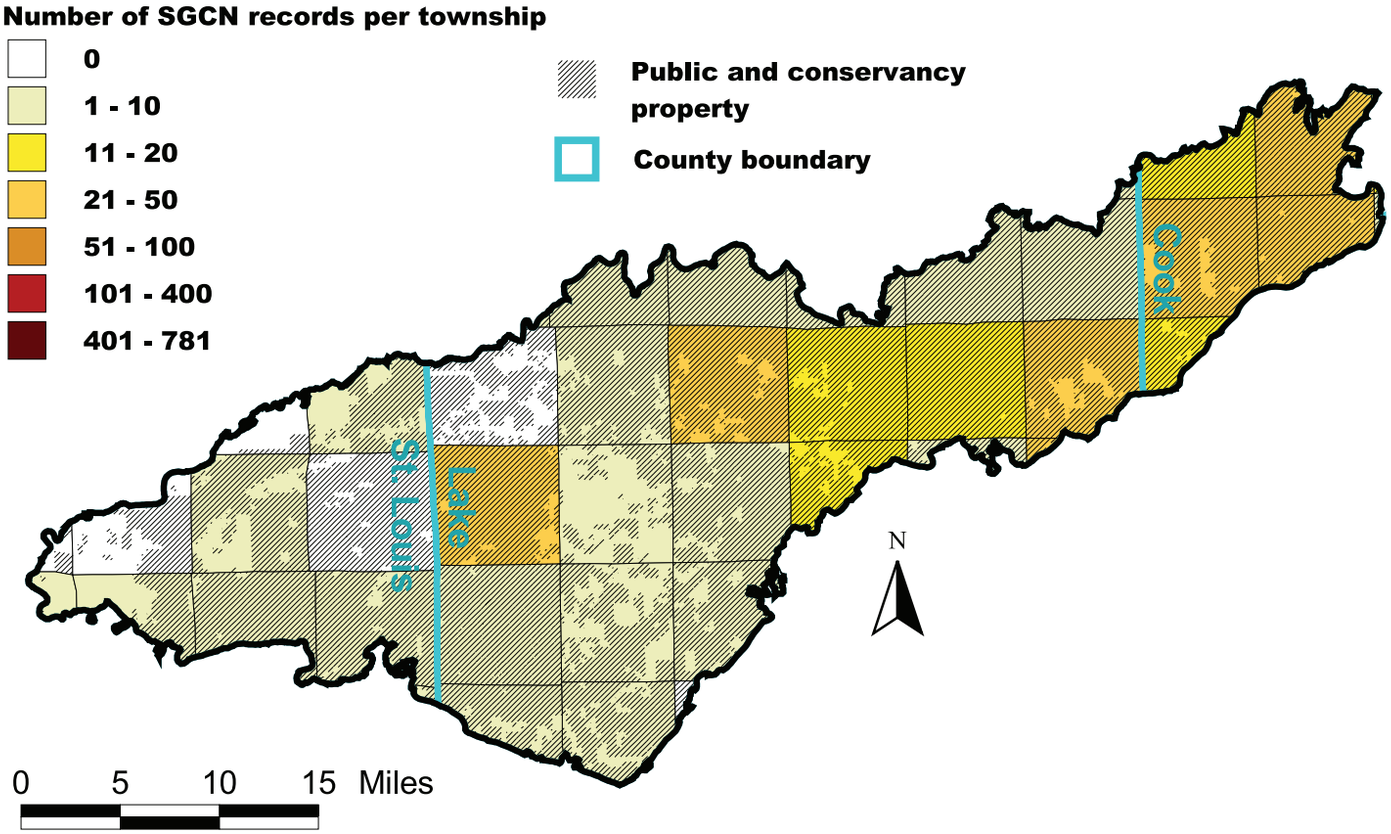
Legal Status State list-Special Concern.

Comments This species is on the southern edge of its range that lies primarily in Canada and the Rocky Mountains.

Illustration by Nan Kane

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	79
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	41
Invasive Species and Competition	17
Pollution	22
Social Tolerance/Persecution/Exploitation	17
Disease	0
Food Source Limitations	3
Other	5

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous	X	X			
Shrub/Woodland-Upland (Jack pine woodland)		X	X		
Forest-Lowland Coniferous		X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

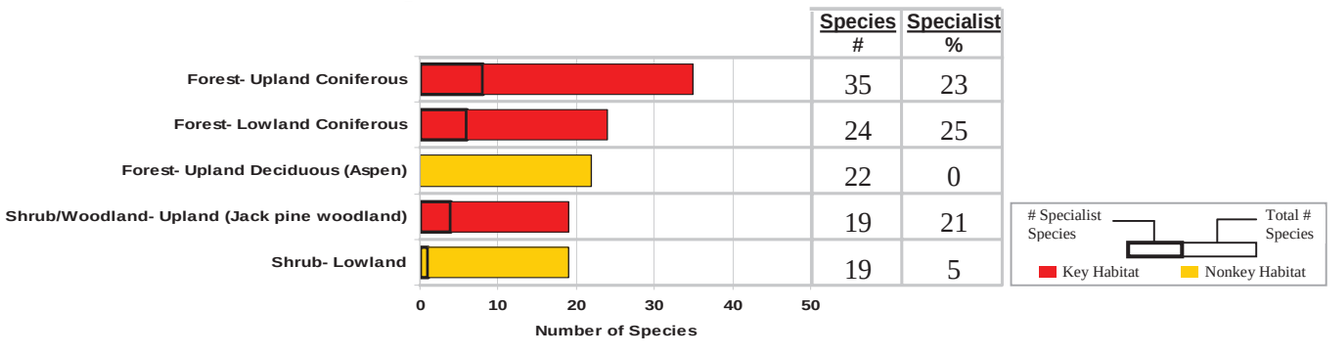
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

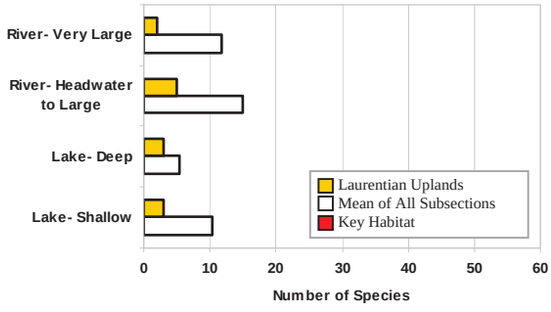
E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change

D – Aquatic Habitat Use

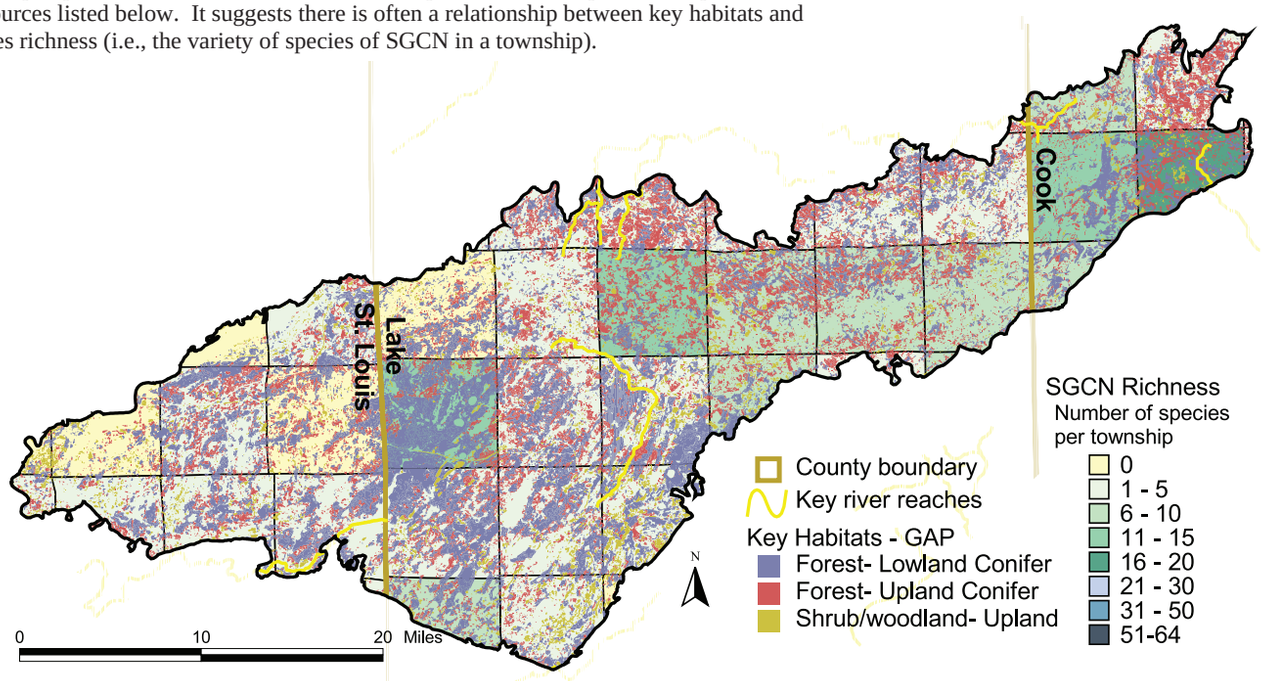


E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP

This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).



Sources: Major River Centerline Traces in Minnesota, 1984; MN DNR 24K Rivers and Streams, 2005; MN DNR County Biological Survey (MCBS), 2005; MN DNR Fish database, 2005; MN DNR Natural Heritage database, 2005; MN DNR Statewide Mussel Survey, 2005; MN GAP Landcover, 1993; The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	34.6	36.1	1	17		1	3				22
Forest-Lowland Coniferous	28.2	35.3		18		2	4				24
Forest-Upland Coniferous	13.2	17.4	1	24		4	6				35
Shrub/Woodland-Upland (Jack pine woodland)	19.4	4.7		11		3	5				19
Lake-Deep	N/A	2.2		2					1		3
Lake-Shallow	N/A	2.1		1					1		2
Wetland-Nonforest	0.0	1.1		10			3		1		14
Grassland	N/A	0.5		9			3				12
Forest-Lowland Deciduous	0.0	0.3		11			2				13
Forest-Upland Deciduous (Hardwood)	0.0	0.3	1	15			3				19
Developed	N/A	0.0		2		1	1				4
Cropland	N/A	0.0		1			2				3
Shoreline-dunes-cliff/talus	N/A	N/A		5		1	4				10
Shrub-Lowland	N/A	N/A		13		1	5				19
River-Headwater to Large	N/A	N/A		2				2	1		5
River-Very Large	N/A	N/A						1	1		2

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Littlefork Vermilion Uplands

SUBSECTION OVERVIEW

The Littlefork Vermilion Uplands Subsection is located in extreme north-central Minnesota. It is named for the Littlefork River, its western border, and the Vermilion River, its eastern border. Topography is level to gently rolling throughout, with many meandering rivers and streams. There are no large recreational lakes in this area. Before settlement by people of European descent, much of the subsection was forested with aspen-birch, and lowlands were occupied by sedge fen, black spruce–sphagnum bog, and white cedar–black ash swamp.

Forestry is the most common land use in this subsection, and quaking aspen, the most common tree species, is harvested for pulp. Recreation is also important, especially in the southeastern section, where there are many public lands.

Quick facts

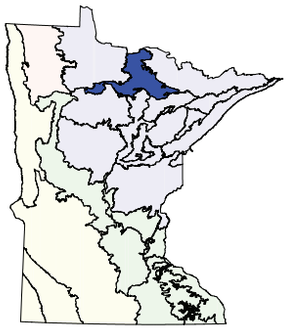
Acres: 1,651,020 (3.1% of state)

Ownership

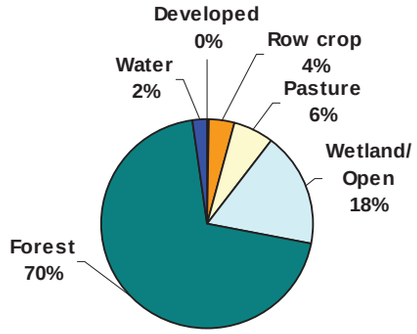
Public	Private	Tribal
57.9%	38.7%	3.4%

Population density (people/sq. mi.)

Current	Change (2000-2010)
6.8	-0.7



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

67 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Littlefork Vermilion Uplands. These SGCN include 16 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 4 mammal SGCN are known or predicted to occur in the Littlefork Vermilion Uplands, approximately 18% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	48	49.5	American bittern
Fish	3	6.4	Lake sturgeon
Insects	8	14.3	Tiger beetle (*C. denikei*)
Mammals	4	18.2	Northern bog lemming
Mollusks	2	5.1	Black sandshell
Reptiles	1	5.9	Common Snapping Turtle
Spiders	0	0	NA

HIGHLIGHTS

- The Littlefork Vermilion Uplands has an excellent mix of northern forests, lakes, and rivers that support a diversity of wildlife on extensive public lands.
- There are bald eagles, Canada lynx, spruce grouse, great gray owls, black-backed woodpeckers, yellow rails, boreal owls, trumpeter swans, boreal chickadees, merlins, red-necked grebes, northern bog lemmings, and lake sturgeons.
- Areas important for SGCN include Nett Lake, Myrtle Lake, Lost Lake, and Caldwell Brook SNAs; McCarthy Beach, and Bearhead SPs; and Koochiching, Big Fork, Pine Island, and Smoky Bear SFs.

SPECIES SPOTLIGHT

Northern bog lemming *(Synaptomys borealis)*

Distribution Extremely limited distribution along the Canadian border from Koochiching to Lake of the Woods and Roseau counties.

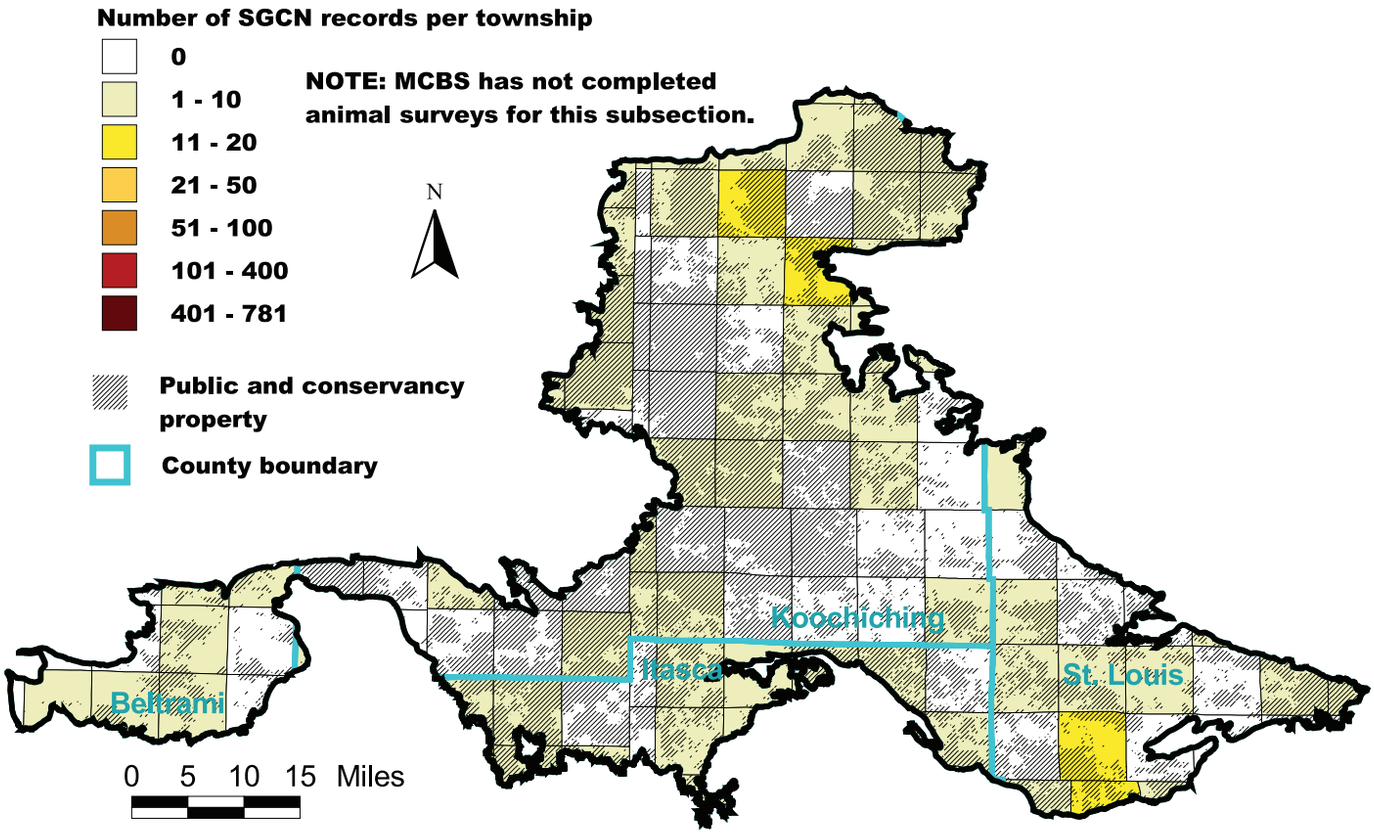
Abundance Extremely rare.

Legal Status State list-Special Concern.

Comments This species is found primarily in Canada and the Minnesota sites are on the southern edge of the range.

Photo by Jim Reichel, Montana Natural Heritage Program

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. Please note that MCBS has not begun animal surveys in this subsection.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	79
Habitat Degradation in MN	87
Habitat Loss/Degradation Outside of MN	46
Invasive Species and Competition	19
Pollution	28
Social Tolerance/Persecution/Exploitation	22
Disease	1
Food Source Limitations	1
Other	4

Littlefork Vermilion Uplands

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous	X	X			
Forest-Lowland Coniferous	X	X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

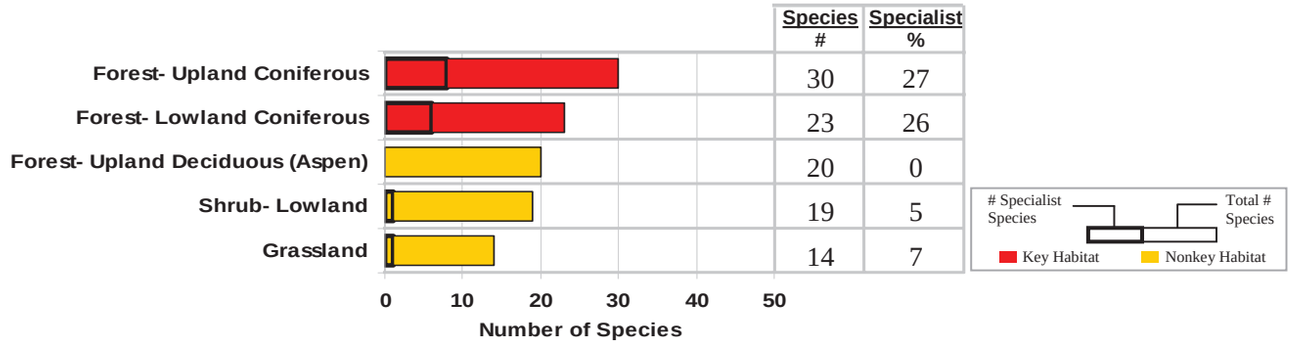
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

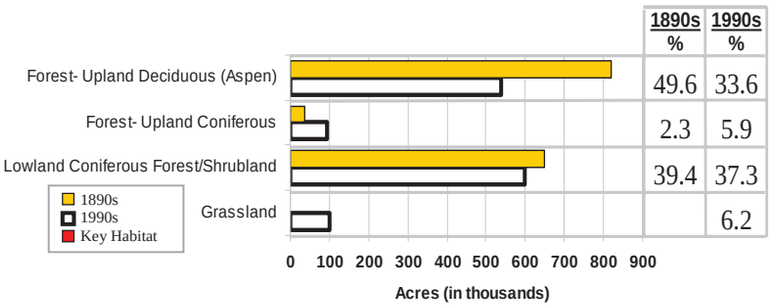
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

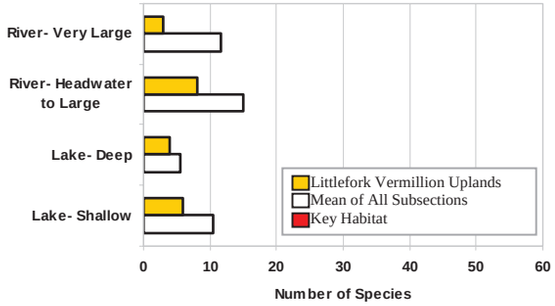
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



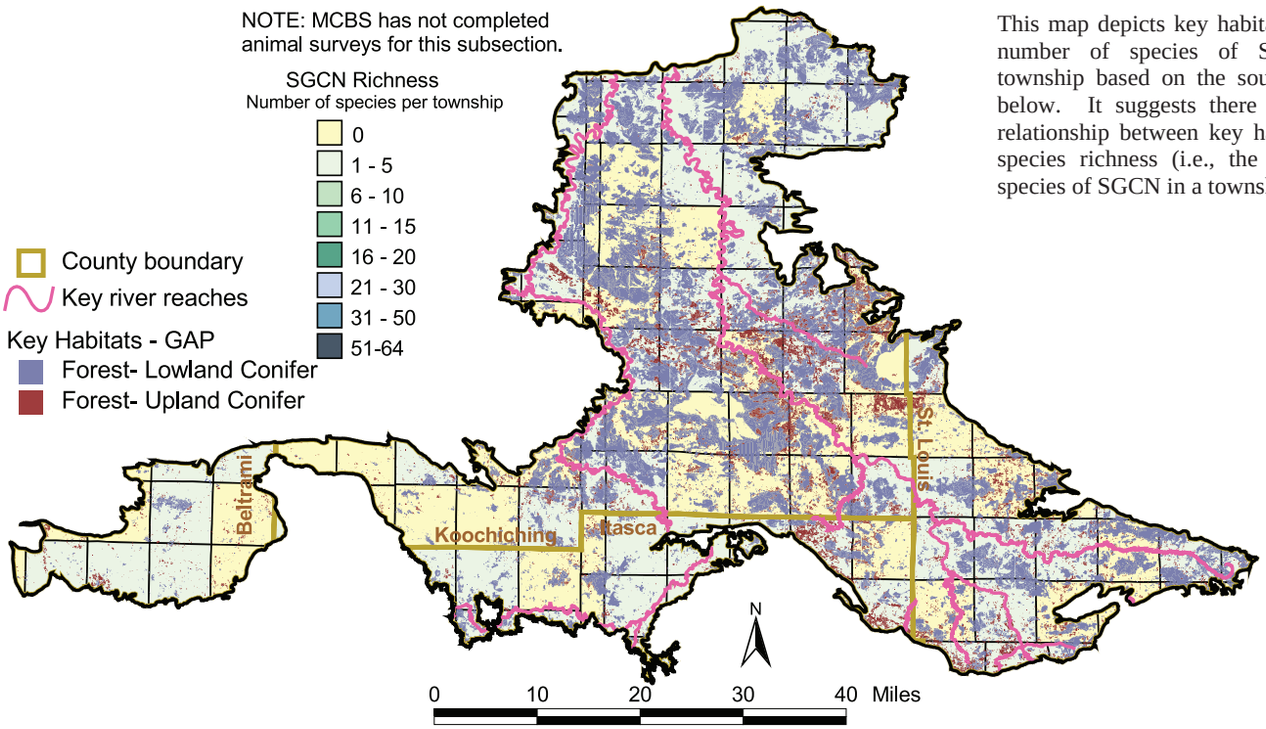
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources: Major River Centerline Traces in Minnesota, 1984; MN DNR 24K Rivers and Streams, 2005; MN DNR Fish database, 2005; MN DNR Natural Heritage database, 2005; MN DNR Statewide Mussel Survey, 2005; MN GAP Landcover, 1993; The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Lowland Coniferous	39.4	37.3		18		2	3				23
Forest-Upland Deciduous (Aspen)	49.6	33.6	1	16		1	2				20
Grassland	N/A	6.2		12			2				14
Forest-Upland Coniferous	2.3	5.9	1	22		4	3				30
Cropland	N/A	4.0		4			2				6
Shrub/Woodland-Upland (Jack pine woodland)	3.7	3.0		13		3	3				19
Forest-Lowland Deciduous	1.3	2.6		12			1				13
Wetland-Nonforest	0.2	2.5		18			2		1		21
Forest-Upland Deciduous (Hardwood)	1.0	2.2	1	15			3				19
Lake-Deep	N/A	1.8		2	1				1		4
Lake-Shallow	N/A	0.6		4					1		5
Developed	N/A	0.3		4		1	1				6
Shoreline-dunes-cliff/talus	N/A	N/A		7		1	1				9
Shrub-Lowland	N/A	N/A		15		1	3				19
River-Headwater to Large	N/A	N/A		2	2	1		2	1		8
River-Very Large	N/A	N/A			1			1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Mille Lacs Uplands

SUBSECTION OVERVIEW

The Mille Lacs Uplands is a large subsection located in east-central Minnesota and includes the St. Croix Moraines, a small area to the southeast along the St. Croix River. The subsection is named after Lake Mille Lacs, well known for its high-quality walleye fishing. Several major rivers run through the area, including the Kettle, Snake, Rum, Ripple, and St. Croix, the latter forming part of the eastern boundary. The subsection contains extensive wetlands and 100 lakes greater than 160 acres in size. Gently rolling hills are the dominant landform. Glaciation has had a major influence on the landscape, and the resulting moraines provide excellent salamander habitat today. Before settlement by people of European descent, maple-basswood forests were prevalent in the south, and the north was a mix of conifer and hardwood forests.

Because of its proximity to the Twin Cities and its vast network of roads, this subsection is under increasing pressure from human activities, including the expansion of motorized recreation and residential development, some of it affecting lakeshores. Agriculture is concentrated in the western and southern portions, and forestry and recreation are more common in the central and eastern portions. Large areas in eastern Pine County are still heavily forested, although few significant examples of once common white pine stands are present. The once common oak and jack pine barrens are all but gone in this area.

Quick facts

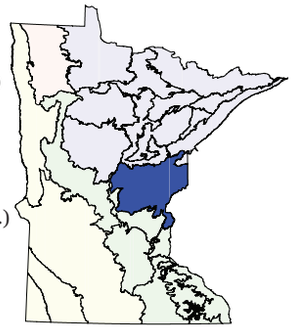
Acres: 3,388,885 (6.3% of state)

Ownership

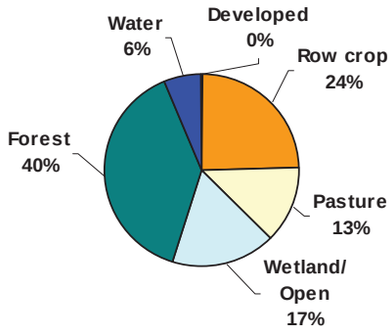
Public	Private	Tribal
17.7%	82.2%	0.1%

Population density (people/sq. mi.)

Current	Change (2000-2010)
49.3	+9.0



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

128 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Mille Lacs Uplands, the third most of all subsections in Minnesota. These SGCN include 57 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 6 mammal SGCN are known or predicted to occur in the Mille Lacs Uplands, approximately 27% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	5	83.3	Spotted salamander
Birds	61	62.9	Red-shouldered hawk
Fish	10	21.3	Southern brook lamprey
Insects	19	33.9	St.Croix snaketail dragonfly
Mammals	6	27.3	*None documented since 1990*
Mollusks	18	46.2	Mucket mussel
Reptiles	7	41.2	Blanding's turtle
Spiders	2	25.0	Jumping spider (*P. fontana*)

HIGHLIGHTS

- Extensive forest lands, riparian forests and open waters characterize the subsection. This mix of habitats supports bald eagles, common terns, sandhill cranes, ospreys, wood turtles, trumpeter swans, yellow rails, and sharp-tailed sparrows, as well as rare mussels like the winged mapleleaf, spike, and round pigtoe. Sand terraces and rock outcrops along the St. Croix River provide habitat for bullsnakes.
- This subsection is a major migratory corridor for waterbirds. It is also one of the most important subsections for forest-dwelling salamanders, such as four-toed and spotted salamanders, which use fishless, seasonal wetlands as breeding habitat.
- Areas important for SGCN include Father Hennepin, Mille-Lacs Kathio, St. Croix, and Wild River SPs; St. Croix Scenic Waterway; Sandstone NWR; Mille Lacs WMA; and Nemadji, St. Croix, and Chengwatana SFs.

SPECIES SPOTLIGHT

Gilt darter *(Percina evides)*

Distribution This fish is found only in the St. Croix River and several of its tributaries, including the Snake, Kettle, and Sunrise rivers. This population is disjunct from populations in the Ozarks and Tennessee uplands.

Abundance Rare. The species has greatly declined across its range and has become extirpated in some areas due to high sediment runoff and contamination.

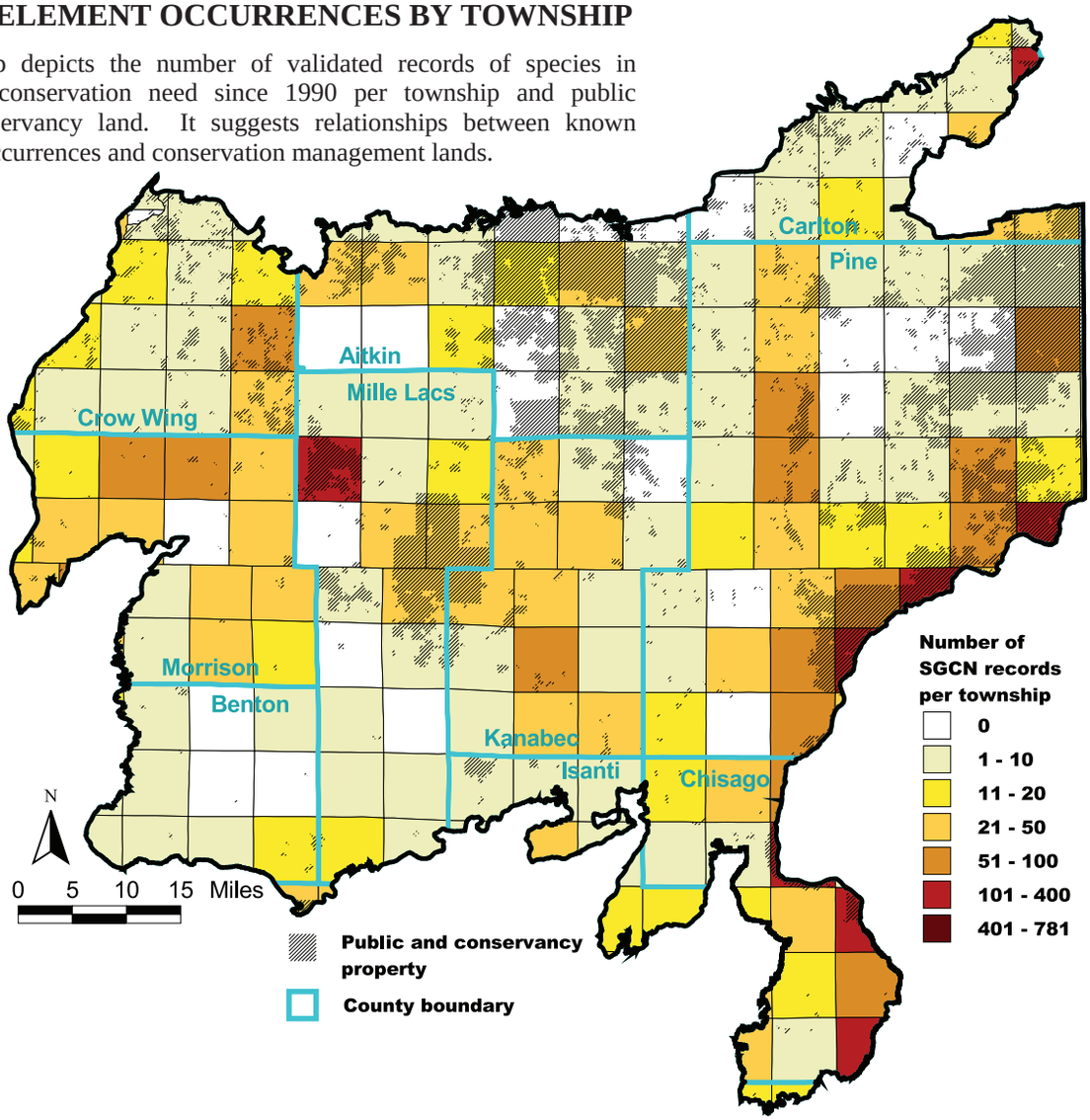
Legal Status State list-Special Concern.

Comments The ideal habitat qualities and high water quality characteristic of the St. Croix River and its tributaries make this watershed a stronghold for the remaining population of gilt darters there.

Photo by Konrad Schmidt

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	80
Habitat Degradation in MN	89
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	30
Pollution	38
Social Tolerance/Persecution/Exploitation	17
Disease	2
Food Source Limitations	3
Other	12

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Deciduous (Mixed hardwood-pine)			X		
Forest-Upland Coniferous	X		X		
Shrub/Woodland-Upland (Jack pine woodland)			X		
Forest-Lowland Coniferous			X		
Wetland-Nonforest	X	X			
Shoreline-dunes-cliff/talus		X			
Lake-Deep				X	
River-Headwater to Large				X	X
River-Very Large (St. Croix River)				X	X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

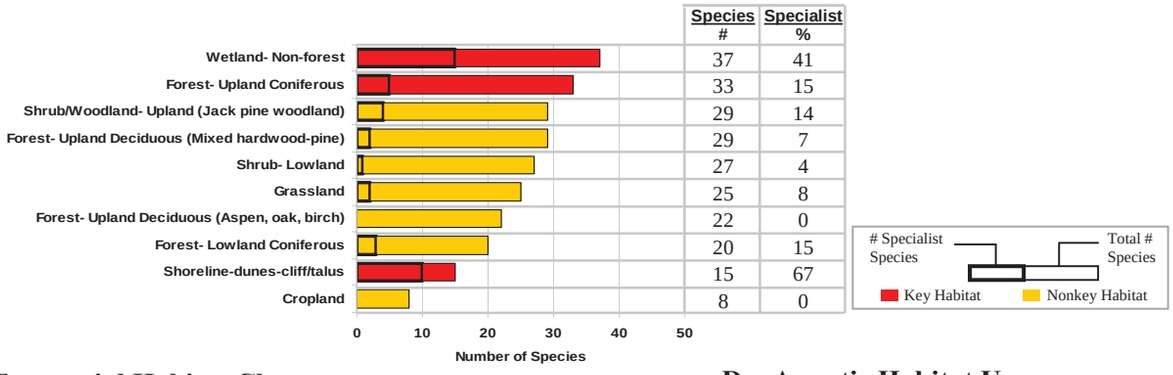
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

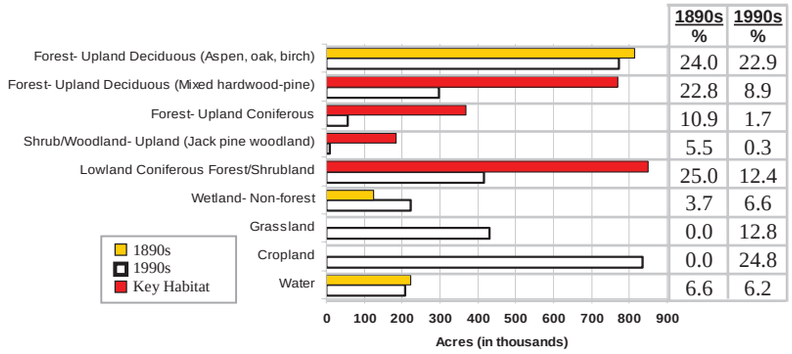
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

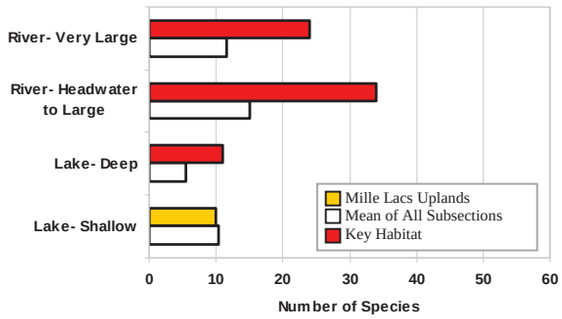
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



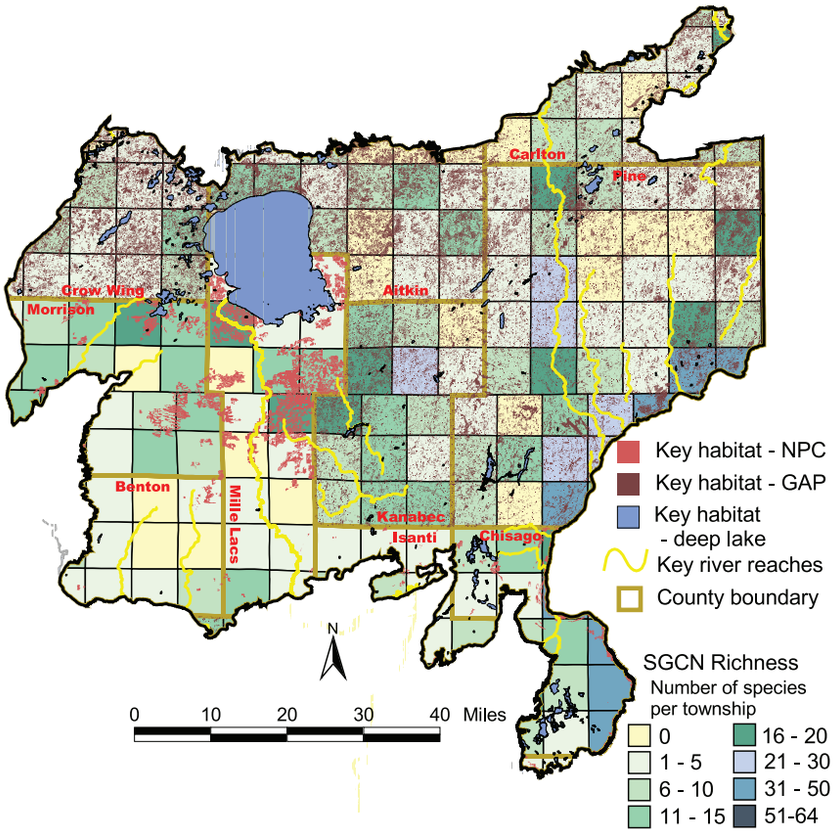
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Lakes, 1990
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	24.7		5			3				8
Forest-Upland Deciduous (Aspen, oak, birch)	24.0	22.9	3	16			3				22
Grassland	N/A	12.8		15			5		4	1	25
Forest-Lowland Coniferous	25.1	12.4		16		1	2			1	20
Forest-Upland Deciduous (Mixed hardwood-pine)	22.7	8.9	3	16		3	5		2		29
Wetland-Nonforest	3.7	6.6	1	28		1	3		2	2	37
Lake-Deep	N/A	5.2	1	2	4	3			1		11
Forest-Lowland Deciduous	1.3	3.2		14		1	2		1		18
Forest-Upland Coniferous	10.9	1.7	2	19		5	5		2		33
Lake-Shallow	N/A	1.0		7					2		9
Developed	N/A	0.3		4		1	2		1		8
Shrub/Woodland-Upland (Jack pine woodland)	5.5	0.3	1	15		5	5		3		29
Prairie	0.3	0.0		13		1	5		5	2	26
Shoreline-dunes-cliff/talus	N/A	N/A	1	11			2		1		15
Shrub-Lowland	N/A	N/A	1	19		1	5		1		27
River-Headwater to Large	N/A	N/A	1	3	9	11		7	3		34
River-Very Large (St. Croix River)	N/A	N/A	2		2	1		17	2		24

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland deciduous mixed hardwood-pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Shoreline, dune, cliff/talus habitats**, actions include:
   a. Support the protection of these habitats from damaging development
   b. Enhance SGCN habitat along the shoreline
   c. Enhance SGCN habitat within dune communities
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
7. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
8. **Deep lakes habitats**, actions include
   a. Maintain good water quality in deep lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys

Priority Conservation Actions for Surveys (continued)

2. Survey SGCN habitats within the subsection, actions include:
    a. Assess the amount and quality of key habitats and map their locations

Strategy II B - Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
    a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
    a. Identify best management practices for maintaining and enhancing key habitats
    b. Identify important patterns and distributions of key habitats to better support SGCN populations
    c. Identify important functional components within key habitats to support specific SGCN
    d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
    a. Identify people's attitudes and values regarding SGCN
    b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
    a. Continue existing population monitoring activities
    b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
    a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
    a. Develop partner-specific performance measures within the subsection
    b. Develop project-specific performance measures for SWG-funded projects
    c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Nashwauk Uplands

SUBSECTION OVERVIEW

The southern boundary of the Nashwauk Uplands Subsection is formed by Giant's Ridge, a high, narrow ridge 200 to 400 feet above the surrounding area. Giant's Ridge forms the northern edge of the Mesabi Range, where the majority of iron mining takes place in Minnesota. Before settlement by people of European descent, the forest in this region consisted of white and red pine, balsam fir, white spruce, and aspen-birch. Wetland vegetation consisted of conifer bogs and swamps.

Today, forestry and mining are the most abundant land uses in this subsection. The predominant tree species used by industry is quaking aspen. Present and past mining activities can affect water quality. A few mining companies are proposing expansions of current facilities or the development of new ones. Outdoor recreation, including motorized recreation, is also an important land use.

Quick facts

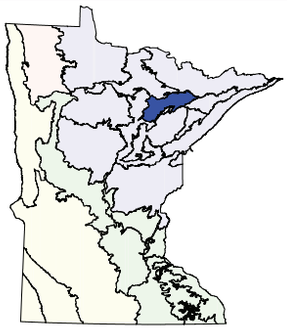
Acres: 810,028 (1.5% of state)

Ownership

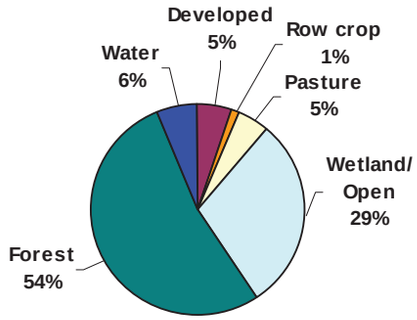
Public	Private	Tribal
39.3%	60.7%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
35.4	-1.3



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

60 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Nashwauk Uplands. These SGCN include 11 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 4 mammal SGCN are known or predicted to occur in the Nashwauk Uplands, approximately 18% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	45	46.4	Bald eagle
Fish	1	2.1	Northern brook lamprey
Insects	6	10.7	*None documented since 1990*
Mammals	4	18.2	Canada Lynx
Mollusks	2	5.1	Black sandshell
Reptiles	1	5.9	Common Snapping Turtle
Spiders	0	0	NA

HIGHLIGHTS

- The northern forest habitats and associated wetlands of the Nashwauk Uplands support bald eagles, Canada lynx, spruce grouse, American bitterns, bobolinks, Connecticut warblers, gray jays, northern goshawks, ospreys, trumpeter swans, and northern brook lampreys.
- Areas important for SGCN include portions of the Superior NF; Lost Lake and Purvis Lake SNAs; Bearhead, McCarthy Beach, Tower Sudan, and Hill Annex Mine SPs; and Sturgeon River and Washington SFs.

SPECIES SPOTLIGHT

Northern brook lamprey *(Ichthyomyzon fossor)*

Distribution This lamprey is found in isolated populations across a broad range in MN from Lake of the Woods, Roseau, and St. Louis counties in the north to Dodge, Mower, and Olmsted counties in the south.

Abundance Rare. Isolated populations are small.

Legal Status State list-Special Concern.

Comments This species declined significantly because of changes in water quality, use of lamprey poisons for fish management, and sedimentation due to land use runoff into streams used as habitat by this lamprey. Current trends are difficult to assess because of low population numbers. This species was not known from MN until its discovery in the state in 1986. Lampricide treatments in North Shore streams are a significant threat to this species.

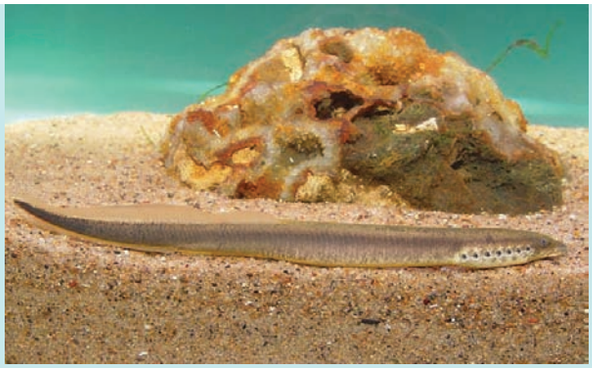
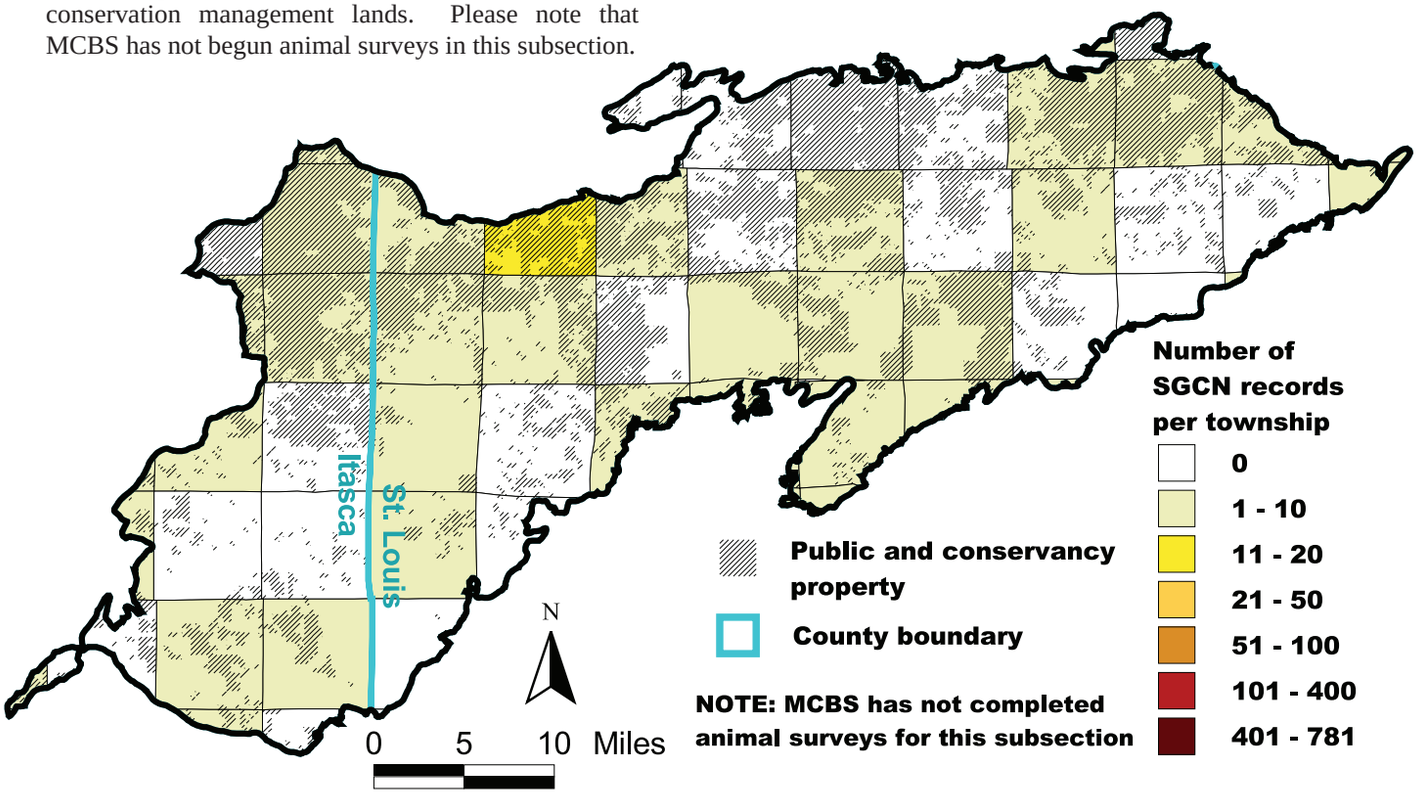


Photo by Konrad Schmidt

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. Please note that MCBS has not begun animal surveys in this subsection.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	80
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	43
Invasive Species and Competition	23
Pollution	30
Social Tolerance/Persecution/Exploitation	23
Disease	0
Food Source Limitations	2
Other	5

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Deciduous (Mixed hardwood-pine)			X		
Forest-Upland Coniferous (Red-white pine)	X	X	X		
Shrub/Woodland-Upland (Jack pine woodland)			X		
Forest-Lowland Coniferous		X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

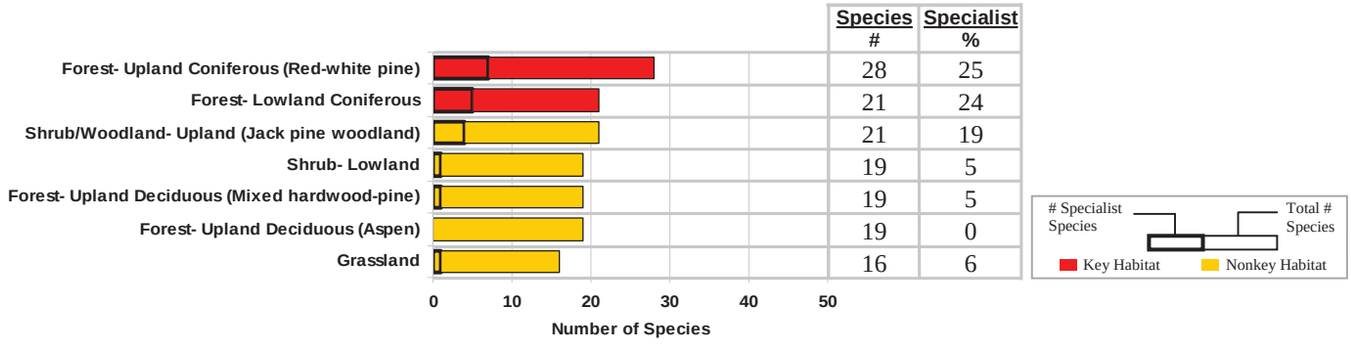
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

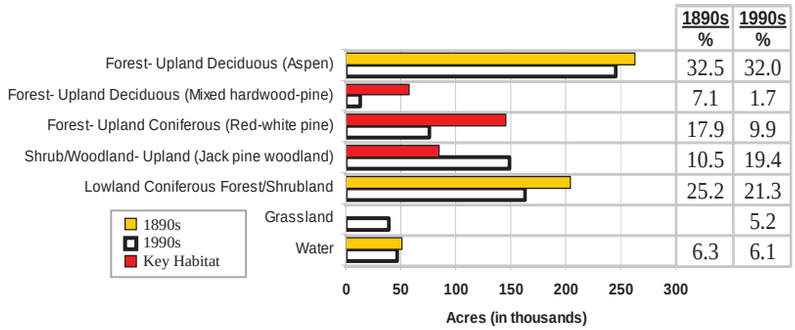
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

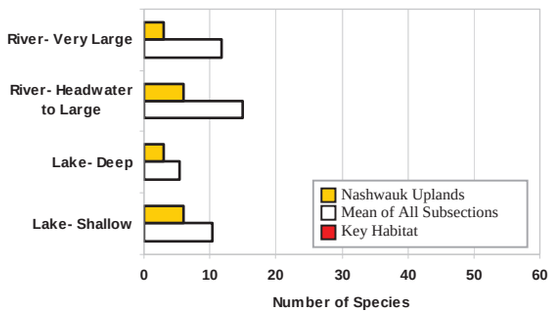
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



D – Aquatic Habitat Use

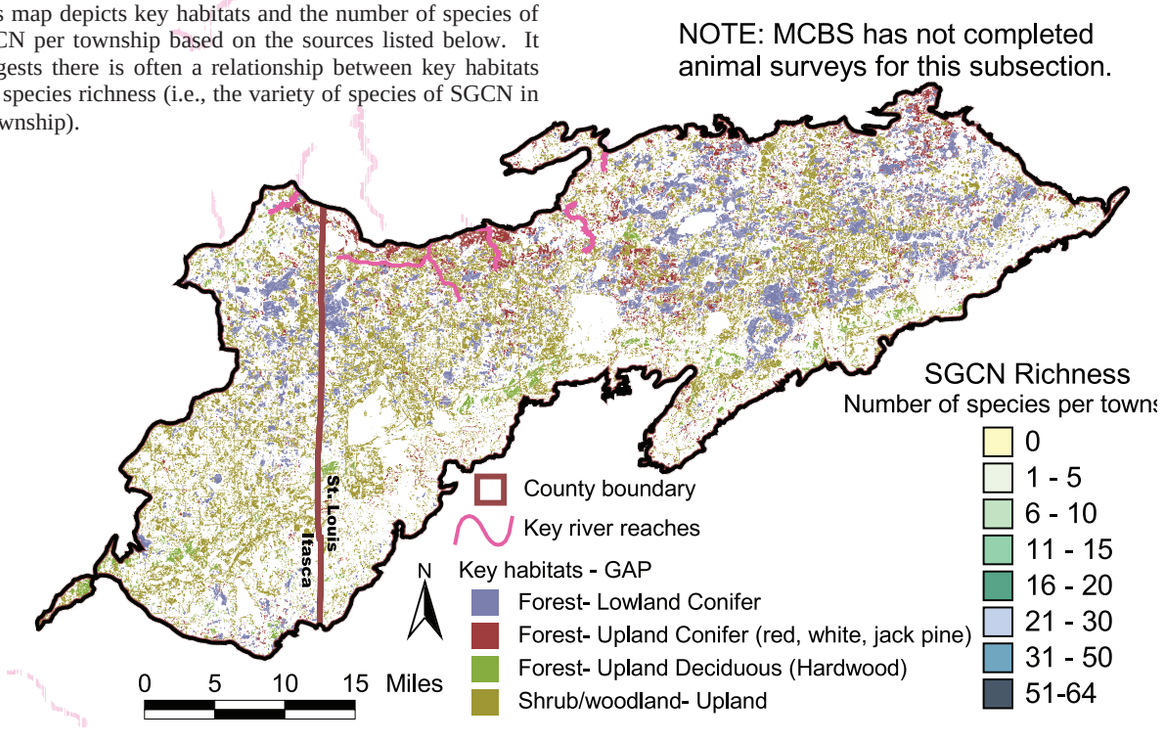


E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP

This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).



Sources: Major River Centerline Traces in Minnesota, 1984; MN DNR 24K Rivers and Streams, 2005; MN DNR Fish database, 2005; MN DNR Natural Heritage database, 2005; MN DNR Statewide Mussel Survey, 2005; MN GAP Landcover, 1993; The Nature Conservancy Rivers and Streams combined dataset, 2005;

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	32.5	31.9	1	16			2				19
Forest-Lowland Coniferous	25.2	21.3		17		2	2				21
Shrub/Woodland-Upland (Jack pine woodland)	10.5	19.4		14		3	4				21
Forest-Upland Coniferous (Red-white pine)	17.9	9.9	1	21		3	3				28
Grassland	N/A	5.2		13			3				16
Lake-Deep	N/A	5.0		2					1		3
Forest-Lowland Deciduous	0.0	1.7		12			1				13
Forest-Upland Deciduous (Mixed hardwood-pine)	7.1	1.7	1	15			3				19
Cropland	N/A	1.2		4			2				6
Lake-Shallow	N/A	1.1		4					1		5
Wetland-Nonforest	0.6	0.9		16			2		1		19
Developed	N/A	0.7		5			1				6
Shoreline-dunes-cliff/talus	N/A	N/A		7			1				8
Shrub-Lowland	N/A	N/A		15		1	3				19
River-Headwater to Large	N/A	N/A		2	1			2	1		6
River-Very Large	N/A	N/A		1				1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland deciduous mixed hardwood-pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Upland coniferous red-white pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

North Shore Highlands

SUBSECTION OVERVIEW

The North Shore Highlands Subsection is a narrow strip 20 to 25 miles wide that follows the shoreline of Lake Superior from Duluth to the eastern tip of Minnesota. Lake Superior dominates the area and moderates its climate. The terrain varies from gently rolling hills to steep cliffs. There are 20 lakes larger than 160 acres in size. Numerous short streams, 10 to 15 miles in length, run from the highland to the shore of Lake Superior, most ending in waterfalls near the shoreline. A mosaic of forest habitats stretches across this landscape, heavily influenced by aspen-birch, with minor amounts of white and red pine, mixed hardwood-pine, and conifer bogs and swamp.

Recreation, tourism, and forestry are the predominant land uses in this subsection. There is tremendous development pressure along the highly environmentally sensitive Lake Superior shoreline, and second-tier development beyond the shoreline looks to be the next significant growth area. The North Shore Highlands is host to the popular North Shore State Trail, which is a major snowmobile destination. Parts of this trail are currently being considered for possible summer season ATV use, as are other areas along the shore. Much of the white pine-red pine forests have been logged and replaced with quaking aspen-paper birch. This subsection contains significant old-growth northern hardwood and upland northern white cedar forest. The subsection also contains the highest density of designated trout streams in Minnesota. The source of water for most of these streams is surface runoff.

Quick facts

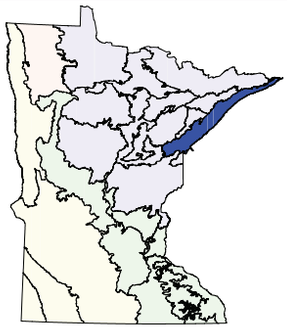
Acres: 1,481,891 (2.7% of state)

Ownership

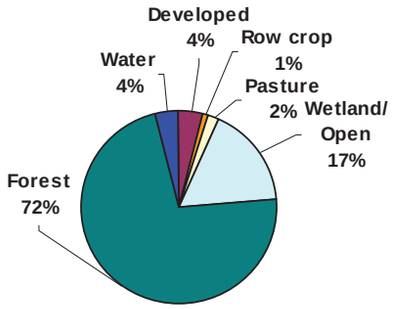
Public	Private	Tribal
53.1%	43.1%	3.8%

Population density (people/sq. mi.)

Current	Change (2000-2010)
56	+2.8



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

84 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the North Shore Highlands. These SGCN include 25 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 10 mammal SGCN are known or predicted to occur in the North Shore Highlands, approximately 46% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	2	33.3	Eastern red-backed salamander
Birds	50	51.5	Black-throated blue warbler
Fish	8	17.0	Lake chub
Insects	9	16.1	Extra-striped snaketail dragonfly
Mammals	10	45.5	Canada lynx
Mollusks	2	5.1	Black Sandshell
Reptiles	3	17.6	Wood turtle
Spiders	0	0	NA

HIGHLIGHTS

- The North Shore Highlands and associated waters of Lake Superior are home to bald eagles, peregrine falcons, common terns, Franklin's ground squirrels, Connecticut warblers, boreal owls, merlins, common ravens, northern myotis, deepwater sculpin, and kiyi.
- This is one of the most important and visible migratory corridors for songbirds and raptors in the entire Midwest as birds pass along the North Shore and over Hawk Ridge every fall.
- Rivers and associated forests within this subsection provide important habitat for wood turtles.
- Areas important for SGCN include Cloquet Valley, Finland, Pat Bayle, and Grand Portage SFs; and many SPs and SNAs along the North Shore of Lake Superior.

SPECIES SPOTLIGHT

Black-throated blue warbler *(Dendroica caerulescens)*

Distribution Limited to selected areas of hardwood and mixed hardwood-coniferous forests of northeastern Minnesota.

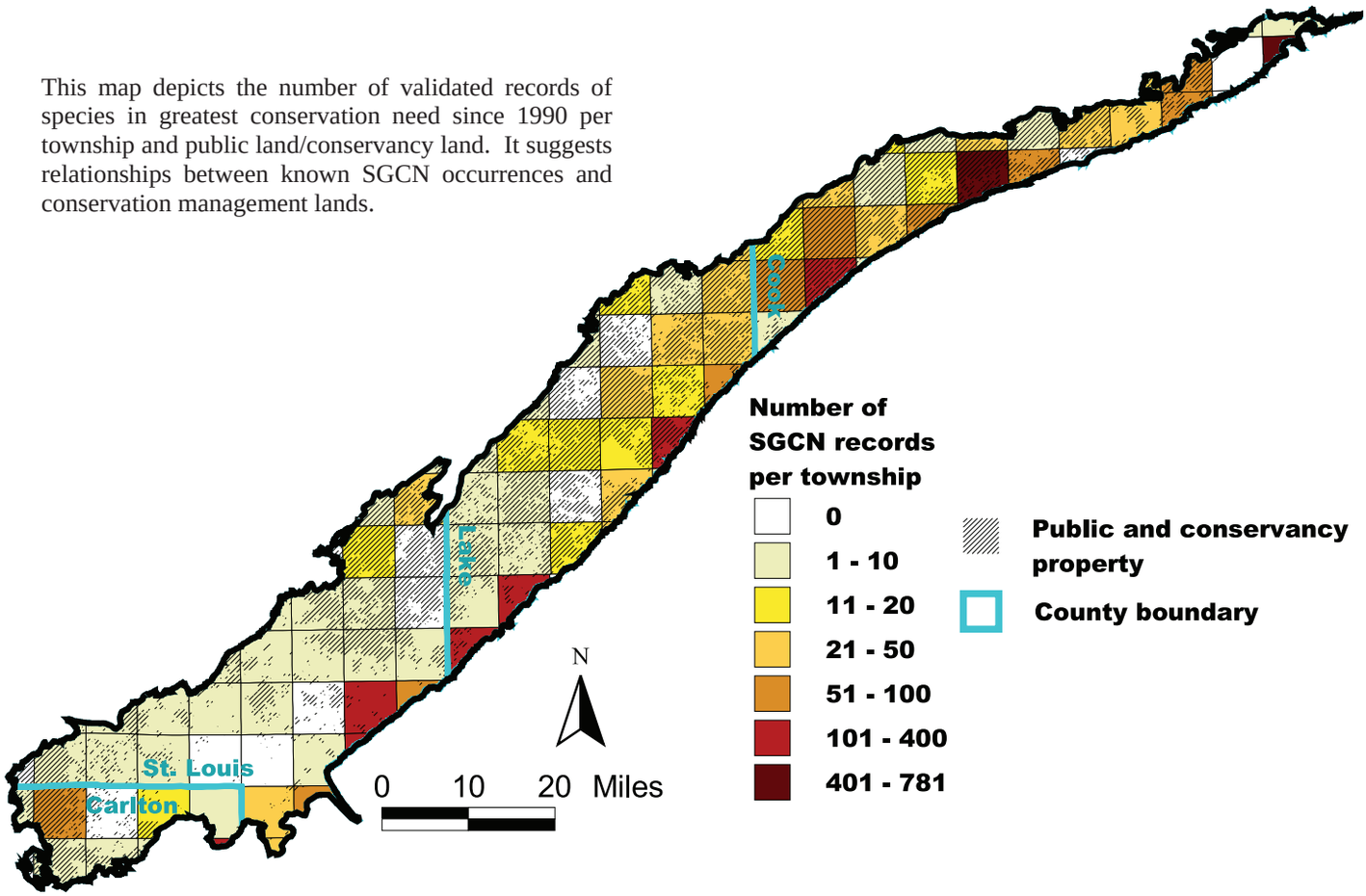
Abundance Rare, and limited to specific habitat areas of northeastern Minnesota, particularly along the North Shore of Lake Superior at Tettegouche State Park.

Legal Status Federally protected migratory bird.

Comments Population considered stable, but more assessment needed to determine long-term trends.

Bill Dyer, Cornell Lab of Ornithology

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	73
Habitat Degradation in MN	82
Habitat Loss/Degradation Outside of MN	38
Invasive Species and Competition	26
Pollution	26
Social Tolerance/Persecution/Exploitation	25
Disease	1
Food Source Limitations	2
Other	6

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous (Red-white pine)	X	X	X		
Forest-Lowland Coniferous		X			
Shoreline-dunes-cliff/talus		X			
Lake-Deep				X	
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

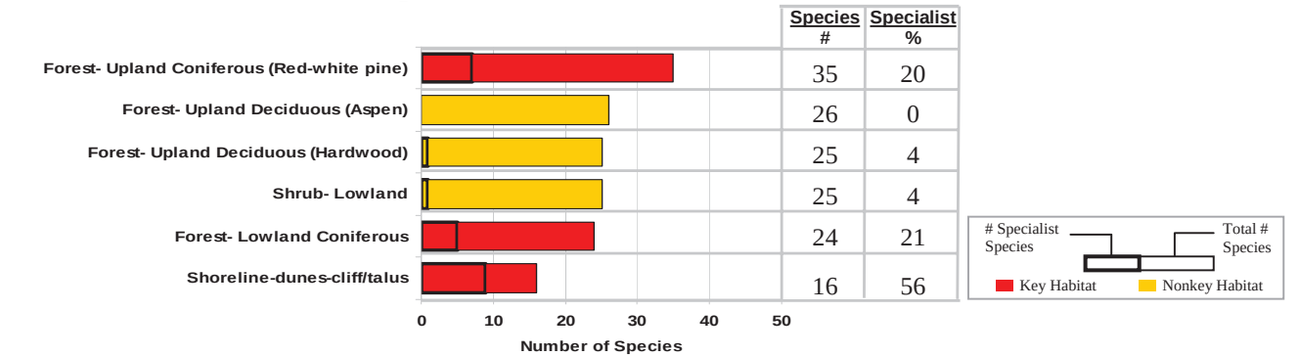
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

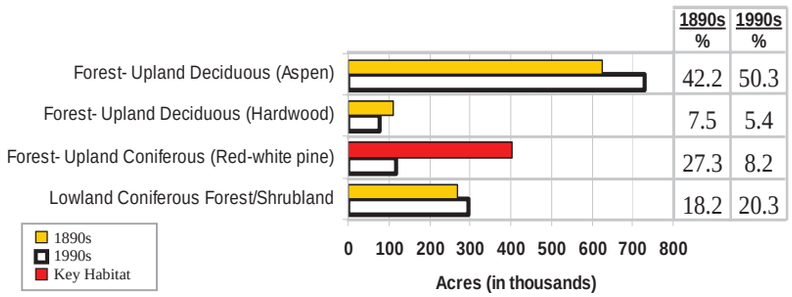
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

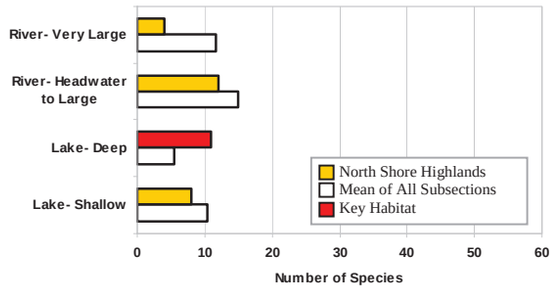
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



D – Aquatic Habitat Use

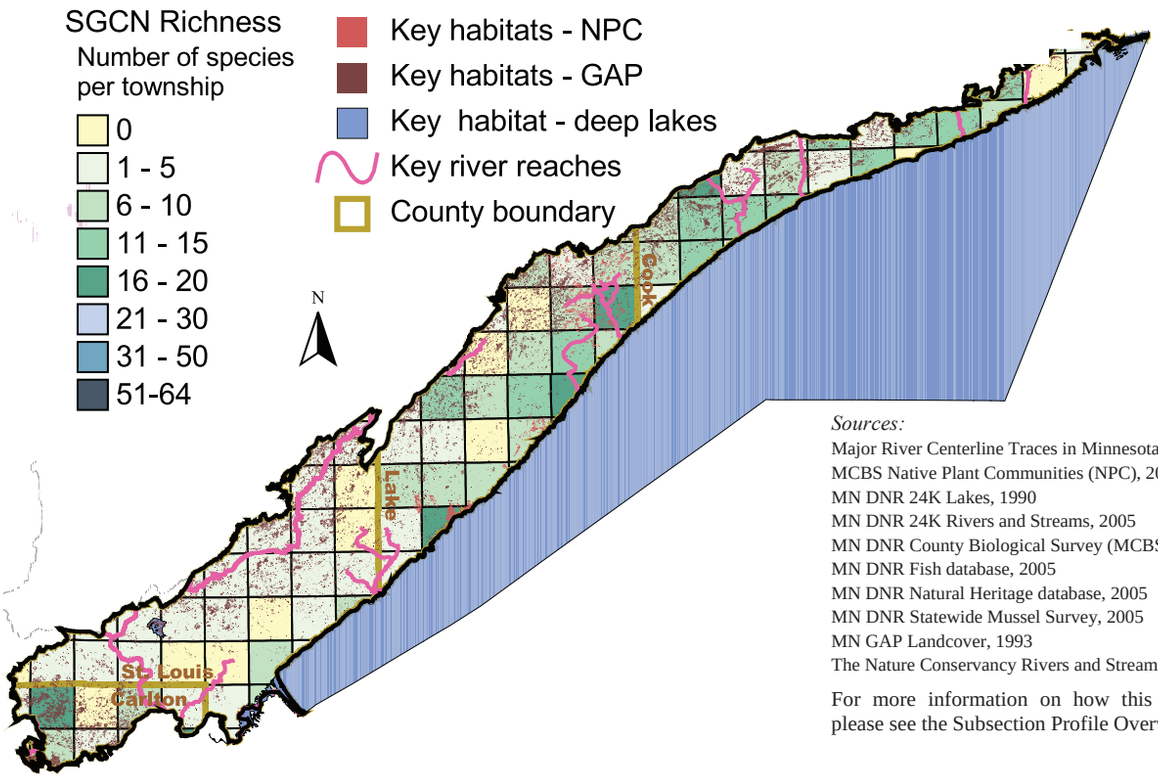


E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP

This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).



Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Lakes, 1990
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	42.2	50.3	2	18			6				26
Forest-Lowland Coniferous	18.2	20.3		17		2	5				24
Forest-Upland Coniferous (Red-white pine)	27.3	8.2	2	21		4	8				35
Forest-Upland Deciduous (Hardwood)	7.5	5.4	2	16		1	6				25
Shrub/Woodland-Upland	0.7	4.9	1	11		3	8				23
Lake-Deep	N/A	2.9		2	7	1			1		11
Developed	N/A	2.7		5			4				9
Grassland	N/A	1.8		12			6		1		19
Cropland	N/A	1.1		3			2				5
Forest-Lowland Deciduous	0.1	0.9		12		1	5				18
Lake-Shallow	N/A	0.8		5					2		7
Wetland-Nonforest	0.1	0.7		20			4		2		26
Shoreline-dunes-cliff/talus	N/A	N/A		11		1	4				16
Shrub-Lowland	N/A	N/A	1	16		1	6		1		25
River-Headwater to Large	N/A	N/A		2	2	3		2	3		12
River-Very Large	N/A	N/A		1				1	2		4

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous red-white pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Shoreline, dune, cliff/talus habitats**, actions include:
   a. Support the protection of these habitats from damaging development
   b. Enhance SGCN habitat along the shoreline
   c. Enhance SGCN habitat within dune communities
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Deep lakes habitats**, actions include:
   a. Maintain good water quality in deep lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN

Priority Conservation Actions for Research (continued)

2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Pine Moraines and Outwash Plains

SUBSECTION OVERVIEW

The Pine Moraines and Outwash Plains Subsection, named for its mix of end moraines and outwash and till plains, is a resource-rich, heavily forested area. The subsection contains sections of the Mississippi River, along with hundreds of lakes, including Leech, Itasca, Ten Mile, Upper and Lower Whitefish, and Gull. Kettle lakes and wetlands are common on the outwash plains. Before this area was settled by people of European descent, forests of jack pine mixed with northern pin oak were most common on outwash plains, and aspen-birch and pine forests were the most common on end moraines.

Forest management and tourism are the predominant land uses in this subsection today. The bait industry is also well represented here. The area around the city of Brainerd, located on the southeastern edge of this subsection, swells in population dramatically each summer. The number of year-round residents is increasing as they convert small lake cabins into larger, year-round houses. Near-shore habitat is being lost at a rapid pace, which negatively affects fish and wildlife. Motorized recreation is popular in many of the state forests in this area. Agriculture is common in the western part of this subsection.

Quick facts

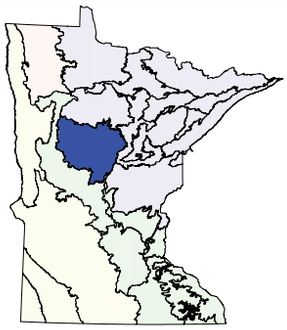
Acres: 3,025,749 (5.6% of state)

Ownership

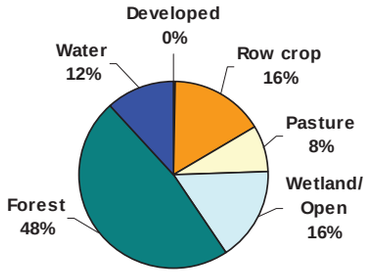
Public	Private	Tribal
29.6%	69.1%	1.3%

Population density (people/sq. mi.)

Current	Change (2000-2010)
25.6	+4.2



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

89 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Pine Moraines and Outwash Plains. These SGCN include 29 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 5 mammal SGCN are known or predicted to occur in the Pine Moraines and Outwash Plains, approximately 23% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	61	62.9	Bald eagle
Fish	4	8.5	Least darter
Insects	12	21.4	Caddisfly (*C. itascae*)
Mammals	5	22.7	Prairie vole
Mollusks	2	5.1	Creek heelsplitter
Reptiles	4	23.5	Eastern hognose snake
Spiders	0	0	NA

HIGHLIGHTS

- This is an important transition zone interspersed with lakes and wetlands valuable for wildlife.
- Featured wildlife includes bald eagles, gray wolves, sharp-tailed grouse, sandhill cranes, upland sandpipers, common terns, yellow rails, red-necked grebes, trumpeter swans, common loons, least darters, and eastern hognose snakes.
- This is one of the most important areas in the state for red-shouldered hawks.
- Areas important for SGCN include Camp Ripley Military Reservation; Chippewa NF; Deep Portage Conservation Reserve; Smoky Hills, Two Inlets, Badoura, Huntersville, Foot Hills, Pillsbury, and Crow Wing SFs; Greenwater Lake SNA; Itasca SP; and several WMAs.

SPECIES SPOTLIGHT

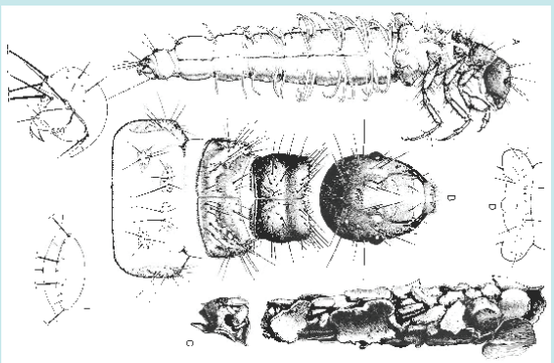
Headwater chilostigman caddisfly *(Chilostigma itascae)*

Distribution Known only from Nicollet Creek in Itasca State Park, Clearwater County. This is the only occurrence of this genus in North America, with other representatives found in Finland and Scandinavia.

Abundance Extremely rare.

Legal Status State list-Endangered.

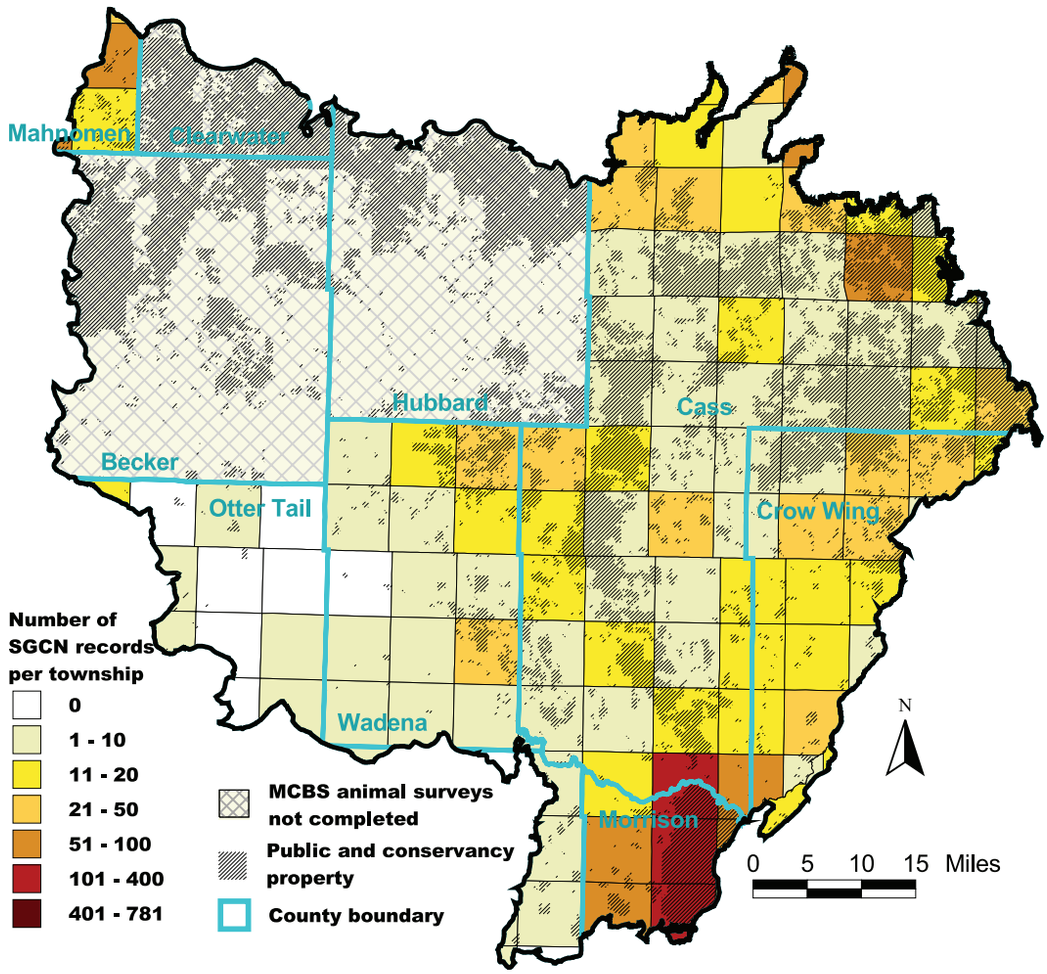
Comments This is one of the few endemic species known to MN. Adults emerge onto the snow in midwinter along Nicollet Creek.



© Royal Ontario Museum

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	83
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	39
Invasive Species and Competition	26
Pollution	30
Social Tolerance/Persecution/Exploitation	20
Disease	3
Food Source Limitations	2
Other	10

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous (Red-white pine)			X		
Shrub/Woodland-Upland (Jack pine woodland)			X		
Wetland-Nonforest	X	X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

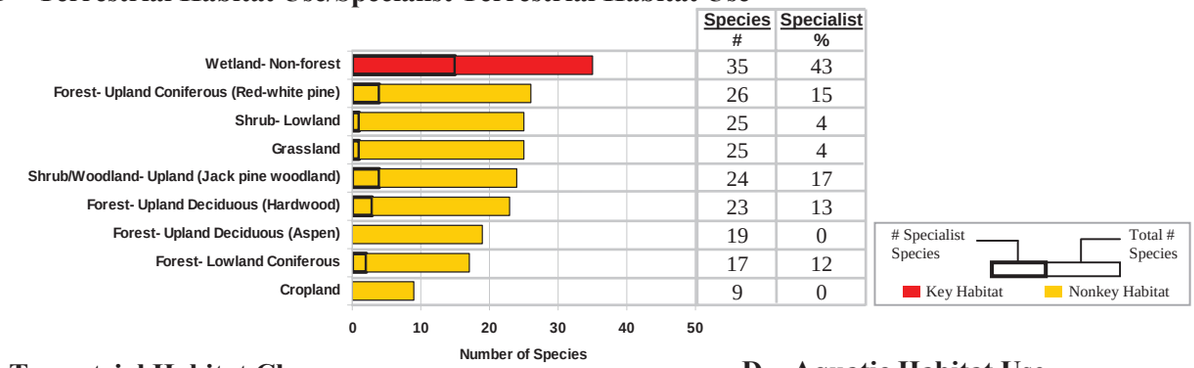
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

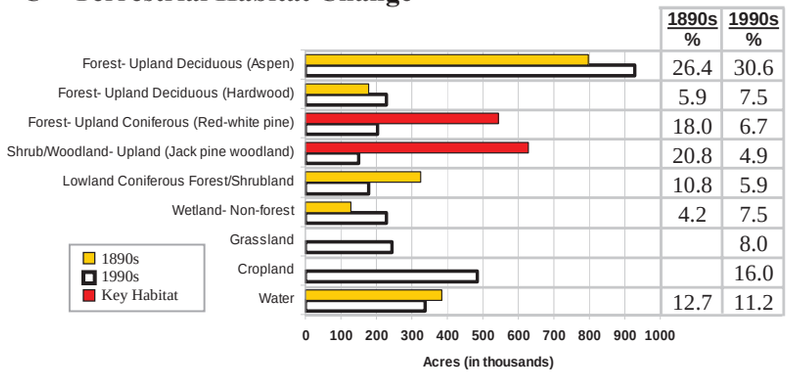
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

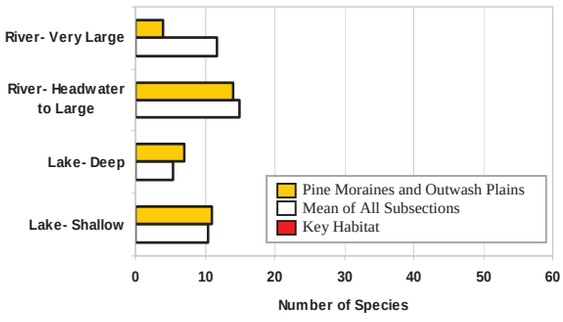
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



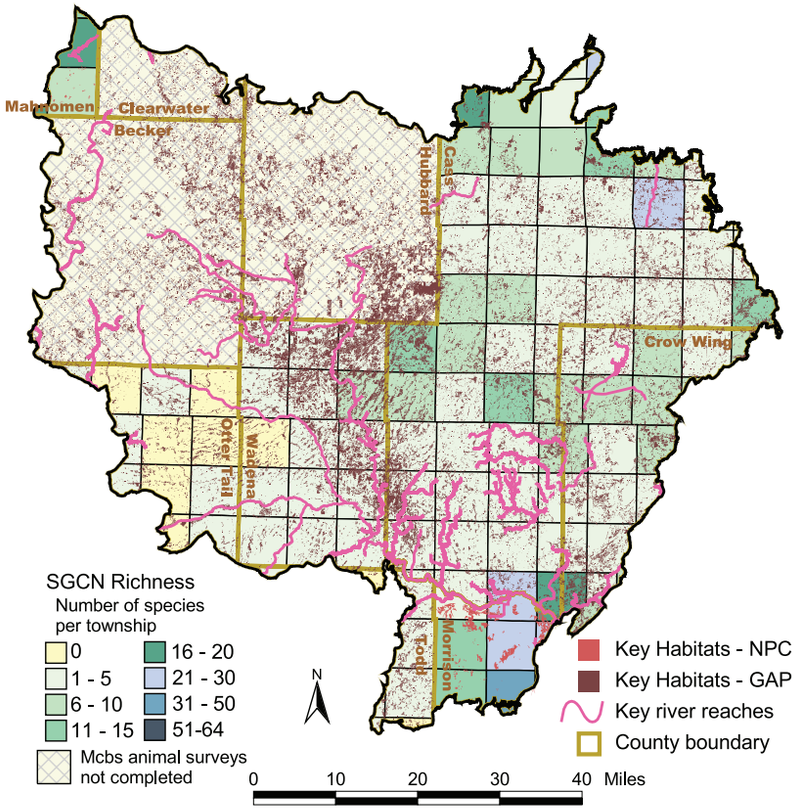
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:

Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	26.4	30.7	1	16			2				19
Cropland	N/A	16.0		6			3				9
Lake-Deep	N/A	9.4		2	3	1			1		7
Grassland	N/A	8.0		17			5		3		25
Wetland-Nonforest	4.2	7.5		30		1	2		2		35
Forest-Upland Deciduous (Hardwood)	5.9	7.5	1	17		1	3		1		23
Forest-Upland Coniferous (Red-white pine)	18.0	6.7	1	17		3	3		2		26
Forest-Lowland Coniferous	10.8	5.9		15		1	1				17
Shrub/Woodland-Upland (Jack pine woodland)	20.8	4.9		13		4	5		2		24
Lake-Shallow	N/A	1.8		8					2		10
Forest-Lowland Deciduous	1.2	1.2		13			1		1		15
Developed	N/A	0.4		4		1	2				7
Prairie	0.2	0.0		15		1	5		3		24
Shoreline-dunes-cliff/talus	N/A	N/A		12			1		1		14
Shrub-Lowland	N/A	N/A		20		1	3		1		25
River-Headwater to Large	N/A	N/A		2	4	4		2	2		14
River-Very Large	N/A	N/A				1		1	2		4

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous red-white pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

St. Louis Moraines

SUBSECTION OVERVIEW

The St. Louis Moraines Subsection is characterized by rolling hills with steep slopes throughout. The Mississippi River cuts through portions of this area, but mainly small, relatively short rivers are present, including the Prairie, Willow, Hill, and Moose. Lakes are common and many are greater than 160 acres in size. North of the city of Grand Rapids, which is located in the center of this subsection, white pines mixed with hardwoods were common before settlement by people of European descent, while south of the city were mainly northern hardwoods. Conifer swamps and bogs were scattered throughout the subsection. Glacial moraines and rolling landscapes in this subsection provide excellent salamander habitat. Fire was an important disturbance for maintaining the large blocks of white and red pine stands.

Forestry and outdoor recreation are the predominant land uses in this subsection. Most of the red and white pines were removed by the early 20th century, and quaking aspen is the primary species harvested today. Expanding residential development on lakeshores is a major concern, especially on the steep slopes and wet areas previously thought undesirable for development. Nonconforming septic systems and shoreline development may have impacts on both habitat and water quality.

Quick facts

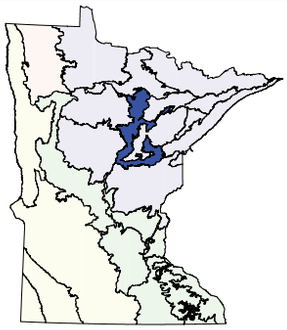
Acres: 1,648,112 (3.1% of state)

Ownership

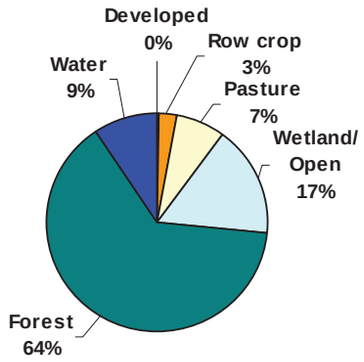
Public	Private	Tribal
44.0%	55.9%	0.1%

Population density (people/sq. mi.)

Current	Change (2000-2010)
18.8	+2.0



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

74 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the St. Louis Moraines. These SGCN include 20 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 6 mammal SGCN are known or predicted to occur in the St. Louis Moraines, approximately 27% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	2	33.3	Four-toed salamander
Birds	51	52.6	Bald eagle
Fish	6	12.8	Least darter
Insects	5	8.9	Caddisfly (*P. milaca*)
Mammals	6	27.3	Gray wolf
Mollusks	2	5.1	Black sandshell
Reptiles	1	5.9	Common snapping turtle
Spiders	1	12.5	Jumping spider (*M. grata*)

HIGHLIGHTS

- Featured species include bald eagles, wood thrushes, ovenbirds, northern goshawks, red-shouldered hawks, four-toed salamanders, least darters, and Blanding's turtles.
- Areas important for SGCN include the Chippewa NF; Hill River, Land O' Lakes, George Washington, and Savanna SFs; Scenic and Savanna Portage SPs; Bass Brook WMA; Botany Bog SNA; and Rice Lake NWR.

SPECIES SPOTLIGHT

Four-toed salamander *(Hemidactylium scutatum)*

Distribution Disjunct and isolated populations from Itasca County to the Minnesota/Wisconsin border.

Abundance Rare, with small populations in mature forests in glacial moraine landscape. Shallow wetlands with open water and sphagnum hummocks provide important nesting sites. First discovered in St. Louis County, MN, in 1994.

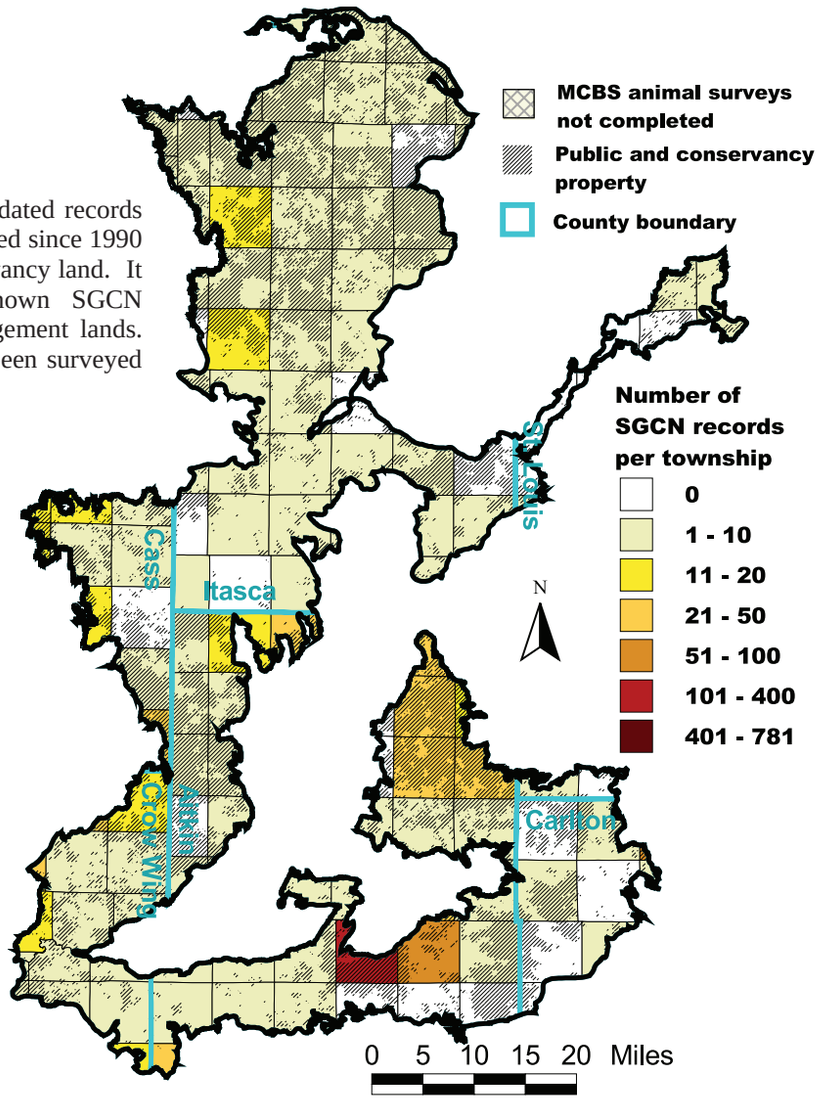
Legal Status State list-Special Concern.

Comments Vulnerable to habitat loss and degradation from forest management activities. Research is needed on movements and impacts related to logging activities.

Photo by Carol Hall

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	80
Habitat Degradation in MN	89
Habitat Loss/Degradation Outside of MN	43
Invasive Species and Competition	22
Pollution	30
Social Tolerance/Persecution/Exploitation	24
Disease	3
Food Source Limitations	1
Other	5

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous (Red-white pine)	X		X		
Lake-Deep				X	
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

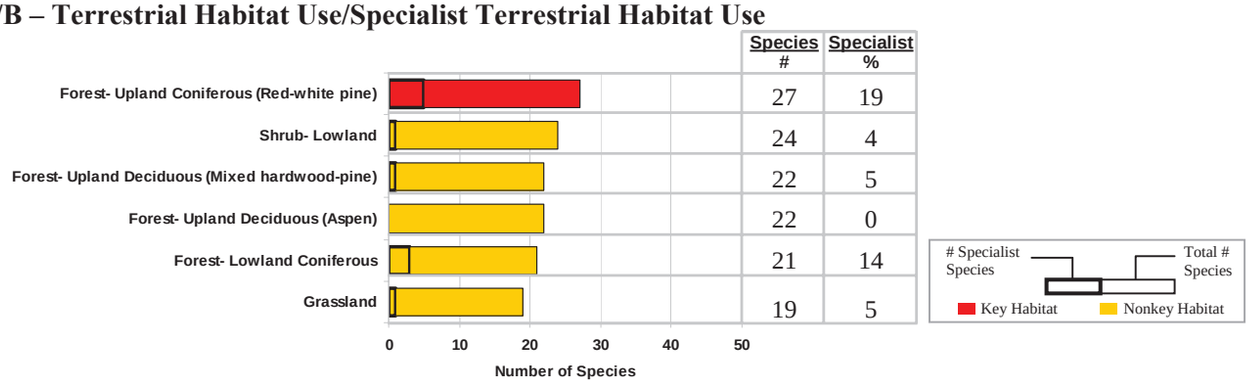
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

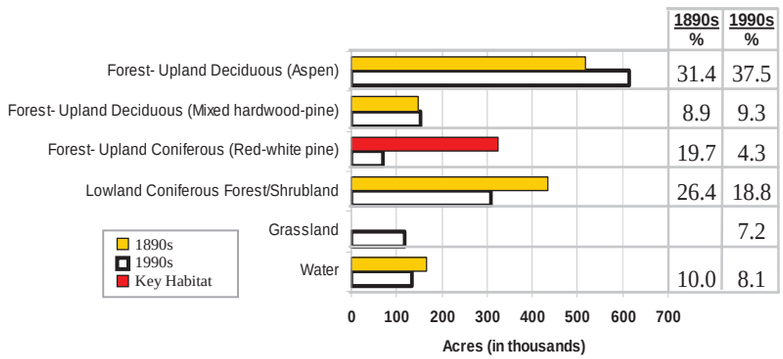
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

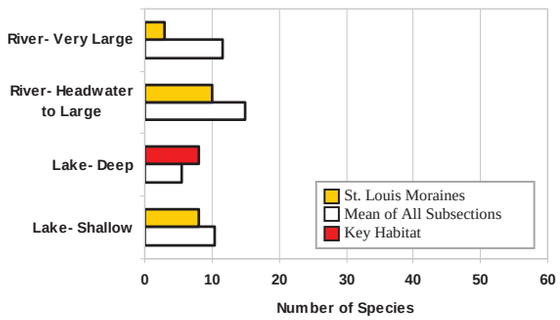
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



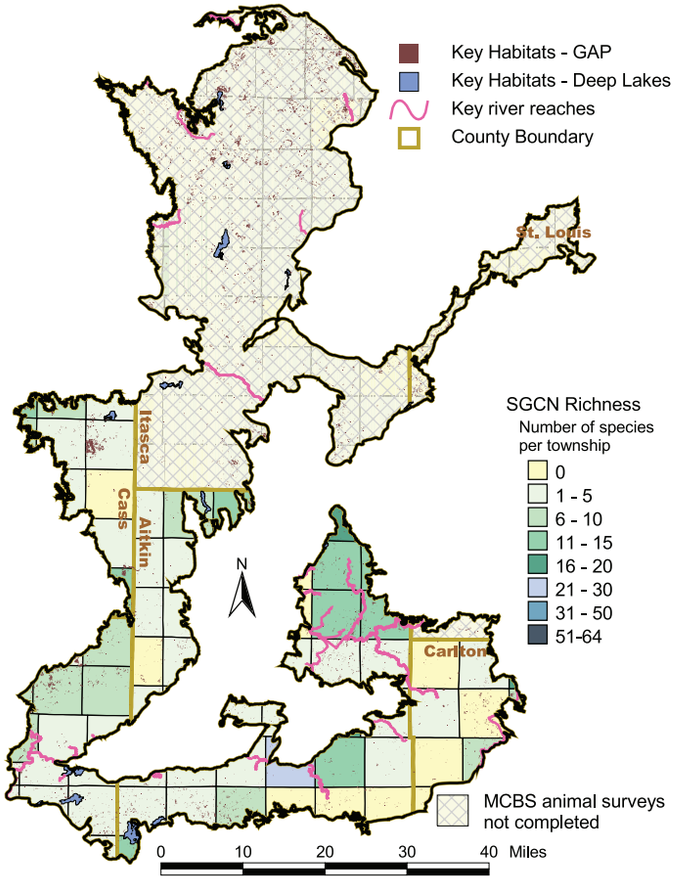
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MN DNR 24K Lakes, 1990
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	31.4	37.5	2	17			3				22
Forest-Lowland Coniferous	26.4	18.8		17		1	3				21
Forest-Upland Deciduous (Mixed hardwood-pine)	8.9	9.3	2	16			4				22
Grassland	N/A	7.2		14			4			1	19
Lake-Deep	N/A	6.4		2	4	1			1		8
Shrub/Woodland-Upland	0.9	4.4	1	13		2	5				21
Forest-Upland Coniferous (Red-white pine)	19.7	4.3	2	19		2	4				27
Forest-Lowland Deciduous	0.4	3.8		13			2				15
Wetland-Nonforest	2.4	3.8		23			3		1	1	28
Cropland	N/A	2.6		5			2				7
Lake-Shallow	N/A	1.7		6					1		7
Developed	N/A	0.2		4			2				6
Shoreline-dunes-cliff/talus	N/A	N/A		8			1				9
Shrub-Lowland	N/A	N/A	1	17		1	5				24
River-Headwater to Large	N/A	N/A		2	5			2	1		10
River-Very Large	N/A	N/A			1			1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous red-white pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Deep lakes habitats**, actions include:
   a. Maintain good water quality in deep lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Tamarack Lowlands

SUBSECTION OVERVIEW

The Tamarack Lowlands is a low-lying subsection that consists largely of a flat to gently rolling ancient lake plain known as Glacial Lake Upham. It is one of the top wildlife-watching sites in Minnesota and the nation due to its extensive wetland vegetation and high percentage of public land, including the Sax-Zim bog, McGregor Marsh Scientific and Natural Area, the Rice Lake National Wildlife Refuge, and many large DNR wildlife management areas, including Grayling and Moose-Willow. Numerous major rivers meander extensively through this subsection on the level landscape, including the Mississippi, St. Louis, Whiteface, East Swan, Savannah, and Willow. There are few lakes here. Before settlement by people of European descent, lowland conifer and aspen-birch were the most common forest communities.

Forestry, tourism, and outdoor recreation are the most common land uses in this subsection, along with some agriculture, primarily sod and wild rice, and peat mining. In the early part of the 20th century, homesteaders drained areas to create agricultural fields, but they were largely unsuccessful. Currently, the predominant forest type in this subsection is conifer in the lowland areas and aspen in the uplands.

Quick facts

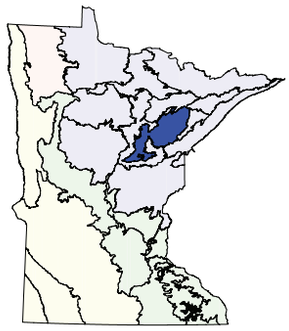
Acres: 1,513,319 (2.8% of state)

Ownership

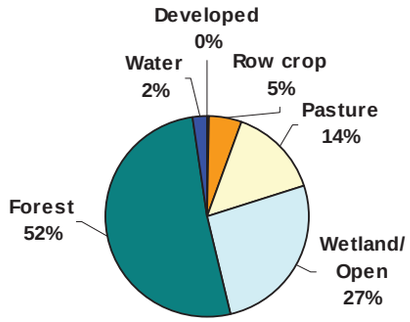
Public	Private	Tribal
52.1%	47.9%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
15.6	+0.3



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

69 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Tamarack Lowlands. These SGCN include 16 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 4 mammal SGCN are known or predicted to occur in the Tamarack Lowlands, approximately 18% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	51	52.6	Veery
Fish	3	6.4	Lake Chub
Insects	5	8.9	Bog copper
Mammals	4	18.2	Gray wolf
Mollusks	2	5.1	Black sandshell
Reptiles	2	11.8	Wood turtle
Spiders	1	12.5	Jumping spider (*M. grata*)

HIGHLIGHTS

- Forests and associated rivers, lakes and wetlands provide habitat for gray wolves, bald eagles, sharp-tailed grouse, sandhill cranes, trumpeter swans, boreal chickadees, Nelson's sharp-tailed sparrows, and wood turtles.
- This is an important wintering area for boreal birds that move south from Canada in times of food shortage, including great gray owls, boreal owls, northern hawk-owls, pine grosbeaks, red crossbills, and pine siskins.
- Areas important for SGCN include the Rice Lake NWR; Moose-Willow and Kimberly Marsh WMAs; Hill River and Cloquet Valley SFs; Savanna Portage SP; and McGregor Marsh SNA.

SPECIES SPOTLIGHT

Yellow rail *(Coturnicops noveboracensis)*

Distribution Found in sedge meadows and wet, grassy, marshy, and peatland habitats from northwest MN, SE to Aitkin County and west to Becker and Ottertail counties.

Abundance Rare, but locally regular nesting species in selected marshy habitats. Secretive, nocturnal behavior makes this species very difficult to assess.

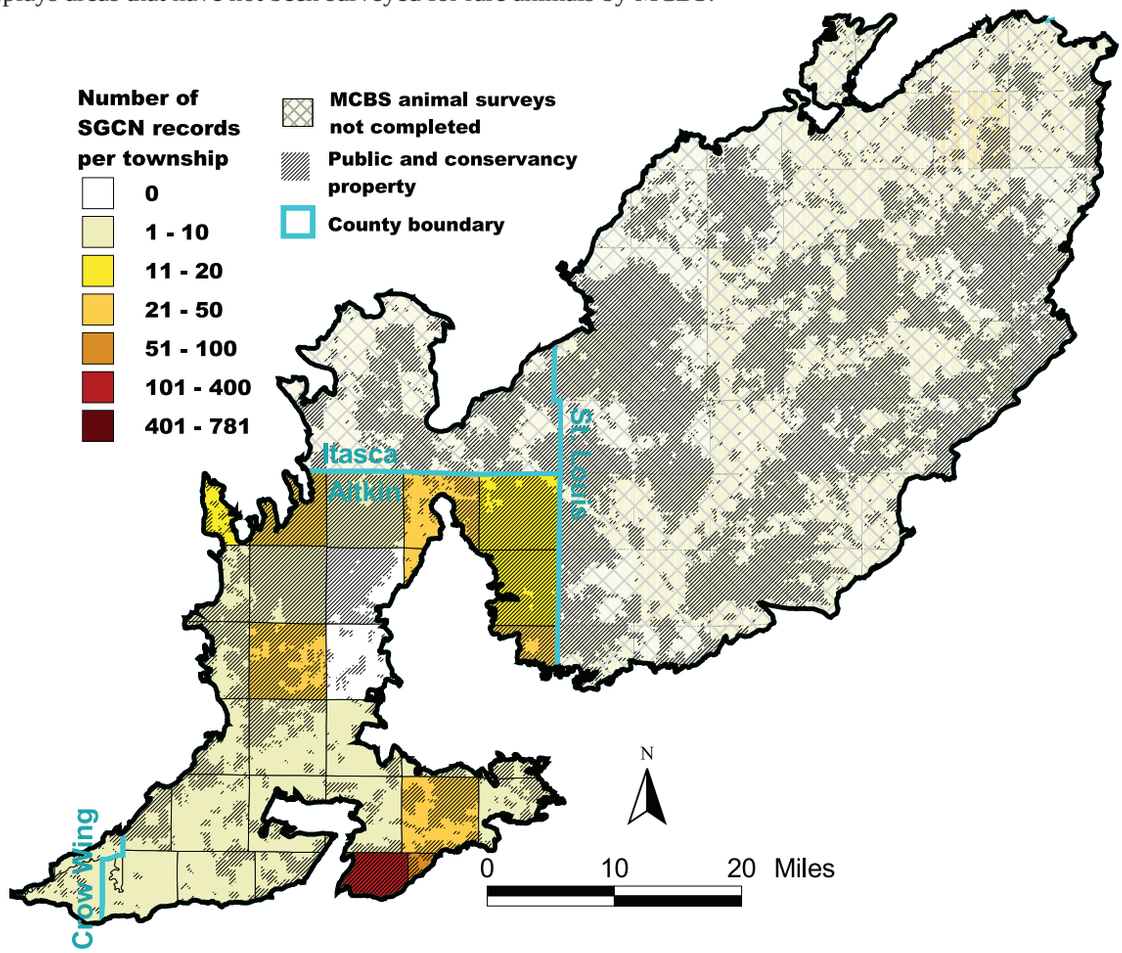
Legal Status State list-Special Concern.

Comments Population has declined in the past due to marsh and swampland drainage, but significant areas of protected state and federal lands, including SNAs, WMAs, and NWRs have helped stabilize remaining numbers.

Photo by Terry Johnson

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	83
Habitat Degradation in MN	90
Habitat Loss/Degradation Outside of MN	45
Invasive Species and Competition	26
Pollution	32
Social Tolerance/Persecution/Exploitation	23
Disease	3
Food Source Limitations	3
Other	6

Tamarack Lowlands

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous (Red-white pine)	X	X			
Forest-Lowland Coniferous		X			
Wetland-Nonforest	X	X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

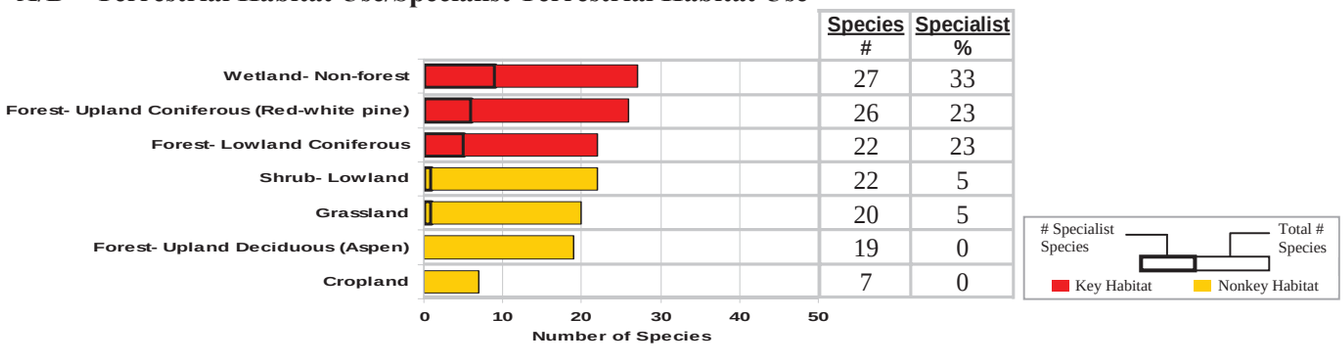
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

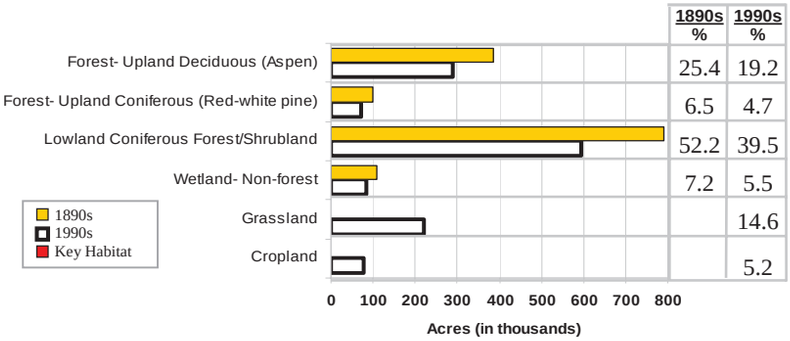
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

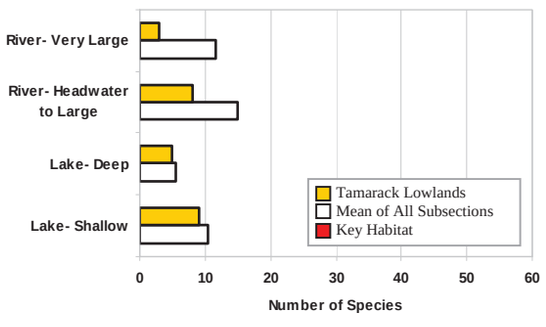
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



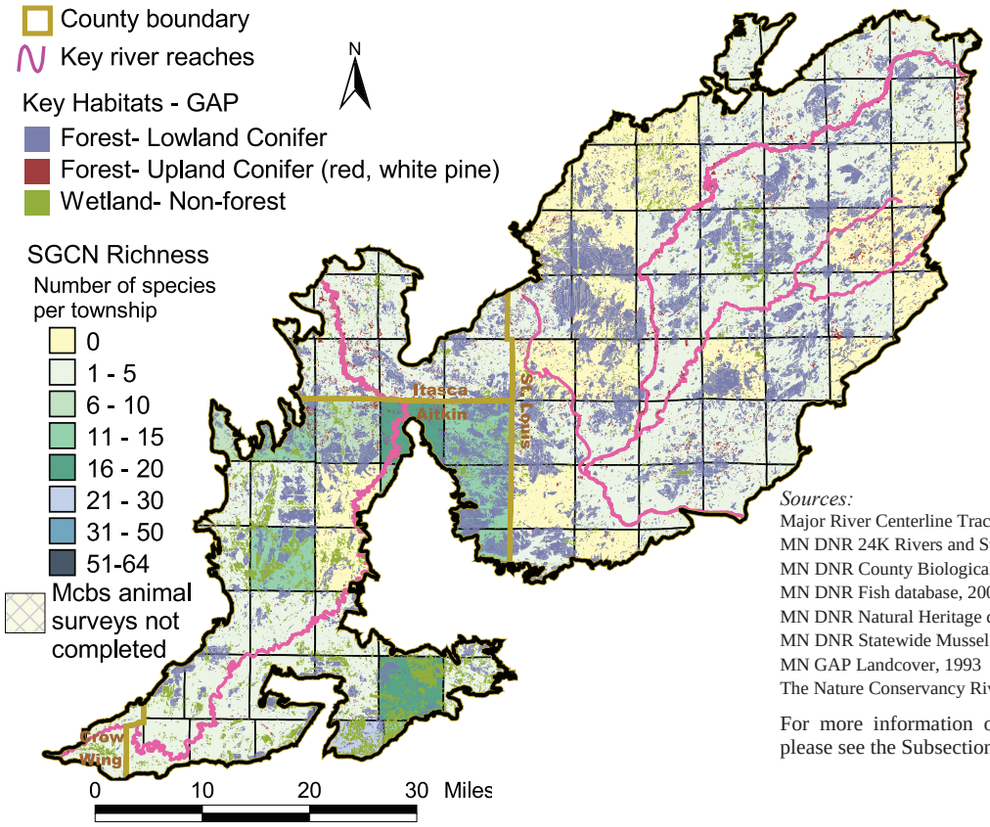
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Lowland Coniferous	52.2	39.5		19		2	1				22
Forest-Upland Deciduous (Aspen)	25.4	19.2	1	16			2				19
Grassland	N/A	14.6		15			4			1	20
Wetland-Nonforest	7.2	5.5		23			2		1	1	27
Cropland	N/A	5.2		5			2				7
Forest-Lowland Deciduous	2.3	4.8		12			1				13
Forest-Upland Coniferous (Red-white pine)	6.5	4.7	1	20		2	3				26
Shrub/Woodland-Upland (Jack pine woodland)	1.8	3.0		13		2	4				19
Forest-Upland Deciduous (Hardwood)	2.1	1.7	1	15			3				19
Lake-Deep	N/A	1.0		2	2				1		5
Lake-Shallow	N/A	0.6		7					1		8
Developed	N/A	0.2		4			2				6
Shoreline-dunes-cliff/talus	N/A	N/A		6			1				7
Shrub-Lowland	N/A	N/A		18		1	3				22
River-Headwater to Large	N/A	N/A		2	2			2	2		8
River-Very Large	N/A	N/A			1			1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, Protect the Key Habitats

1. **Upland coniferous red-white pine forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Toimi Uplands

SUBSECTION OVERVIEW

The Toimi Uplands Subsection is located in northeastern Minnesota, due west of the North Shore Highlands Subsection. It is heavily forested and consists mainly of drumlin fields, rolling hills that run from the southwest to the northeast. Before settlement by people of European descent, the area was covered with white pine, white spruce, and aspen-birch forests. This subsection's high elevation serves as the source of several rivers, including the St. Louis, Cloquet, and Whitefish. There are also numerous wetlands, especially in the northwest quadrant.

The Toimi Uplands is still predominantly forested, and the most important land use is forestry. With 84 percent of the land in public ownership, recreation is important, especially around lakes and rivers, and for hunters in the public forests. Logging of pines in the early part of the 20th century increased aspen-birch forests.

Quick facts

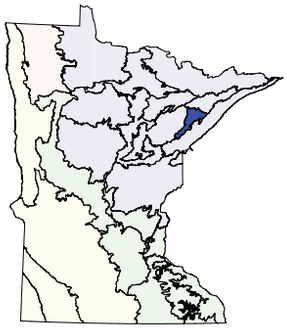
Acres: 339,147 (0.6% of state)

Ownership

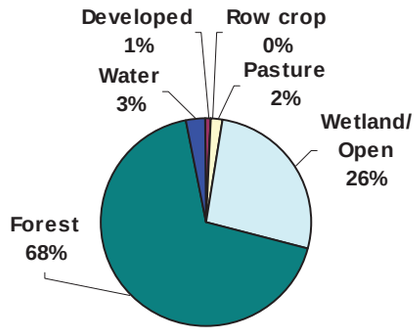
Public	Private	Tribal
84.2%	15.8%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
4.3	+0.6



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

52 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Toimi Uplands. These SGCN include 10 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 4 mammal SGCN are known or predicted to occur in the Toimi Uplands, approximately 18% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	*None documented since 1990*
Birds	37	38.1	Northern goshawk
Fish	1	2.1	*None documented since 1990*
Insects	5	8.9	Disa alpine
Mammals	4	18.2	Canada lynx
Mollusks	2	5.1	Creek heelsplitter
Reptiles	2	11.8	Wood turtle
Spiders	0	0	NA

HIGHLIGHTS

- The rolling hills of the Toimi Uplands provide habitat for gray wolves, bald eagles, and a variety of boreal forest birds like Connecticut warblers and spruce grouse. There are also wood turtles, red-necked grebes, and northern harriers present.
- Areas important for SGCN include the Cloquet Valley State Forest and portions of the Superior National Forest.

SPECIES SPOTLIGHT

Spruce grouse *(Falcipennis canadensis)*

Distribution Boreal (Laurentian) forests of extreme north-central and northeastern Minnesota.

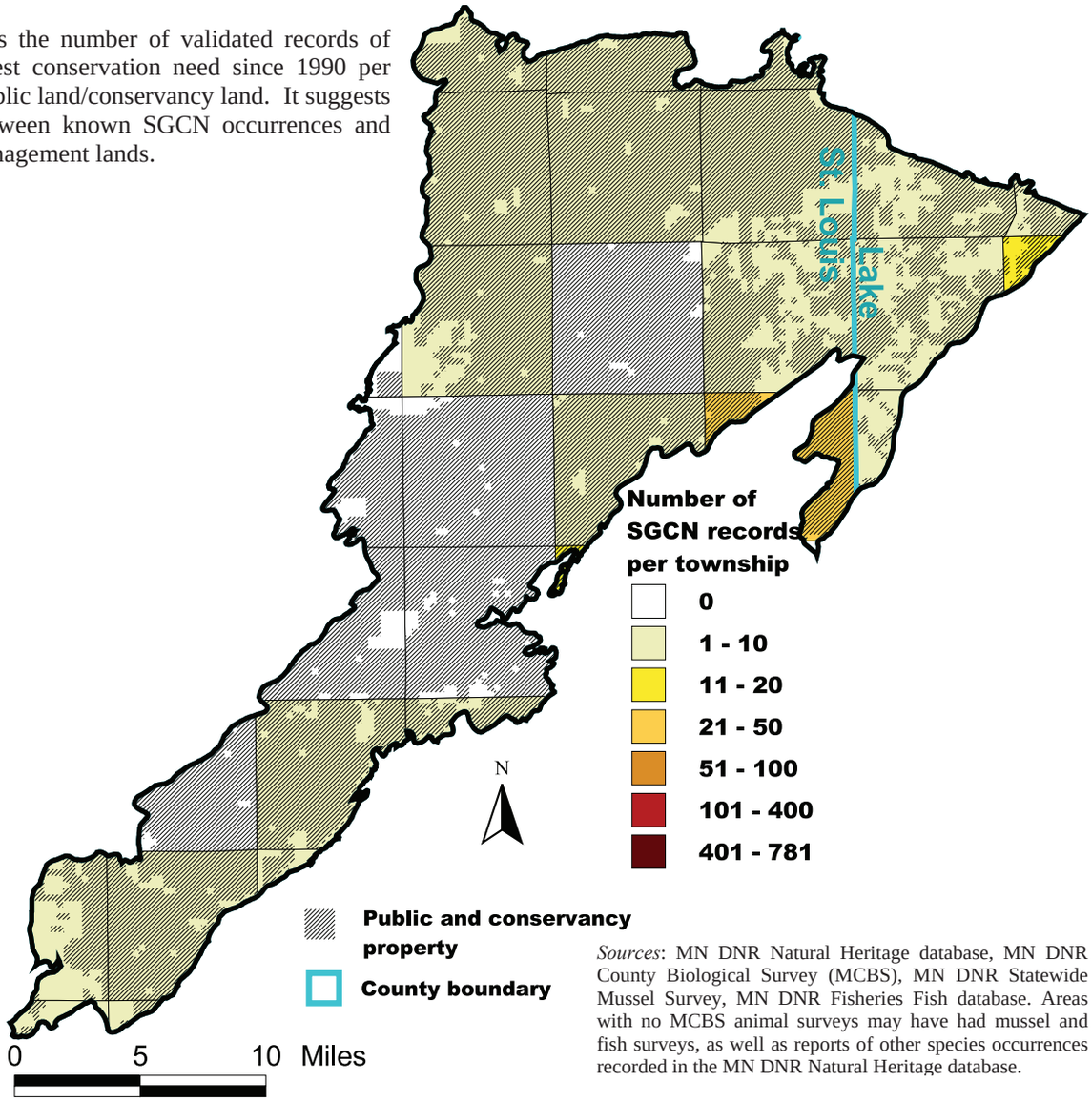
Abundance Uncommon, with most birds occurring in the northern Arrowhead region of MN.

Legal Status Game bird.

Comments Low numbers and cyclic changes make population assessment difficult, but numbers are sufficient to support limited hunting. This species is an excellent symbol of northern Laurentian forests.

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	81
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	44
Invasive Species and Competition	21
Pollution	27
Social Tolerance/Persecution/Exploitation	19
Disease	0
Food Source Limitations	2
Other	6

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Forest-Upland Coniferous	X	X			
Forest-Lowland Coniferous		X			
Shrub/Woodland-Upland (Jack pine woodland)		X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

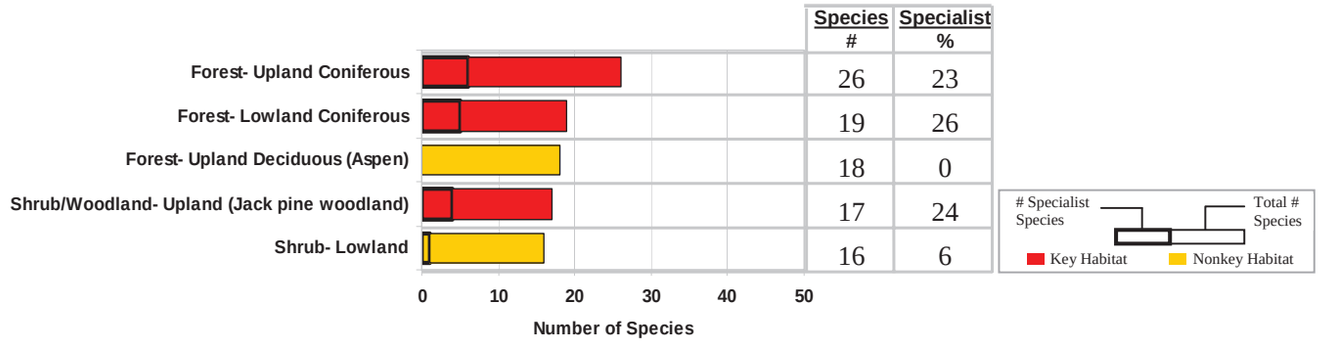
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

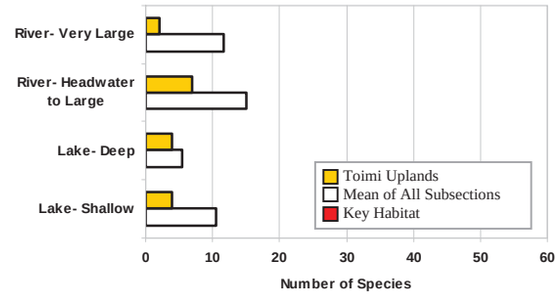
E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change

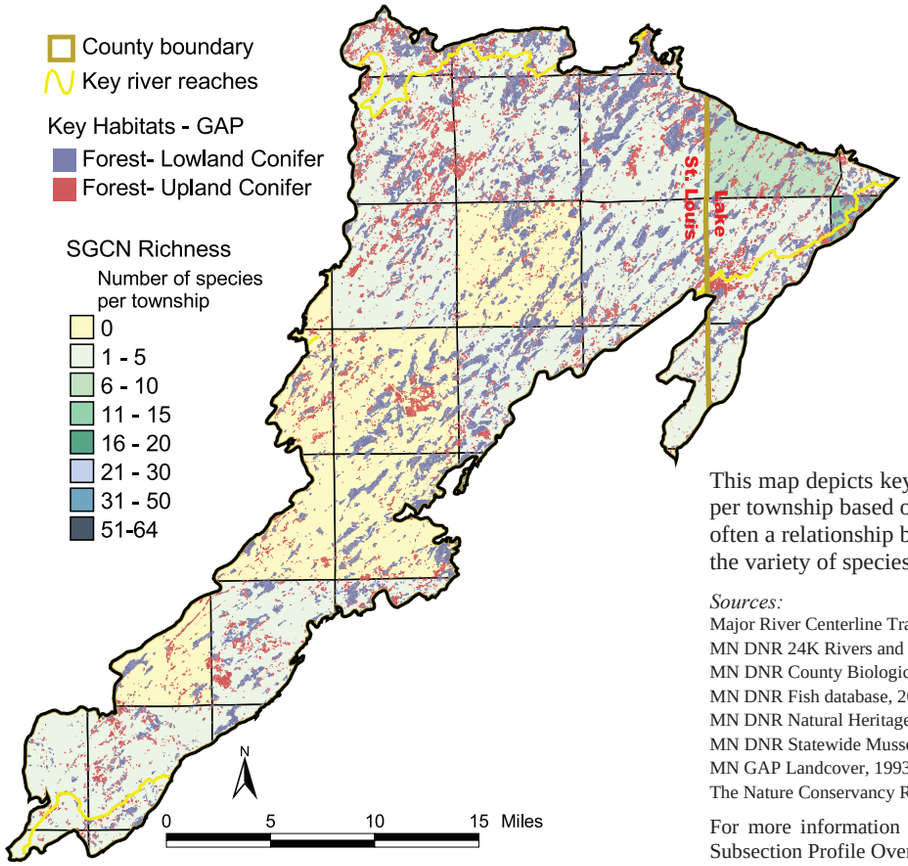
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	49.1	38.9	1	15			2				18
Forest-Lowland Coniferous	32.8	33.5		15		2	2				19
Forest-Upland Coniferous	10.9	9.7	1	20		2	3				26
Shrub/Woodland-Upland (Jack pine woodland)	1.4	7.9		10		3	4				17
Forest-Upland Deciduous (Hardwood)	1.3	2.9	1	14			3				18
Grassland	N/A	2.1		9			3				12
Forest-Lowland Deciduous	0.5	1.6		11			1				12
Lake-Deep	N/A	1.4		2	1				1		4
Wetland-Nonforest	0.5	1.3		11			2		1		14
Lake-Shallow	N/A	0.4		2					1		3
Developed	N/A	0.2		2			1				3
Cropland	N/A	0.1		1			2				3
Shoreline-dunes-cliff/talus	N/A	N/A		5			1				6
Shrub-Lowland	N/A	N/A		12		1	3				16
River-Headwater to Large	N/A	N/A		2	1			2	2		7
River-Very Large	N/A	N/A						1	1		2

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Lowland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

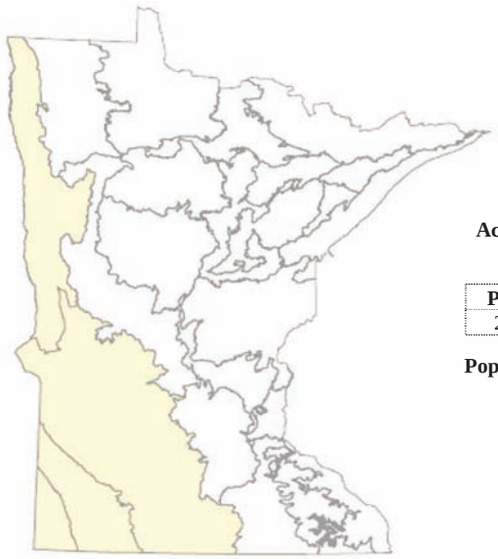
Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Prairie Parkland Province



Quick facts

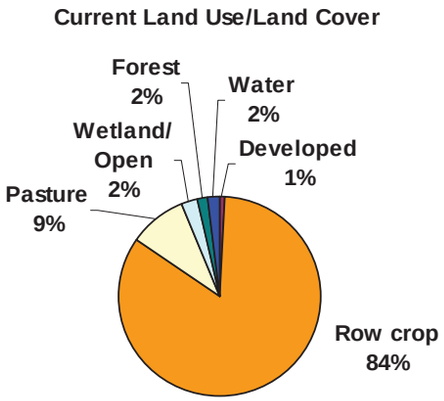
Acres: 16,094,655 (30% of state)

Ownership

Public	Private	Tribal
2.2%	97.8%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
27.6	+0.2



Overview

The Prairie Province traverses western Minnesota, Manitoba, North Dakota, South Dakota, Iowa, Nebraska, Kansas, Oklahoma, Missouri, Illinois, and Indiana. The Prairie Parkland Province stretches across most of the southern and western parts of Minnesota. Before European settlement, the area was covered mostly by tallgrass prairie and wetlands. These habitats ranged from sparsely vegetated sand dunes, to vast expanses of tallgrass prairie, to wet sedge meadows and marshes, to short-grass prairies on the Prairie Coteau. The topography of the province is predominantly level to gently rolling. Major landforms include lake plains and ground moraines.

The land surface is the result of glaciation. The last lobe of ice deposited calcareous drift in the southern part of the province and was fronted by the largest pro-glacial lake in North America, Glacial Lake Agassiz. The deep-water sediments of Glacial Lake Agassiz cover the northern part of the province. Glacial River Warren, the early outlet at the southern end of Glacial Lake Agassiz, cut a deep, broad valley that bisects a portion of this province. This valley is now occupied by the Minnesota River. Bedrock is exposed along valley walls of the Minnesota River and where smaller river valleys cut through a bedrock high at the extreme southwestern corner of the state, known as the Prairie Coteau.

With the advent of European settlement, much of the flat and fertile prairie land fell to the settler's plow. Now, just a century and a half later, less than 1 percent (about 150,000 acres) of the original 18 million acres of prairie remains. As prairie habitats dwindle, populations of prairie-dependent mammals, birds, and insects also decline. At one time, prairie birds—marbled godwits, upland sandpipers, Sprague's pipits, chestnut-collared longspurs, bobolinks, western meadowlarks, western kingbirds—were numerous. Waterfowl covered the region's wetlands, which have declined significantly since settlement. Abundant species included trumpeter swans, Canada geese, mallards, American pintails, canvasbacks, blue-winged teal, gadwalls, redheads, and northern

shovelers. Waterbirds included whooping crane, Wilson's snipe, American bittern, sora, Virginia rail, and western grebe. Gallinaceous birds included the greater prairie chicken and sharp-tailed grouse. Bison roamed throughout the Prairie Parkland Province and American elk and white-tailed deer were common. Other mammals included Franklin's and Richardson's ground squirrels, as well as badgers and an occasional pronghorn. Less conspicuous species included Topeka shiner minnows and regal fritillary and Dakota skipper butterflies.

C. Anderson MN DNR

Remnant prairie and the Pomme de Terre River amidst an agricultural landscape – Minnesota River Prairie Subsection

Province Subsections

Coteau Moraines
Inner Coteau
Minnesota River Prairie
Red River Prairie

Summaries of Species in Greatest Conservation Need

A list of the species in the province, including identification of those unique to the province, is found in Appendix F. Table 5.15 presents the number of species in greatest conservation need in each subsection and the number unique to each subsection. Subsections are ranked from most to fewest SGCN. This ranking can help conservation stakeholders prioritize their efforts in a province. The Minnesota River Prairie subsection has considerably more species in greatest conservation need than the other subsections in

the Prairie Parkland Province. Part of this difference reflects the fact that this subsection is considerably larger than the other subsections, but further investigations into the reasons for these differences should be carried out during implementation of the CWCS.

Table 5.15. Number of SGCN in and Number Unique to the Prairie Parkland Province by Subsection

Subsection	Number of SGCN	Number of SGCN Unique to Subsection
Minnesota River Prairie	116	1
Red River Prairie	83	4
Inner Coteau	78	1
Coteau Moraines	78	0
Prairie Parkland Province	139	13

SGCN Problem Assessment

The SGCN problem assessment provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the province. The following table lists the percentage of SGCN in the province influenced by nine possible factors or problems. The results of the species problem assessment indicate that habitat loss and degradation in the province are the predominant challenges facing SGCN populations.

Table 5.16. SGCN Problem Analysis for the Prairie Parkland Province

Problem	Percentage of SGCN for which this is a known problem.
Habitat Loss in MN	88
Habitat Degradation in MN	91
Habitat Loss/Degradation Outside of MN	30
Invasive Species and Competition	27
Pollution	33
Social Tolerance/Persecution/Exploitation	20
Disease	4
Food Source Limitations	4
Other	19

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Summaries of Key Habitats

Table 5.17 ranks the habitats by the frequency with which they are identified in the subsections as key habitats. Table 5.18 ranks the subsections by their number of key habitats.

Table 5.17. Frequency of Key Habitats in the Prairie Parkland Province by Subsection

Key Habitat Ranked by Frequency	Number of Subsections	Percentage of Subsections
Prairie	4	100
Wetland-Nonforest	4	100
River-Headwater to Large	4	100
River-Very Large	2	50
Forest-Lowland Deciduous	1	25
Shoreline-dunes-cliff/talus	1	25
Lake-Shallow	1	25

Table 5.18. Number of Key Habitats in the Prairie Parkland Province by Subsection

Subsection	Number of Key Habitats
Minnesota River Prairie	6
Red River Prairie	5
Coteau Moraines	3
Inner Coteau	3

Assessment of SGCN and Key Habitats

Table 5.19 provides the number of species that use at least one key habitat at the subsection, province, and statewide scales. Subsections are ranked within each province by the percentage of SGCN that use at least one key habitat in the subsection. The percentage among the subsections in the Prairie Parkland Province does not vary greatly.

Table 5.19. SGCN That Use Key Habitats in the Prairie Parkland Province by Subsection

Subsection	Total Number of SGCN	Number of SGCN Using at Least 1 Key Habitat	Percentage of SGCN Using At Least 1 Key Habitat
Red River Prairie	83	78	94.0
Inner Coteau	78	73	93.6
Coteau Moraines	78	72	92.3
Minnesota River Prairie	116	102	87.9
Province total	139	127	91.4
State total	292	269	92.1

Note: Subsections are ranked by the percentage of SGCN that use at least one key habitat in the subsection.

W. R. Smith MN DNR

Birdwatchers at Salt Lake – Lac Qui Parle County – Minnesota River Prairie Subsection

Coteau Moraines

SUBSECTION OVERVIEW

The Coteau Moraines Subsection in southwestern Minnesota also includes part of northwestern Iowa and extends into southeastern South Dakota. On its northeast boundary, the subsection rises abruptly from the Minnesota River Prairie Subsection. It is a high landform with Buffalo Ridge running along its western edge. The highest point on the ridge is 1,995 feet above sea level, second only to Eagle Mountain in the North Shore Highlands Subsection. Windy conditions are common. Shallow lakes are common, including a few large ones. Prairie wetlands are numerous, making this subsection important for waterfowl. There are a number of small streams here and one larger river, the Des Moines. Before settlement by people of European descent, prairie covered virtually all of the landscape. Fires were common and critical to maintaining the prairie plant communities.

Today, agriculture is the predominant land use, and its expansion and intensification have resulted in water quality and water quantity concerns. Nitrates, phosphates, and pesticides are present in the shallow aquifers. Tiling and ditching of land, and channelization of the river systems have degraded habitat and disturbed aquatic connectivity. Gravel and boulder mining occur in this subsection, and large-scale wind-power production is expanding dramatically. Many of the remaining prairie-grassland complexes are in private ownership and have been used for grazing. Wetland protection and restoration are important conservation issues.

Quick facts

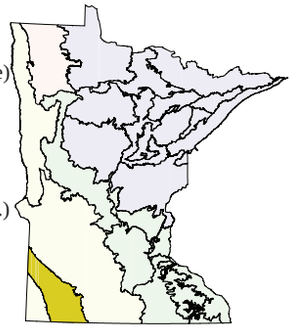
Acres: 2,045,491 (3.8% of state)

Ownership

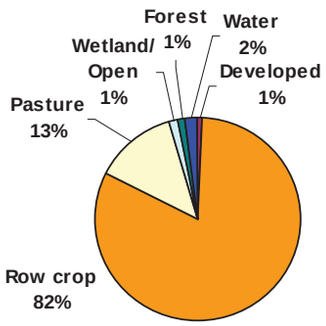
Public	Private	Tribal
2.7%	97.3%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
20.2	-0.4



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

78 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Coteau Moraines. These SGCN include 30 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 9 mammal SGCN are known or predicted to occur in the Coteau Moraines, approximately 41% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common Mudpuppy
Birds	44	45.4	Upland sandpiper
Fish	3	6.4	Plains topminnow
Insects	9	16.1	Dakota skipper
Mammals	9	40.9	Prairie vole
Mollusks	7	17.9	Spike mussel
Reptiles	4	23.5	Smooth green snake
Spiders	1	12.5	Jumping spider (*P. pius*)

HIGHLIGHTS

- The abundance of publicly owned wetlands on state and federal wildlife areas and associated grasslands provides important habitat for American bitterns, Franklin's gulls, northern harriers, short-eared owls, Forster's terns, and a multitude of nesting ducks and associated wetland birds.
- Areas important for SGCN include numerous state WMAs; federal WPAs; Nature Conservancy lands; Camden, Kilen Woods, and Lake Shetek SPs; and Compass, Prairie Bush Clover, and Des Moines River SNAs.
- The greater Heron Lake Complex (and surrounding grasslands/prairies) is widely considered to be a highly significant resource in this subsection, providing breeding and/or migration habitat for many species of SGCN (such as waterbirds, shorebirds, and grassland birds).

SPECIES SPOTLIGHT

Poweshiek skipper *(Oarisma powesheik)*

Distribution Prairie/grassland regions of western and southern MN, including small remnant prairies.

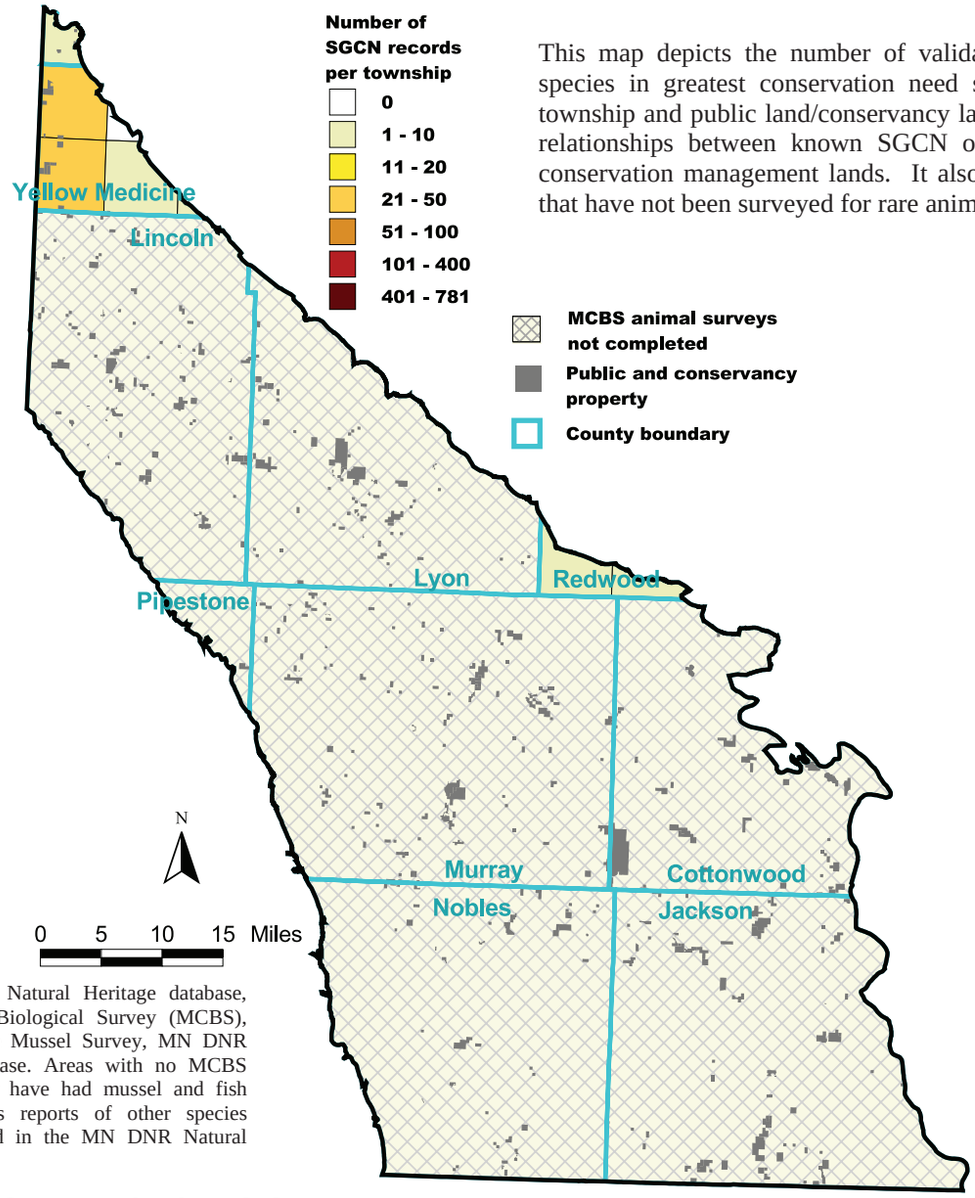
Abundance Rare throughout its range in MN, and even rarer outside of MN. Loss of prairies and grasslands throughout the agricultural regions of MN has contributed to a significant decline of this species. It seems to persist even in somewhat degraded grassland habitat.

Legal Status State list-Special Concern.

Comments The life history of this species is very poorly known.

Photo by Robert Dana

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	88
Habitat Degradation in MN	92
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	28
Pollution	35
Social Tolerance/Persecution/Exploitation	21
Disease	5
Food Source Limitations	5
Other	21

Coteau Moraines

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Prairie	X	X	X		
Wetland-Nonforest		X	X		
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

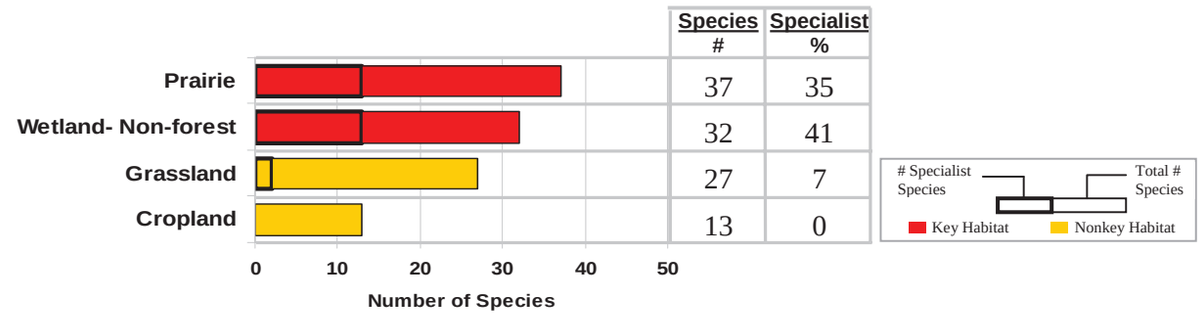
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

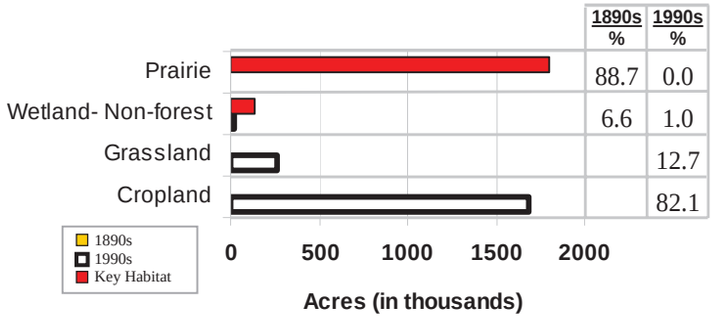
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

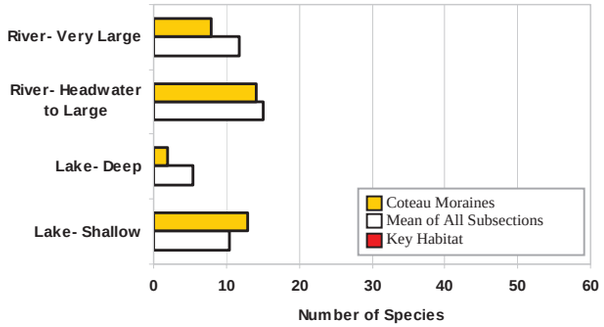
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



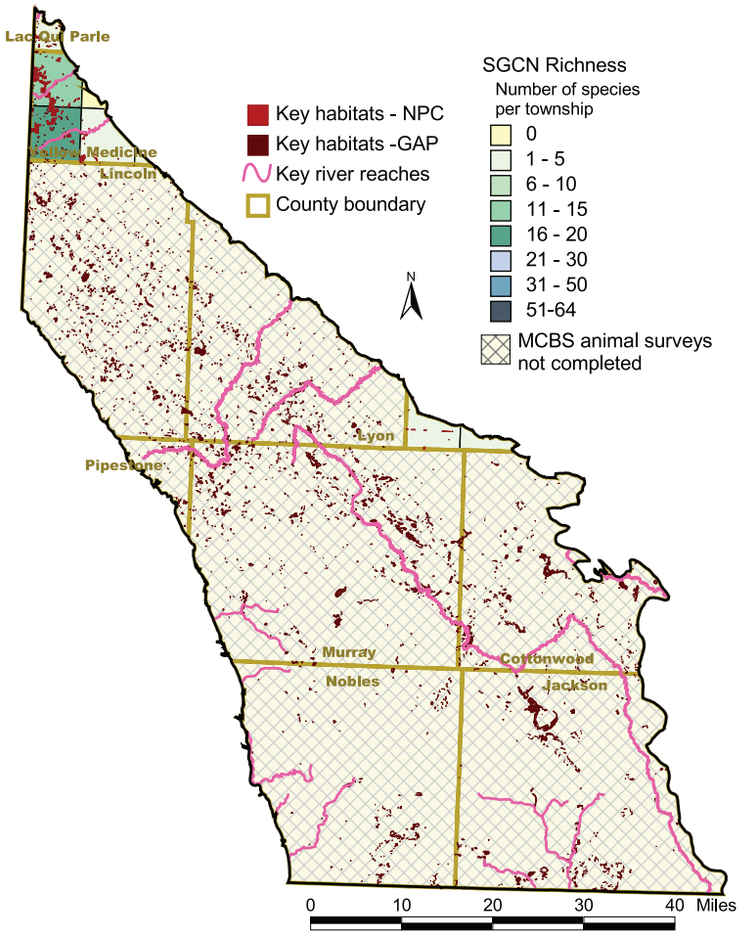
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	82.2		7			5		1		13
Grassland	N/A	12.7		15			9		3		27
Lake-Shallow	N/A	1.7		11					2		13
Wetland-Nonforest	6.6	1.0		28			2		2		32
Forest-Upland Deciduous (Hardwood)	0.0	0.8		5			3		1		9
Developed	N/A	0.7		4			2				6
Shrub/Woodland-Upland	0.6	0.4		11		1	6		2		20
Forest-Lowland Deciduous	1.0	0.3		6			1		1		8
Lake-Deep	N/A	0.2	1						1		2
Forest-Upland Coniferous	0.0	0.0		5			3		2		10
Prairie	88.7	0.0		15		9	9		3	1	37
Shoreline-dunes-cliff/talus	N/A	N/A		10			3				13
River-Headwater to Large	N/A	N/A	1	1	3			7	2		14
River-Very Large	N/A	N/A	1					5	2		8

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Inner Coteau

SUBSECTION OVERVIEW

The Inner Coteau Subsection is located in the extreme southwest corner of Minnesota and includes parts of southeastern South Dakota and northwestern Iowa. This high plain lies west of Buffalo Ridge, which is the western boundary of the Coteau Moraines Subsection. This subsection contains several rivers, including the Rock and Redwood, but very few lakes. Before settlement by people of European descent, prairie covered virtually all of this landscape, and wet prairies were scattered throughout. Fires were common and critical to maintaining native prairie.

Agriculture is the predominant land use here, and its expansion and intensification have resulted in water quality and water quantity concerns. Nitrates, phosphates, and pesticides are present in the shallow aquifers. Very few remnants of prairie and wetlands remain, and their conservation is a major concern. Gravel and boulder mining occurs in this subsection, particularly on ridges of prairie and grasslands where large-scale wind-power production is expanding.

Quick facts

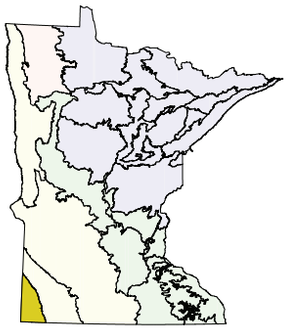
Acres: 776,757 (1.4% of state)

Ownership

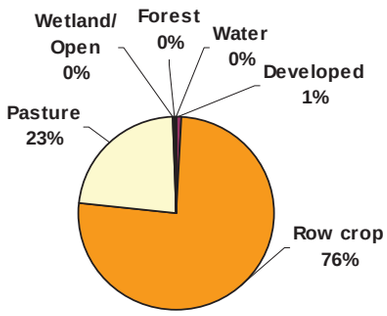
Public	Private	Tribal
0.9%	99.1%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
25.3	-0.7



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

78 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Inner Coteau. These SGCN include 33 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 10 mammal SGCN are known or predicted to occur in the Inner Coteau, approximately 46% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	2	33.3	Northern cricket frog
Birds	39	40.2	Grasshopper sparrow
Fish	3	6.4	Topeka shiner
Insects	10	17.9	Regal fritillary
Mammals	10	45.5	Western harvest mouse
Mollusks	7	17.9	Creek heelsplitter
Reptiles	5	29.4	Lined snake
Spiders	2	25.0	*H. texanus*

HIGHLIGHTS:

- The Inner Coteau contains some excellent tracts of remaining native prairie interspersed with wetlands and streams, which provide habitat for Swainson's hawks, short-eared owls, dickcissels, bobolinks, upland sandpipers, plains topminnows, Richardson's ground squirrels and a variety of ducks.
- Rivers, streams and associated wetlands provide some of the few refuges remaining for Blanding's turtles in this area of the state.
- In addition to several records of Western foxsnakes, this subsection contains the only documented site with lined snakes in the state.
- Areas important for SGCN include Blue Mounds and Split Rock Creek SPs; Pipestone National Monument, Prairie Coteau, and Compass Prairie SNAs; Altona, Terrace, and Burke WMAs; and Nature Conservancy lands. Public and private lands form key corridors along Buffalo Ridge.

SPECIES SPOTLIGHT

Topeka shiner *(Notropis topeka)*

Distribution Extremely limited distribution in small streams of the Missouri River drainage in Pipestone, Rock, and Nobles counties.

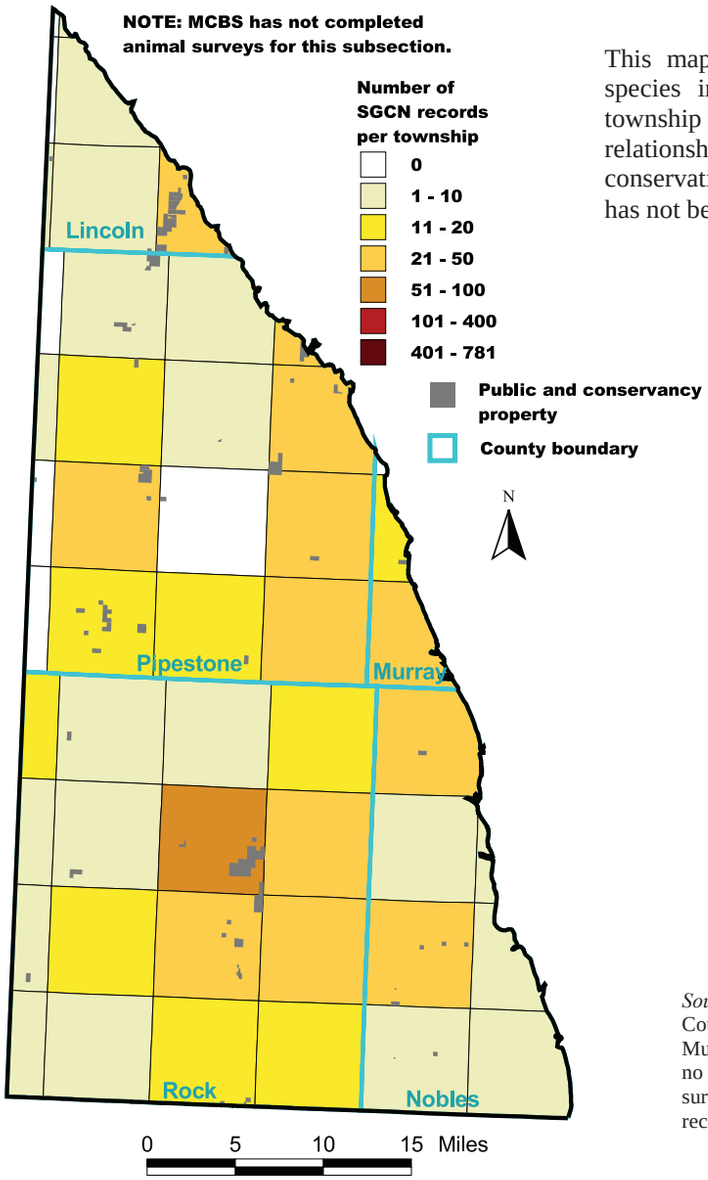
Abundance Rare throughout its midwestern range, there are pockets of good stream habitat in SW MN, primarily on private farmlands.

Legal Status Federal list-Endangered; state list-Special Concern.

Comments This species is now benefiting from investment of the federal Landowner Incentive Program, a state-administered voluntary program that provides funding to private landowners to implement habitat management projects benefiting "at-risk" species.

Photo by Konrad Schmidt

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. Please note that MCBS has not begun rare animal surveys in this subsection.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	88
Habitat Degradation in MN	92
Habitat Loss/Degradation Outside of MN	28
Invasive Species and Competition	28
Pollution	36
Social Tolerance/Persecution/Exploitation	19
Disease	4
Food Source Limitations	6
Other	23

Inner Coteau

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Prairie	X	X	X		
Wetland-Nonforest		X	X		
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

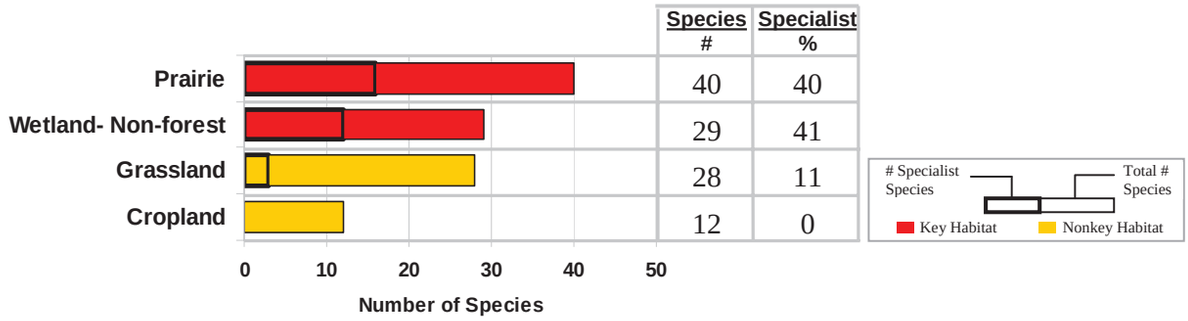
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

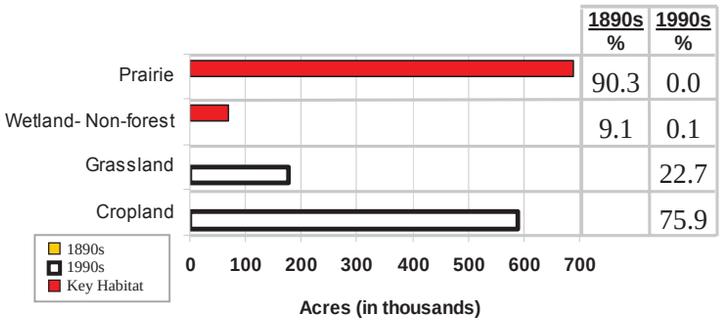
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

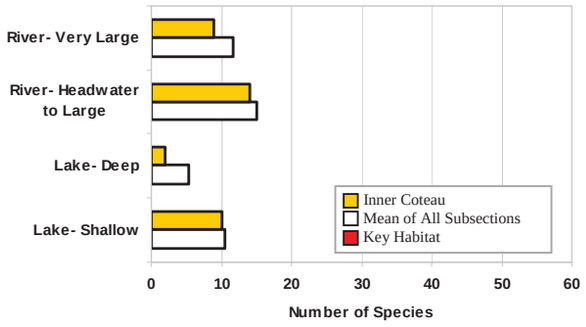
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



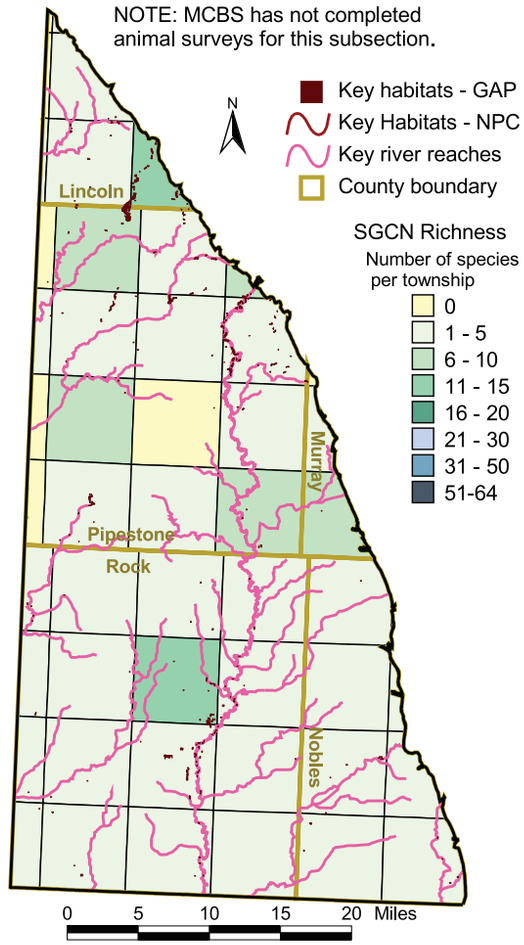
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Railroad Rights-of-Way Prairies
MN DNR 24K Rivers and Streams, 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	75.9		6			5		1		12
Grassland	N/A	22.7		14			10		4		28
Developed	N/A	0.9		4			3				7
Forest-Upland Deciduous (Hardwood)	0.0	0.2		5			3		1		9
Wetland-Nonforest	9.1	0.1	1	24			2		2		29
Shrub/Woodland-Upland	0.1	0.1		11		2	7		2		22
Lake-Shallow	N/A	0.1		8					2		10
Forest-Lowland Deciduous	0.6	0.0		6			1		1		8
Prairie	90.3	0.0		14		10	10		4	2	40
Shoreline-dunes-cliff/talus	N/A	N/A	1	9			3				13
Shrub-Lowland	N/A	N/A		11			3		1		15
River-Headwater to Large	N/A	N/A	1	1	3			7	2		14
River-Very Large	N/A	N/A	2					5	2		9

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Minnesota River Prairie

SUBSECTION OVERVIEW

The Minnesota River Prairie is a large subsection that includes part of northwestern Iowa and spreads across southwestern Minnesota into eastern South Dakota. The Minnesota River forms a broad valley, dividing the area in half. This valley once had a continuous band of floodplain forest that extended upstream as far as Lac Qui Parle, with highly unique bedrock exposures. There are 150 lakes larger than 160 acres in the subsection, most of which are shallow. Before settlement by people of European descent, the predominant vegetation was tallgrass prairie and wetlands. Fire was once a common natural disturbance and critical to maintaining native prairie communities.

Today, row-crop agriculture is the predominant land use, and prairie remnants and floodplain forests are rare. A major concern is impacts on water quality from intensive agricultural activities, including use of fertilizers and pesticides, expanding use of pattern tiling, and ditching and draining of small wetlands. Continued loss of the small amount of native upland habitat and over-intensive grazing remain a concern.

Quick facts

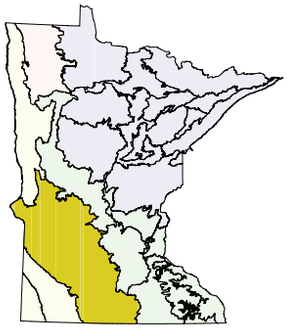
Acres: 9,321,886 (17.3% of state)

Ownership

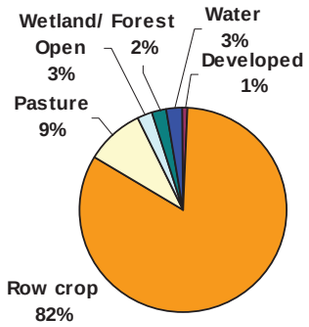
Public	Private	Tribal
2.8%	97.2%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
31.7	+0.5



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

116 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Minnesota River Prairie. These SGCN include 52 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 10 mammal SGCN are known or predicted to occur in the Minnesota River Prairie, approximately 46% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common mudpuppy
Birds	65	67.0	Black tern
Fish	6	12.8	Blue sucker
Insects	11	19.6	Poweshiek skipper
Mammals	10	45.5	Western harvest mouse
Mollusks	12	30.8	Fluted-shell
Reptiles	8	47.1	Five-lined skink
Spiders	3	37.5	Jumping spider (*M. grata*)

HIGHLIGHTS

- The remaining wetlands and grasslands offer excellent habitat for bald eagles, prairie chickens, marbled godwits, upland sandpipers, Richardson's ground squirrels, regal fritillaries, swainson's hawks, Forster's terns, dickcissels, and mucket and elktoe mussels.
- This is an important nesting area for prairie ducks and is also a major migratory corridor in the Mississippi Flyway.
- The Minnesota River provides habitat for paddlefish, mussels, and softshell turtles, while associated dry grasslands provide habitat for bullsnakes and western hognose snakes, and foxsnakes occur in upland riparian forests.
- Areas important for SGCN include Lac qui Parle and Swan Lake WMAs; Big Stone NWR; Sibley, Monson Lake, Upper Sioux Agency, and Lac qui Parle SPs; The Nature Conservancy's Chippewa Prairie; and many SNAs and WPAs.

SPECIES SPOTLIGHT

Creek heelsplitter *(Lasmigona compressa)*

Distribution Widespread but spotty distribution in the Mississippi River drainage north of St. Anthony Falls, MN, with sporadic occurrences in other MN river systems, including the Pomme de Terre and Chippewa rivers in western MN.

Abundance Rare. Present in low numbers in a variety of sites from SW to NE MN, but pollution and siltation of small streams and rivers have greatly reduced suitable habitat.

Legal Status State list-Special Concern.

Comments Host species include yellow perch, black crappie, slimy sculpin, and spotfin shiner. Management efforts for this mussel need to include consideration of the host species.

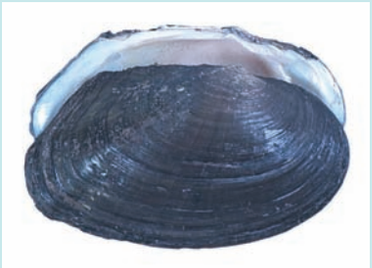
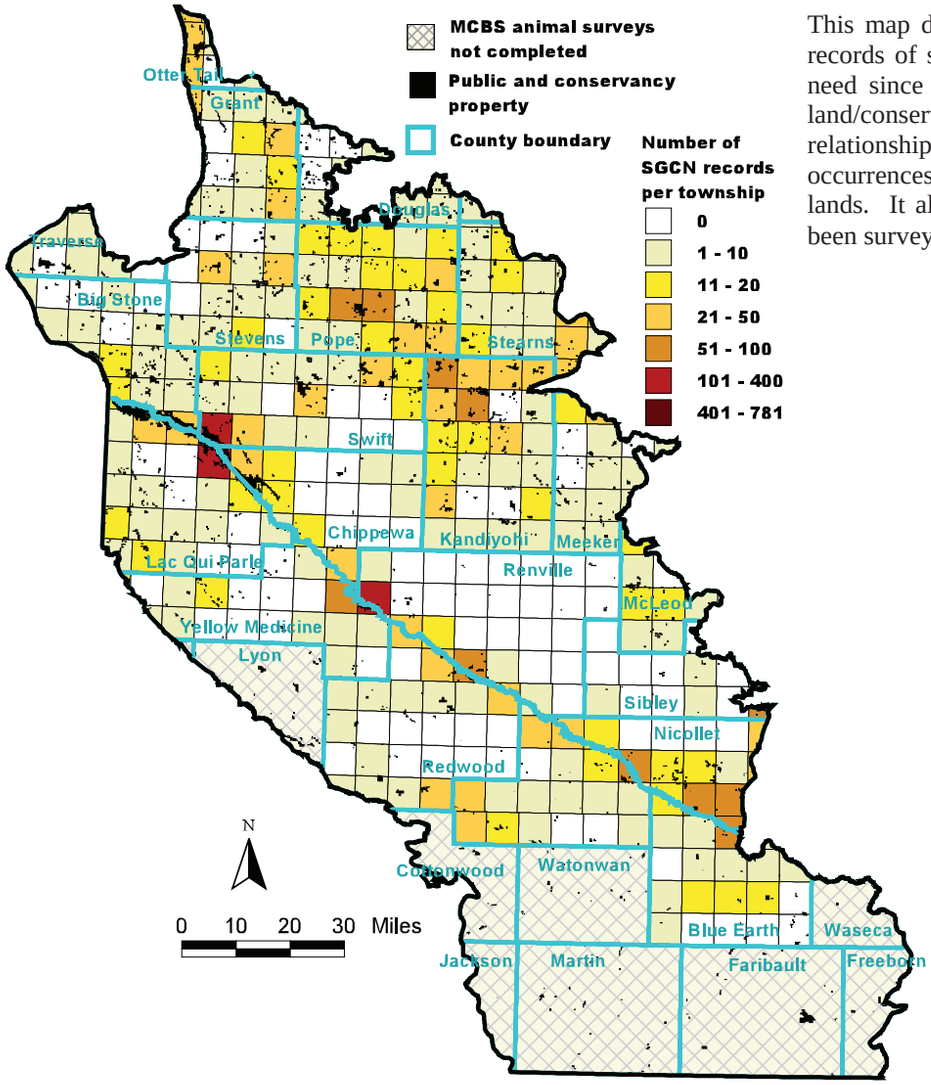


Photo by Deb Rose

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	87
Habitat Degradation in MN	90
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	29
Pollution	34
Social Tolerance/Persecution/Exploitation	22
Disease	4
Food Source Limitations	4
Other	18

Minnesota River Prairie

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Prairie	X	X	X		
Wetland-Nonforest	X	X	X		
Shoreline-dunes-cliff/talus		X			
Lake-Shallow				X	
River-Headwater to Large					X
River-Very Large (Minnesota River)					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

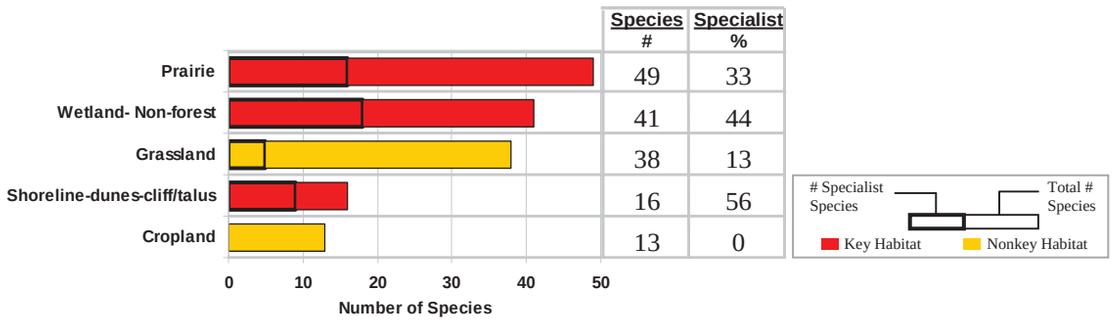
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

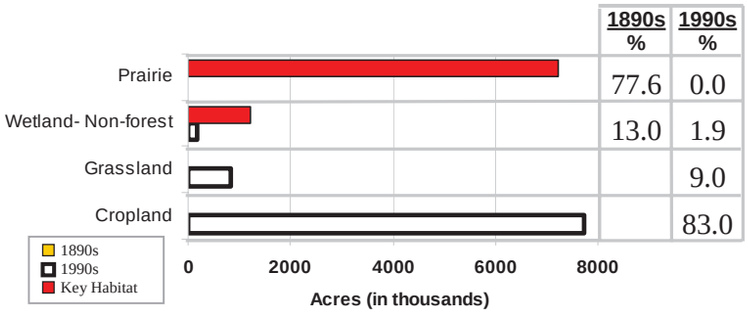
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

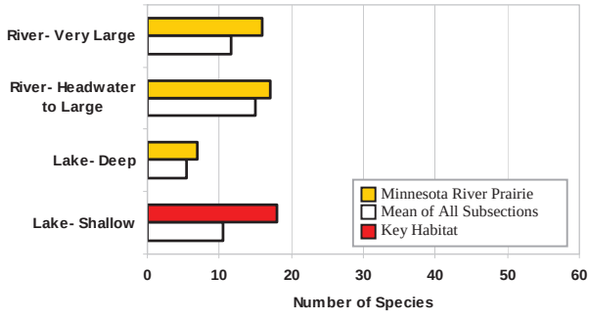
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



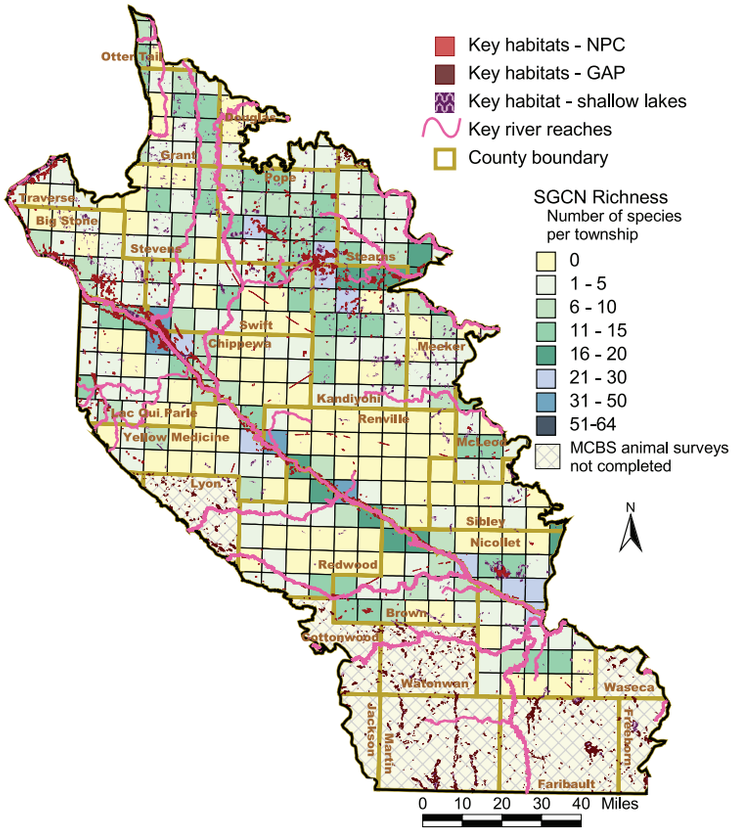
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MCBS Railroad Rights-of-Way Prairies
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	83.0		7			5		1		13
Grassland	N/A	9.0		20		1	10		6	1	38
Lake-Shallow	N/A	2.1		14	1				2		17
Wetland-Nonforest	13.0	1.9		34		1	2		2	2	41
Forest-Upland Deciduous (Hardwood)	1.5	1.6		14			4		3		21
Developed	N/A	0.8		4			3		1		8
Oak Savanna	1.9	0.5		15		1	7		5		28
Lake-Deep	N/A	0.4	1	2	3				1		7
Forest-Lowland Deciduous	1.5	0.4		14			2		1		17
Forest-Lowland Coniferous	0.0	0.2		8						1	9
Forest-Upland Deciduous (Non-hardwood)	0.8	0.1		12			2				14
Prairie	77.6	0.0		19		10	10		7	3	49
Forest-Upland Coniferous	0.0	0.0		13			3		3		19
Shoreline-dunes-cliff/talus	N/A	N/A		11			3		2		16
Shrub-Lowland	N/A	N/A		15			3		1		19
River-Headwater to Large	N/A	N/A	1	2	4			8	2		17
River-Very Large (Minnesota River)	N/A	N/A	1	1	2			10	2		16

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Nonforested wetlands and floodplain forests**, actions include:
   a. Manage invasive species
   b. Enforce the Wetlands Conservation Act
   c. Manage habitats adjacent to wetlands and floodplain forests to enhance SGCN values
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Shoreline, dune, cliff/talus habitats**, actions include:
   a. Support the protection of these habitats from damaging development
   b. Enhance SGCN habitat along the shoreline
   c. Enhance SGCN habitat within dune communities
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Red River Prairie

SUBSECTION OVERVIEW

The Red River of the North forms the western boundary of the Red River Prairie Subsection and Minnesota. The former range limit of what was once tallgrass prairie forms the eastern boundary. Wet prairies were an important habitat in this subsection. The dominant landform is the large, flat, lake plain of Glacial Lake Agassiz, and associated landforms including beach ridges and sand dunes.

Rich soils deposited from Glacial Lake Agassiz make this subsection highly desirable for agriculture. The Agassiz beach ridges include a significant proportion of the state's remaining prairie acres, half of which are protected in preserves. Most of the remainder of the subsection has been drained using tile and ditching for row crop production. Less than 1 percent of former prairie remains, and remnant patches are often too small to be fully functional, due to the altered surrounding landscape. Some prairie remnants that are not protected in preserves are enrolled in conservation programs, but many have no formal protection and are subject to further agricultural development or mining for construction aggregates. Dams and channelization disrupt aquatic connectivity and degrade habitat along rivers. The cities of Breckenridge, Fargo, and Grand Forks are growing, which compounds current concerns regarding water quantity and water quality.

Quick facts

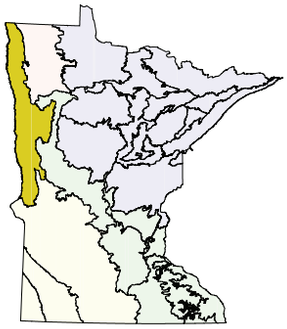
Acres: 3,950,520 (7.3% of state)

Ownership

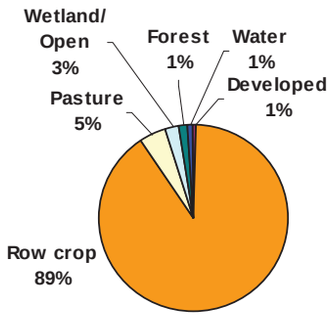
Public	Private	Tribal
2.6%	97.4%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
22.3	-0.1



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

83 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Red River Prairie. These SGCN include 36 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 9 mammal SGCN are known or predicted to occur in the Red River Prairie, approximately 41% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common mudpuppy
Birds	54	55.7	Henslow's sparrow
Fish	2	4.3	Flathead chub
Insects	10	17.9	Red-tailed prairie leafhopper
Mammals	9	40.9	Northern grasshopper mouse
Mollusks	3	7.7	Fluted-shell
Reptiles	3	17.6	Western hognose snake
Spiders	1	12.5	*M. arizonensis*

HIGHLIGHTS

- Scattered remnant tracts of native prairie and riparian woodlands in the Red River Prairie are home to a surprising variety of wildlife. Some of the most pristine and extensive prairie tracts remaining in the state are found here.
- Featured wildlife include greater prairie chickens, marbled godwits, loggerhead shrikes, poweshiek skippers, northern pocket gophers and northern grasshopper mice. Lake sturgeon and black sandshells are found in the Red River.
- Areas important for SGCN include Malmberg Prairie, Agassiz Dunes, Pembina Trail Preserve, Felton Prairie, Bluestem Prairie, Sandpiper Prairie, and Ottertail SNAs; Red River State Recreation Area; Buffalo River SP; and many state WMAs, federal WPAs, TNC lands including the Glacial Ridge and the Audubon Sanctuary at Warren.

SPECIES SPOTLIGHT

Upland sandpiper *(Bartramia longicauda)*

Distribution Broad distribution on prairies and grasslands throughout the state except in far northeastern counties.

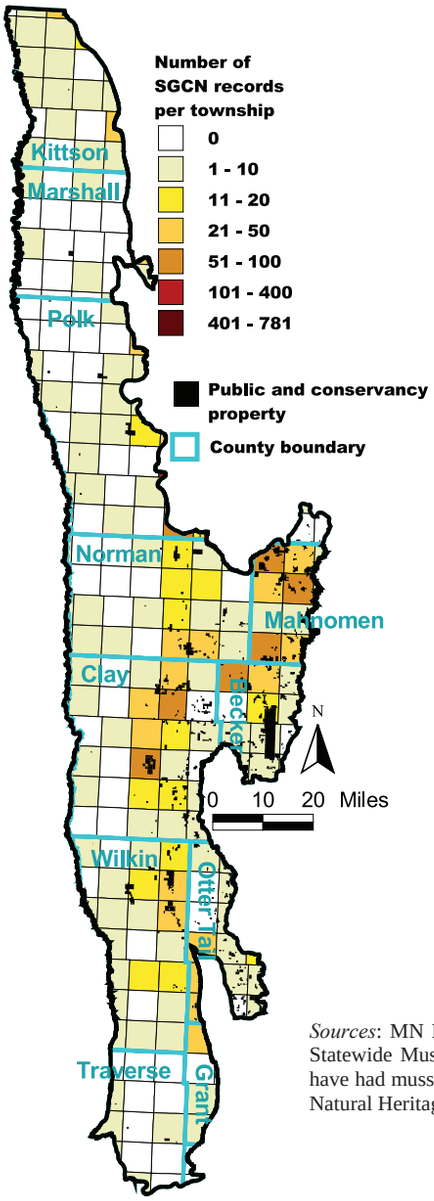
Abundance Rare, but locally common on native prairies of western and northwest Minnesota. Sporadic numbers elsewhere in southern and central MN.

Legal Status Protected migratory bird.

Comments Long-term decline has followed loss of grassland throughout the state. Species has shown some adaptability to use grassy areas at airports and hayfields. Protection of prairies on state WMAs, state parks, federal WPAs, National Wildlife Refuges, and Nature Conservancy lands have helped preserve remaining populations.

Photo by Carrol Henderson

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	90
Habitat Degradation in MN	94
Habitat Loss/Degradation Outside of MN	35
Invasive Species and Competition	20
Pollution	31
Social Tolerance/Persecution/Exploitation	22
Disease	4
Food Source Limitations	5
Other	16

Red River Prairie

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Prairie	X	X	X		
Forest-Lowland Deciduous			X		
Wetland-Nonforest	X	X	X		
River-Headwater to Large					X
River-Very Large (Red River)					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

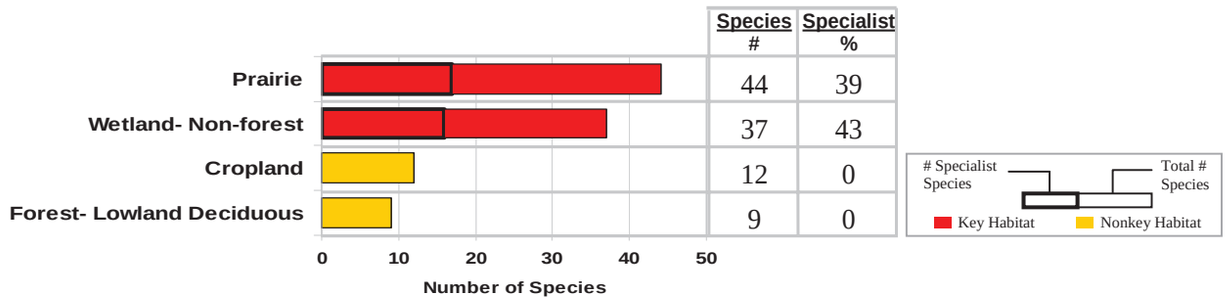
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

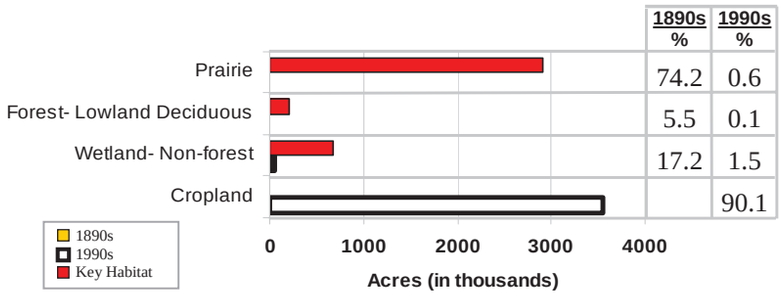
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

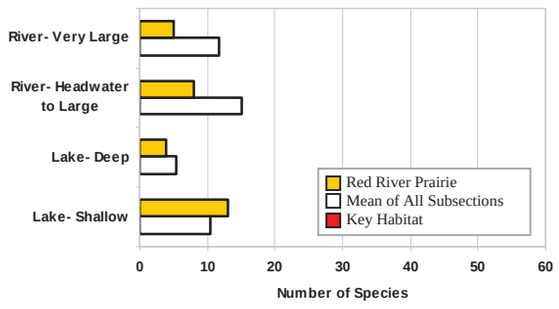
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



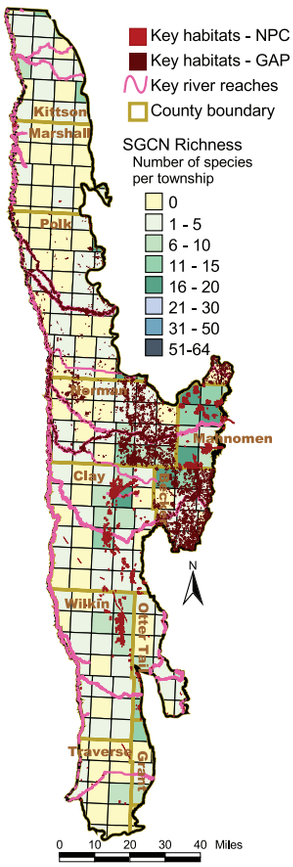
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MCBS Railroad Rights-of-Way Prairies
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	**Percentage of Subsection (1890s)**	**Percentage of Subsection (1990s)**	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Mollusks**	**Reptiles**	**Spiders**	**Total Number of Species**
Cropland	N/A	90.2		7			5				12
Grassland	N/A	4.6		23			9		2		34
Wetland-Nonforest	17.2	1.5		33		1	2		1		37
Forest-Upland Deciduous (Hardwood)	0.1	0.6		7			3				10
Developed	N/A	0.6		4			3				7
Forest-Upland Deciduous (Aspen-oak)	0.7	0.6		7			1				8
Prairie	74.2	0.6		24		9	8		2	1	44
Lake-Shallow	N/A	0.5		10					1		11
Forest-Lowland Coniferous	0.0	0.3		8							8
Lake-Deep	N/A	0.3	1	1	1				1		4
Forest-Lowland Deciduous	5.5	0.1		8			1				9
Shrub/Woodland-Upland	1.5	0.1		13		1	5		1		20
Forest-Upland Coniferous	0.0	0.0		7			3		1		11
Shoreline-dunes-cliff/talus	N/A	N/A		10			3				13
Shrub-Lowland	N/A	N/A		15			3				18
River-Headwater to Large	N/A	N/A	1	2	1			3	1		8
River-Very Large (Red River)	N/A	N/A	1		1			2	1		5

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Lowland deciduous hardwood forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands and floodplain forests**, actions include:
   a. Manage invasive species
   b. Enforce the Wetlands Conservation Act
   c. Manage habitats adjacent to wetlands and floodplain forests to enhance SGCN values
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN

Priority Conservation Actions for Research (continued)

2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

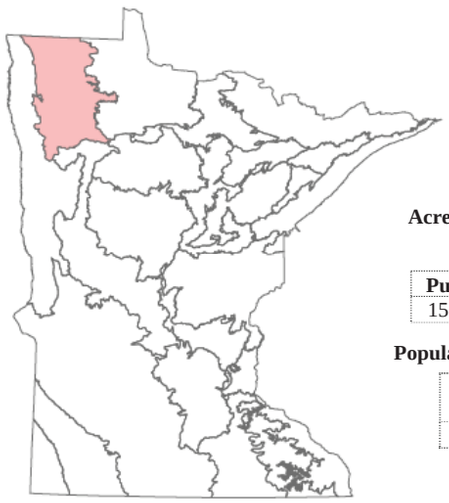
Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Tallgrass Aspen Parklands Province



Quick facts

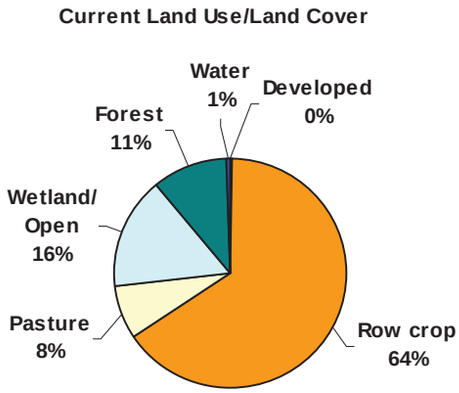
Acres: 2,906,127 (5.4% of state)

Ownership

Public	Private	Tribal
15.6%	84.1%	0.3%

Population density (people/sq. mi.)

Current	Change (2000-2010)
8.7	0.0



Overview

The Tallgrass Aspen Parklands Province in northwestern Minnesota is characterized by the low-lying, flat topography that was once part of Glacial Lake Agassiz. It is the southern end of a much larger province that stretches north and west into Canada and

R. Dana MN DNR

Tallgrass Aspen Parklands – Kittson County

serves as the transition zone between the prairie and forest areas, much like the neighboring province to the south, the Eastern Broadleaf Forest. The interaction of fire with lands that were dry enough to burn or too wet to burn created a complex mosaic of

prairie, wetlands, brushland, woodland, and forest. Extensive peatlands occur in this province where the regional water table is at the land surface.

The vast expanses of natural landscape of this province provide a spectacular setting for viewing sharp-tailed grouse, American elk, moose, greater prairie chickens, marbled godwits, bobolinks, and upland sandpipers. Large state and federal refuges provide homes for wetland wildlife like the sandhill crane, horned grebe, Franklin's gull, American white pelican, yellow rail, Forster's tern, trumpeter swan, and American bittern.

Today, well over 60 percent of this province is in agriculture, mostly in the southern half. In the northern half, large areas have recently been cleared for farming. However, some remnants of large contiguous patches of native plant communities, including wetlands, remain.

Province Subsections

Aspen Parklands

Summaries of Species in Greatest Conservation Need

A list of the species in the province, including identification of those unique to the province, is found in Appendix F. Table 5.20 presents the number of species in greatest conservation need in the province's one subsection and the number unique to that subsection.

Table 5.20. SGCN in the Tallgrass Aspen Parklands Province by Subsection

Subsection	Number of SGCN	Number of SGCN unique to subsection
Aspen Parklands	85	2

SGCN Problem Assessment

The SGCN problem assessment provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the province. The following table lists the percentage of SGCN in the province influenced by nine possible factors or problems. The results of the species problem assessment indicate that habitat loss and degradation in the province are the predominant challenges facing SGCN populations.

Table 5.21. SGCN Problem Analysis for the Tallgrass Aspen Parklands Province

Problem	Percentage of SGCN for which this is a known problem
Habitat Loss in MN	90
Habitat Degradation in MN	95
Habitat Loss/Degradation Outside of MN	43
Invasive Species and Competition	24
Pollution	32
Social Tolerance/Persecution/Exploitation	25
Disease	6
Food Source Limitations	5
Other	12

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Summaries of Key Habitats

Table 5.22 ranks the habitats by the frequency with which they are identified in the subsections as key habitats. Table 5.23 ranks the subsections by their number of key habitats.

Table 5.22. Frequency of Key Habitats in the Tallgrass Aspen Parklands Province by Subsection

Key Habitat Ranked by Frequency	Number of Subsections	Percentage of Subsections
Grassland	1	100
Prairie	1	100
Shrub/Woodland-Upland	1	100
Wetland-Nonforest	1	100
Lake-Shallow	1	100
River-Headwater to Large	1	100

Table 5.23. Number of Key Habitats in the Tallgrass Aspen Parklands Province by Subsection

Province	Subsection	Number of Key Habitats
Tallgrass Aspen Parklands	Aspen Parklands	6

Assessment of SGCN and Key Habitats

Table 5.24 provides the number of species that use at least one key habitat at the subsection, province, and statewide scales.

Table 5.24. SGCN That Use Key Habitats in the Tallgrass Aspen Parklands by Subsection

Subsection	Total Number of SGCN	Number of SGCN Using at Least 1 Key Habitat	Percentage of SGCN Using at Least 1 Key Habitat
Aspen Parklands	85	74	87.1
Province total	85	74	87.1
State total	292	269	92.1

R. Dana MN DNR

Tallgrass Aspen Parklands – Kittson County

Aspen Parklands

SUBSECTION OVERVIEW

The Aspen Parklands Subsection, located in northwestern Minnesota, is a mix of lacustrine plain and shoreline (beach) ridges formed by Glacial Lake Agassiz, with extensive forested peatlands to the east and tallgrass prairie to the west. The subsection is the southern end of a much larger province that stretches north and west into Canada and serves as the transition zone between the prairie and forest areas. The large Roseau and Red rivers are in this subsection, and flooding is common due to the level topography. Deep lakes are rare. This subsection contains large complexes of wetlands, aspen and brush prairie with dry prairie on beach ridges.

Well over 60 percent of this subsection is in agriculture, mostly in the southern half. In the northern half, extensive areas have recently been cleared for farming. Still, some remnants of large contiguous patches of native plant communities, including wetlands, remain. Wild rice cultivation is common in the eastern edge of this area. Motorized recreation is on the rise.

Quick facts

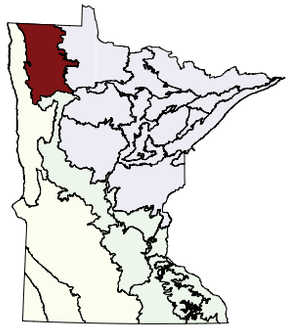
Acres: 2,906,127 (5.4% of state)

Ownership

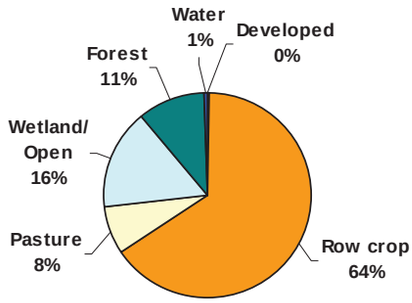
Public	Private	Tribal
15.6%	84.1%	0.3%

Population density (people/sq. mi.)

Current	Change (2000-2010)
8.7	0.0



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

85 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Aspen Parklands. These SGCN include 30 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 7 mammal SGCN are known or predicted to occur in the Aspen Parklands, approximately 32% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common Mudpuppy
Birds	63	64.9	Upland sandpiper
Fish	1	2.1	Lake Sturgeon
Insects	7	12.5	Garita skipper
Mammals	7	31.8	Least weasel
Mollusks	3	7.7	Black sandshell
Reptiles	2	11.8	Common snapping turtle
Spiders	1	12.5	Marpissa grata

HIGHLIGHTS

- Gray wolves, sharp-tailed grouse, sandhill cranes, eared grebes, northern harriers, marbled godwits, American bitterns, Franklin's gulls, Assiniboia skipper, great gray owls and moose make this subsection unique. It is also a major migratory stopover and breeding area for waterfowl.
- Areas important for SGCN include Agassiz NWR; Thief Lake, Roseau River, Twin Lakes, and Elm Lake WMAs; Lake Bronson and Old Mill SPs; and Gully Fen, Two Rivers Aspen Prairie Parkland, and Lake Bronson Parkland SNAs.

SPECIES SPOTLIGHT

American bittern *(Botaurus lentiginosus)*

Distribution Primarily found in marshlands of central, western, and northwestern Minnesota.

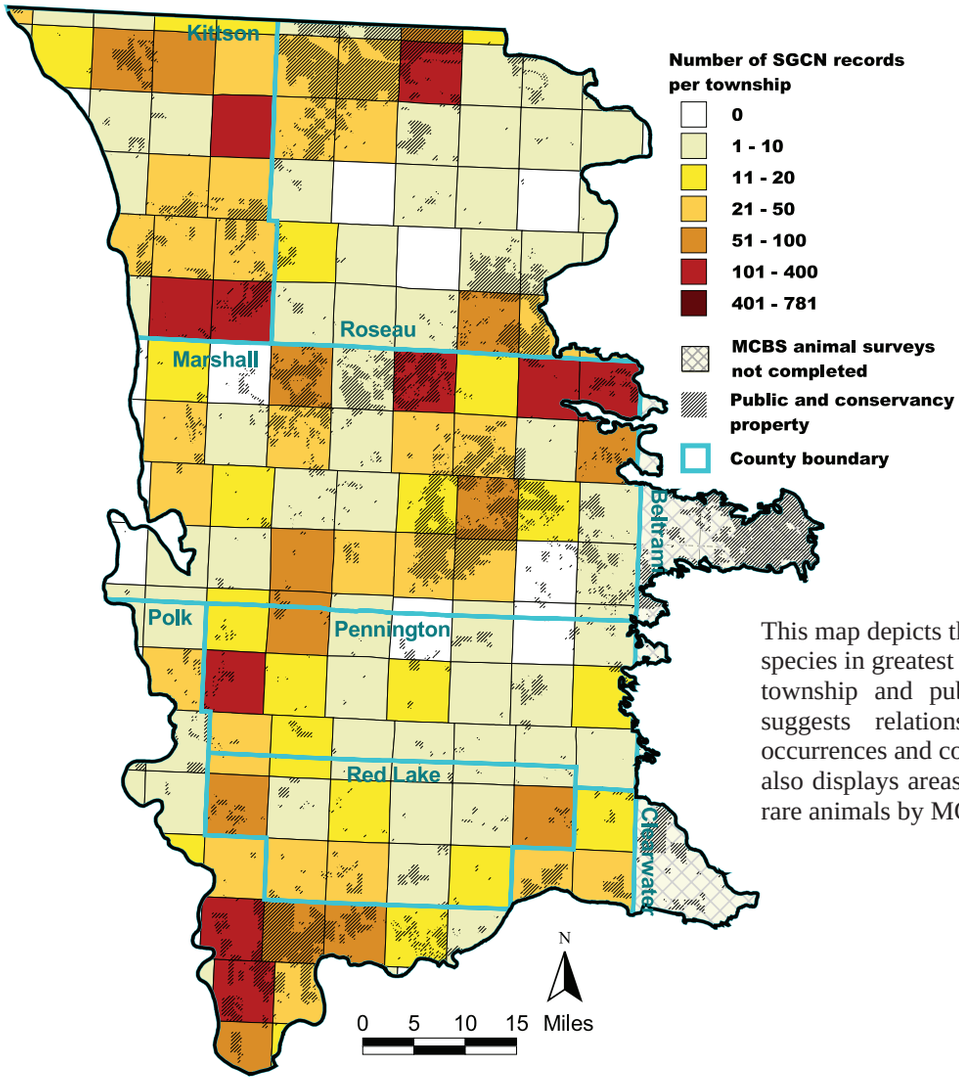
Abundance Uncommon. This bird has declined significantly because of wetland drainage. The best remaining population appears to be in the vicinity of the Agassiz National Wildlife Refuge in northwestern Minnesota.

Legal Status Federally protected migratory bird.

Comments This species has a broad range across North America, but many sites formerly occupied are vacant, suggesting that there could be other detrimental factors at work in addition to habitat loss. Telemetry research on habitat use and migratory patterns has been carried out in recent years at the Agassiz NWR.

Photo by Carrol Henderson

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	89
Habitat Degradation in MN	94
Habitat Loss/Degradation Outside of MN	42
Invasive Species and Competition	24
Pollution	32
Social Tolerance/Persecution/Exploitation	25
Disease	6
Food Source Limitations	5
Other	12

Aspen Parklands

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	**A**	**B**	**C**	**D**	**E**
Shrub/Woodland-Upland (Brush prairie)			X		
Prairie	X	X	X		
Wetland-Nonforest (Wet prairie)	X	X	X		
Grassland	X				
Lake-Shallow				X	
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

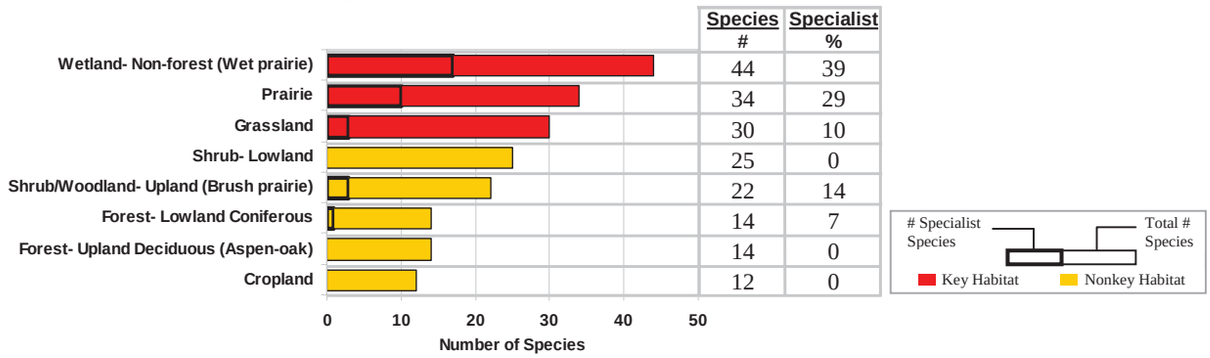
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

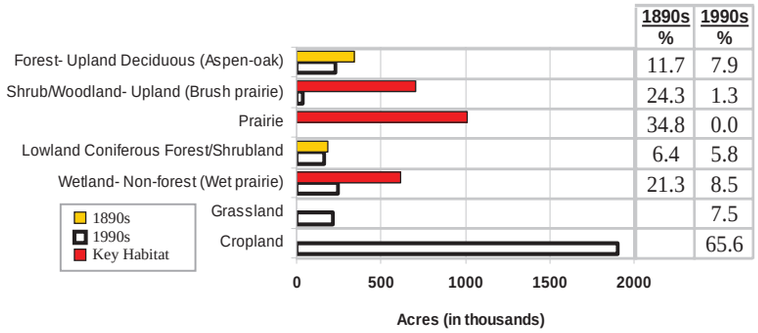
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

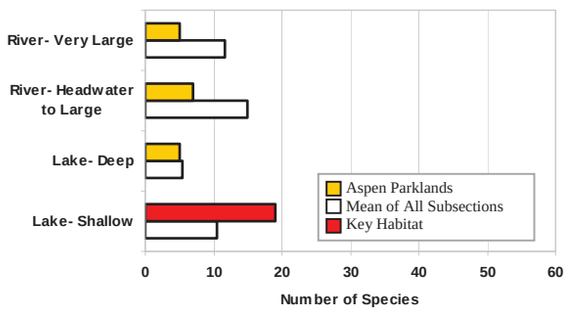
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



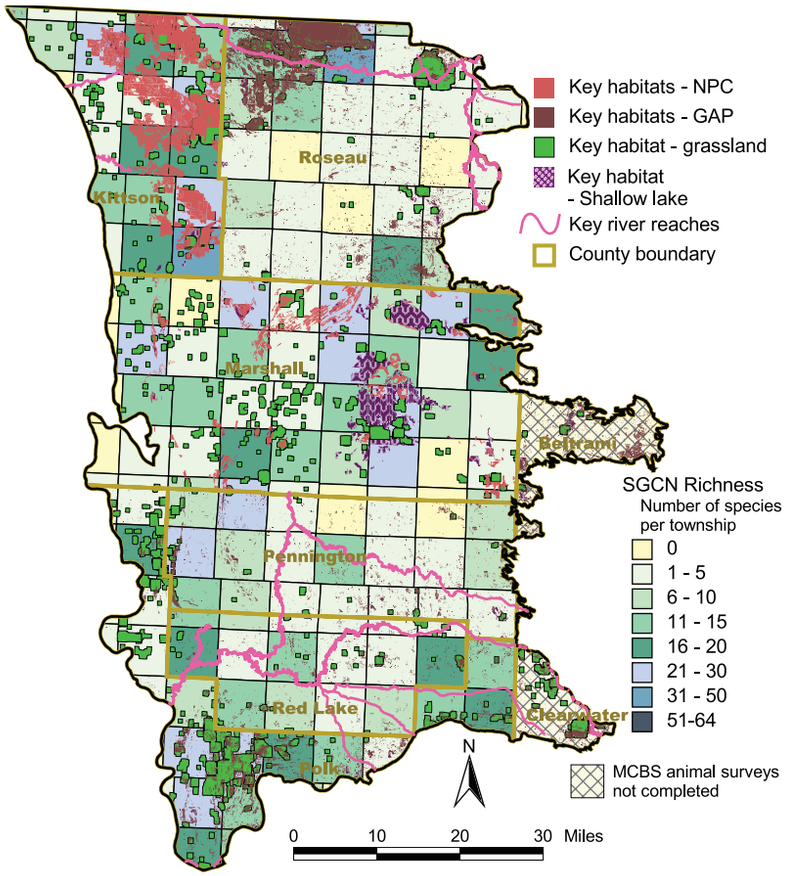
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Grassland Bird Conservation Areas (GBCA), 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MCBS Railroad Rights-of-Way Prairies, 1997.
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
MN GAP Landcover, 1993
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	65.6		8			4				12
Wetland-Nonforest (Wet prairie)	21.3	8.5		38			4		1	1	44
Forest-Upland Deciduous (Aspen-oak)	11.7	7.9		11			3				14
Grassland	N/A	7.5		21			7		1	1	30
Forest-Lowland Coniferous	6.4	5.8		13			1				14
Forest-Upland Deciduous (Hardwood)	0.0	2.5		11			4				15
Shrub/Woodland-Upland (Brush prairie)	24.3	1.3		14		2	5		1		22
Lake-Shallow	N/A	0.5		15					1		16
Developed	N/A	0.3		4			3				7
Forest-Lowland Deciduous	1.1	0.1		13			1				14
Forest-Upland Coniferous	0.0	0.0		13			4		1		18
Prairie	34.8	0.0		19		7	6		1	1	34
Shoreline-dunes-cliff/talus	N/A	N/A		10			2				12
Shrub-Lowland	N/A	N/A		20			5				25
River-Headwater to Large	N/A	N/A	1	2				3	1		7
River-Very Large	N/A	N/A	1		1			2	1		5

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Brush prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain brush prairie
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats (e.g., grasslands) adjacent to wetlands to enhance SGCN values
   c. Manage invasive species
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys

Priority Conservation Actions for Surveys (continued)

2. Survey SGCN habitats within the subsection, actions include:
    a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
    a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
    a. Identify best management practices for maintaining and enhancing key habitats
    b. Identify important patterns and distributions of key habitats to better support SGCN populations
    c. Identify important functional components within key habitats to support specific SGCN
    d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
    a. Identify people's attitudes and values regarding SGCN
    b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
    a. Continue existing population monitoring activities
    b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
    a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
    a. Develop partner-specific performance measures within the subsection
    b. Develop project-specific performance measures for SWG-funded projects
    c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Chapter 6

Habitat Descriptions

This chapter describes the 16 key habitats identified in the subsection profiles in chapter 5, focusing on the important components of these key habitats, both in terms of habitat quality and features important to the species in greatest conservation need (SGCN). The key habitats, organized alphabetically within three major groups, are as follows:

Forests

Forest-Lowland Deciduous
Forest-Lowland Coniferous

Forest-Upland Coniferous
Forest-Upland Deciduous (Aspen)
Forest-Upland Deciduous (Hardwood)
Forest-Upland Deciduous (Oak)

} All are included in an overview section on Upland Forests.

Open landscape

Prairie
Shoreline-dunes-cliff/talus
Shrub - Lowland
Shrub/Woodland-Upland
Surrogate Grassland
Wetland - Nonforested

Aquatic

Lake-Deep
Lake-Shallow

River-Headwater to Large
River-Very Large

} All are included in an overview section on Rivers.

The key habitat descriptions begin with a table showing a "crosswalk" to the Minnesota Native Plant Community (NPC) classification, Version 2.0 (MN DNR 2003), including a listing of the ecological systems and the native plant communities that are equivalent to the CWCS habitats. No crosswalk information is provided for aquatic habitats and the anthropogenic grassland habitat as they are not currently part of the NPC classification.

A map of the distribution of the habitat follows, showing the habitat type as a percentage of ECS subsections, both currently and, when available, historically. This information was mainly derived from the Presettlement Vegetation Map of Minnesota

developed by Marschner (1930) and the Minnesota GAP Landcover Map developed by the Minnesota GAP Analysis Project (1993). Different sources of information were used for aquatic habitats, wetlands, and oak forests and are cited under individual maps.

Next is a general description of the key habitat, which gives an account of key plant species, habitat structure, natural processes, and some of the human activities currently changing the habitat.

Following the general overview is a section that describes features within the habitat that are important for some SGCN. This is not an exhaustive description of all the SGCN that use the habitat, but rather illustrates some elements important to consider for managing each key habitat. Much of the information in this section is opportunity based; we do not currently have adequate information on the important habitat elements for many of the SGCN. This lack of information will be important to address during CWCS implementation.

The habitat descriptions conclude with specific management options that, if implemented, would benefit SGCN and would improve the function and quality of the habitat. Again, these management actions illustrate possible opportunities and are not exhaustive.

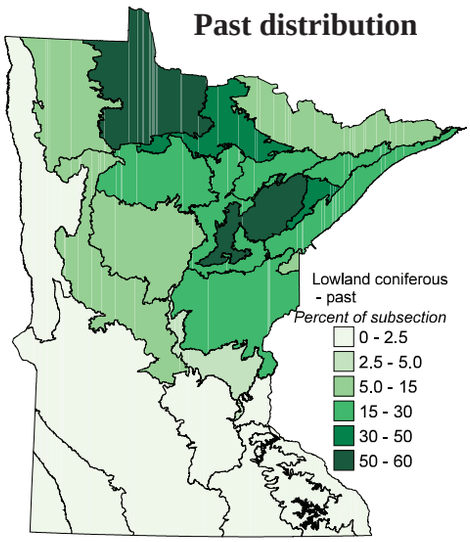
Readers will note that the upland forest habitat types and the rivers each have a preface with a general description that address all of the habitats found in these groups. This approach was taken because many of the features important for SGCN are common among all forest types and rivers. Following these general descriptions are the habitat descriptions for each of the four types of upland forests, and 2 main types of rivers.

Forest-Lowland Coniferous

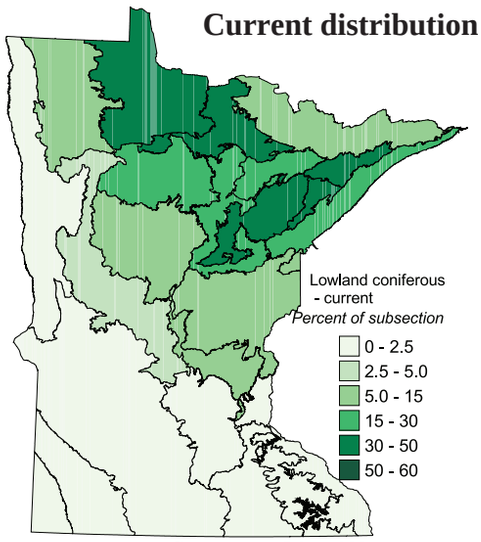
Ecological Systems	Native Plant Community Types (NPCs)	NPC Codes
Forested Rich Peatland (FP)	Rich Black Spruce Swamp (Basin)	FPn62a
	White Cedar Swamp (Northeastern)	FPn63a
	White Cedar Swamp (Northcentral)	FPn63b
	White Cedar Swamp (Northwestern)	FPn63c
	Rich Black Spruce Swamp (Water Track)	FPn71a
	Rich Tamarack Swamp (Eastcentral)	FPn72a
	Rich Tamarack (Sundew-Pitcher Plant) Swamp	FPn81a
	Rich Tamarack (Alder) Swamp	FPn82a
	Extremely Rich Tamarack Swamp	FPn82b
	Tamarack Swamp (Southern)	FPs63a
	Tamarack-Black Spruce Swamp (Aspen Parkland)	FPw63a
	Tamarack Seepage Swamp (Aspen Parkland)	FPw63b
Acid Peatland (AP)	Black Spruce Bog	APn80a
	Poor Black Spruce Swamp	APn81a
	Poor Tamarack-Black Spruce Swamp	APn81b
Wet Forest (WF)	Lowland White Cedar Forest (North Shore)	WFn53a
	Lowland White Cedar Forest (Northern)	WFn53b

E.R Rowe MN DNR

Rich Tamarack Swamp (FPn82)



Source: Marschner 1930



Source: MN GAP 1993

General Description

Lowland conifer forest habitats are found in shallow basins, along lakes and streams, and as part of large peatland complexes. Although large peatlands are concentrated in the Agassiz Lowlands and Tamarack Lowlands subsections, the habitat is found throughout the Laurentian Mixed Forest Province. The soils are peat or mucky mineral soil that is usually saturated with water deficient in oxygen and low in nutrients. This habitat includes conifer swamp forests and wet cedar forests, some of which may be relatively nutrient rich, and forested bogs, which grow on more acid, nutrient-poor substrates.

Lowland conifer forests are dominated by black spruce, tamarack, or white cedar. Tree height and density vary from nearly closed canopies of white cedar or black spruce of moderate height on richer sites to scattered, stunted black spruce in the most nutrient-poor black spruce bogs. The understory of this habitat is characterized by a mossy ground layer with an abundance of forbs, sedges, and broad-leaved evergreen shrubs. Brown mosses predominate in the richer environments, whereas the more acid-loving species of *Sphagnum* dominate the bogs. Typical shrubs include Labrador tea (*Ledum groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), and bog rosemary (*Andromeda glaucophylla*). Richer examples of this habitat (that is, nonbogs) also support species characteristic of surrounding upland forests, but these species are limited to tree bases and moss hummocks elevated above the water table.

Plant adaptations to the harsh growing conditions in lowland conifer forests include evergreen leaves (conifers and ericaceous shrubs), reliance on ectomycorrhizal fungi to facilitate nutrient uptake, capture of insects to provide additional nutrients (pitcher plants [*Sarracenia purpurea*] and sundews [*Drosera* spp.]), and secondary compounds in leaves to reduce herbivory.

The important natural disturbance prior to settlement by people of European descent in lowland conifer forests was small-scale blowdown, which occurred every 40 to 80 years on many sites. Catastrophic blowdown was much rarer, occurring every 365 to 1,000 years. Likewise, catastrophic wildfire was rare in lowland conifer forests, generally occurring every 360 to 1,000 years, except for sites in small basins surrounded by more fire-prone upland conifer forests, where return intervals were as low as 220 years.

In spite of numerous attempts at drainage in the early 20th century, lowland conifer forests still cover vast areas, primarily in large peatlands in the northern part of the Laurentian Mixed Forest Province. Drainage efforts continue today, albeit at a smaller scale. Peat mining and mineral development occur in some existing lowland conifer forests. Roads and access routes for timber and decorative tree harvests may alter the hydrology of these wetlands, potentially altering the vegetation. These forests are particularly sensitive to off-road vehicle use, and even a single incident of vehicle use can change the hydrology and hamper the recovery of the slow-growing species for many years afterward.

Examples of Features Important for Species in Greatest Conservation Need

Connecticut warblers nest in tamarack and spruce bogs with varying amounts of shrubby understory. **Boreal chickadees** prefer young and mature wet spruce forests, where they require cavities for nesting. **Rusty blackbirds** use lowland conifer forests as breeding habitat, often nesting at the edge of beaver ponds. **Olive-sided flycatchers** breed in lowland conifers, generally requiring a fairly open canopy with tall prominent trees and snags. Two butterflies, the **disa alpine** and the **bog copper,** require lowland conifers with cranberries (*Vaccinium macrocarpon* or *V. oxycoccos*) and lowland black spruce forests, respectively. **Northern bog lemmings** are limited to lowland conifer forests and open peatlands in extreme northern Minnesota; they have been shown to disappear from peatlands altered by human activities.

Management Options to Support Species in Greatest Conservation Need

Explore opportunities to implement forest management practices that:

- Use natural disturbance return intervals to guide rotation periods.
- Mimic landscape disturbance patterns with timber harvest (for example, small patches).
- Regulate and monitor harvest of nontimber forest products such as spruce tops to avoid rutting and damage to sensitive peat substrates.
- Manage stands to retain biological legacies (at site level) such as large snags and stumps.

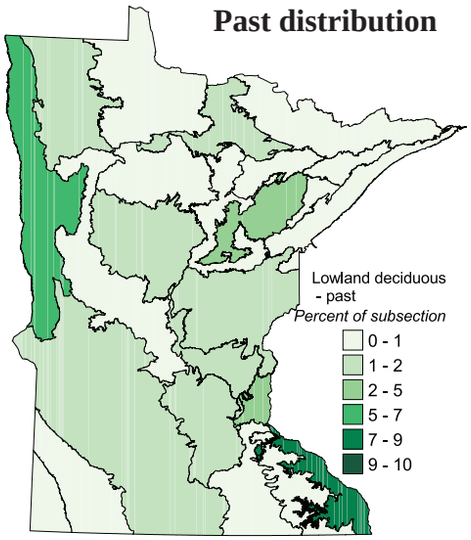
Forest-Lowland Deciduous

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Wet Forest (WF)	Black Ash-Aspen-Balsam Poplar Swamp (Northeastern)	WFn55a
	Black Ash-Yellow Birch-Red Maple-Basswood Swamp (Eastcentral)	WFn55b
	Black Ash-Mountain Maple (Northern)	WFn55c
	Black Ash-Conifer Swamp (Northeastern)	WFn64a
	Black Ash-Yellow Birch-Red Maple-Alder Swamp (Eastcentral)	WFn64b
	Black Ash-Alder Swamp (Northern)	WFn64c
	Black Ash (Red Maple) Seepage Swamp	WFs57a
	Black Ash-Sugar Maple-Basswood (Blue Beech) Seepage Swamp	WFs57b
	Lowland Black Ash-Aspen-Balsam Poplar Forest	WFw54a
Floodplain Forest (FF)	Black Ash-Silver Maple Terrace Forest	FFn57a
	Silver Maple (Sensitive Fern) Floodplain Forest	FFn67a
	Silver Maple-Green Ash-Cottonwood Terrace Forest	FFs59a
	Swamp White Oak Terrace Forest	FFs59b
	Elm-Ash-Basswood Terrace Forest	FFs59c
	Silver Maple (Virginia Creeper) Floodplain Forest	FFs68a

D.S. Wovcha MN DNR

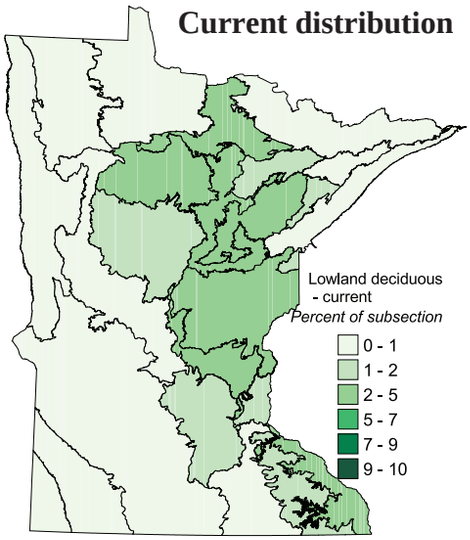
Silver Maple-Green Ash-Cottonwood Terrace Forest (FFs59a)

Past distribution



Source: Marschner 1930

Current distribution



Source: MN GAP 1993

General Description

Lowland deciduous forest habitats occur primarily on floodplains and associated terraces along major rivers and their tributaries, and in shallow, poorly drained basins. Floodplain and terrace forests are seasonally wet forests that flood following spring snowmelt as well as unusually heavy rains. These forests are found on sandy or silty alluvium (soil deposited by flowing water) associated with streams and rivers throughout the Eastern Broadleaf Forest Province and are extensive along the Mississippi, Minnesota, and St. Croix rivers. In the Laurentian Mixed Forest Province, these forests also occur along major rivers but are not as extensive as in the Eastern Broadleaf Forest Province. These forests also rarely occur in the Tallgrass Aspen Parklands and Prairie Parkland provinces.

The canopy of these forests is dominated by deciduous trees that are tolerant of saturated soils, prolonged inundation, frequent erosion, and sediment deposition. Species less tolerant of these conditions occur on terraces, which flood only in very wet years. In southern Minnesota, silver maple (which often occurs as nearly pure stands), black willow, and cottonwood are common canopy dominants. Less common species include river birch, elms, green ash, and swamp white oak. In the north, black ash and silver maple are important canopy trees with lesser amounts of green ash, American elm, bur oak, and basswood. Canopy coverage in these forests is highly variable; areas of continuous canopy are punctuated with large gaps, which may be vegetated with ephemeral herbaceous plants or may remain largely unvegetated if flood disturbance is repeated and severe. The understory is typically open, with few shrubs or saplings. Pools or mucky depressions in old river channels are often present on actively flooded sites.

Hardwood swamp forests are another form of the lowland deciduous forest. Hardwood swamps are found in shallow depressions or in narrow zones along the margins of lakes, rivers, and peatlands. In southeastern Minnesota, this habitat occurs as small patches in areas of groundwater seepage, usually at the base of steep slopes on level river terraces. In such settings, the water table is almost always within reach of plant roots but does not remain above the mineral soil surface for long periods during the growing season. Soils are peaty or mucky mineral soils. Black ash is the dominant canopy tree in swamp forests statewide; yellow birch, red maple, aspens, and balsam poplar are common associates in the Laurentian Mixed Forest Province; and basswood, elms, paper birch, and yellow birch in the Eastern Broadleaf Forest Province. Conifer species, especially white cedar and balsam fir, are sometimes present in the canopy and understory.

Understories are characterized by patches of shrubs, including speckled alder (*Alnus incana*), mountain maple (*Acer spicatum*), dogwoods (*Cornus* spp.), gooseberries or currants (*Ribes* spp), and winterberry (*Ilex verticillata*). Mosses and upland forest herbs occur on raised hummocks, down logs, and tip-up mounds, and sedges and wetland forbs occur in wet or mucky hollows. These swamp forests have the highest plant species diversity of all the forested habitats in Minnesota.

Since settlement by people of European descent, large areas of floodplain forests in southern Minnesota have been lost due to urbanization and conversion to agriculture. Now, these forests, which once formed continuous bands of habitat along the major rivers in southeastern Minnesota, persist as a broken chain of forest patches. In addition, the damming of major rivers has greatly reduced the annual pulse of flooding that maintained the ecological integrity of the floodplain forests. Other factors that have reduced the value of the habitat for wildlife include the loss of most canopy American elms from Dutch elm disease and the invasive spread of reed canary grass (*Phalaris arundinacea*), which impedes establishment of seedlings of native plants. Most hardwood swamps are still intact, but threats include dieback of black ash, flooding due to an increased beaver population, and the potential of the emerald ash borer to invade Minnesota.

Examples of Features Important for Species in Greatest Conservation Need

Key habitat features for **prothonotary warblers** are lowland hardwood forests greater than 250 acres (100 hectares) in size, waterways with at least a 100 foot (30 meters) strip of lowland hardwood forest, and the presence of suitable nest cavities within 15 feet (five meters) of low-lying or seasonally flooded areas.

Cerulean warblers require large tracts of mature deciduous forest. **Red-shouldered hawks** are most commonly found in large tracts of mature lowland deciduous forest, with scattered wetland openings and diverse topography such as numerous small hills, ridges, and depressions. They prefer nesting sites in large-diameter trees in high, thick canopies.

Crayfish burrows in floodplain forests may be key habitat requirements for **eastern massasaugas.** This species also uses mammal burrows, sawdust piles, and canals from old plant roots.

Management Options to Support Species in Greatest Conservation Need

Explore opportunities to implement forest management practices that:

- Use natural disturbance return intervals to guide rotation periods; employ management techniques to promote uneven aged stands with mature trees.
- Mimic landscape disturbance patterns with timber harvest (such as, more large patches).
- Manage stands to retain biological legacies (at site level) such as large trees with cavities.
- Develop management practices to minimize reed canary grass invasions.

Upland Forests

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Fire-dependent Forest (FD)	All FD Native Plant Communities	FD*xyn*
Mesic Hardwood Forest (MH)	All MH Native Plant Communities	MH*xyn*

Fred Harris, MN DNR

Forest Upland Deciduous (Aspen)

T.J. Whitfeld MN DNR

Forest Upland Deciduous (Hardwood)

D.S. Wovcha MN DNR

Forest Upland Deciduous (Oak)

T.J. Whitfeld MN DNR

Forest Upland Coniferous

Distribution

See distribution maps for individual upland forest habitats:

Forest Upland Deciduous (Aspen)
Forest Upland Deciduous (Hardwood)
Forest Upland Deciduous (Oak)
Forest Upland Coniferous

General Description

Upland forests are found on mesic to dry sites throughout the Laurentian Mixed Forest and Eastern Broadleaf Forest provinces, and much less commonly in the Prairie Parkland and Tallgrass Aspen Parklands provinces. The most characteristic feature of upland forests is a tree canopy, with a combined coverage of species ranging from 50 to 100 percent. The most common upland forest trees are aspens, oaks, maples, birches, basswood, pines, spruce, and balsam fir. Because the forest canopy blocks most of the sunlight before it reaches the understory, most understory plants have evolved some degree of shade tolerance. The amount of light reaching the understory also has a strong effect on the structural complexity of the forest. Forests dominated by sugar maple and basswood typically have a poorly developed shrub layer. As these forests age, they become structurally more complex as canopy trees die, producing gaps in the canopy that allow growth of less shade-tolerant shrubs and trees. Standing large dead trees become more frequent, eventually becoming large down logs, which add to the structural diversity of older forests. Forests dominated by tree species other than maple and basswood tend to have a more open canopy and a denser layer of shrubs such as hazelnuts (*Corylus* spp.), dogwoods (*Cornus* spp.), and mountain maple (*Acer spicatum*).

Historically, the distribution and size of patches of contiguous upland forest were determined by soils, landforms, and natural disturbances (such as windstorms but especially fire). Fire, which was particularly important in drier upland forests, has been essentially replaced with timber harvest, resulting in a different distribution of forest patch sizes, ages, and composition. Moreover, conversion of upland forests to other uses (such as, agriculture, urban development, transportation corridors) has fragmented forests across the state, so that few large patches of upland forest remain in southeastern and central Minnesota. The remaining forests in these regions typically lack the ecological complexity of pre-European settlement forests because of a number of factors (such as, grazing, invasive plants and animals, edge effects, changes in native animal populations, and consumptive uses), whose relative importance varies in different regions of the state. Even in the largely forested areas of northern Minnesota, rural sprawl has greatly reduced the extent of large, contiguous forest areas; most forest areas are within 25 kilometers (15.5 miles) of small housing settlements.

The features of a predisturbance ecosystem that persist after disturbance have been termed "biological legacies" (Perry and Amaranthus, 1997). Biological legacies include green trees, surviving propagules and organisms (such as, buried seeds, seeds stored in serotinous cones, surviving roots, basal buds, mycorrhizal fungi and other soil microbes, invertebrates, and mammals), dead wood, and certain aspects of soil chemistry and structure (such as, organic matter, large soil aggregates, pH, and nutrient balances) Maintenance or re-creation of biological legacies that are important to SGCN can be an effective management strategy, even in the absence of natural disturbance regimes.

Examples of Features Important for Species in Greatest Conservation Need

SGCN are adapted to the wide range of habitat conditions and landscape patterns of upland forests created by natural disturbance regimes. Habitat features important to many SGCN include large areas of relatively undisturbed, contiguous forest (**least flycatcher, black-throated blue warbler, ovenbird**), a dense understory (**Canada warbler,** black-throated blue warbler**, veery**), a closed canopy (least flycatcher, ovenbird, **northern goshawk, four-toed salamander**), down trees (**Canada lynx,** four-toed salamander, **and red-backed salamander**), large trees near water (**bald eagle**), and early successional or disturbed forest with a dense understory (Canada warbler). Northern goshawks prefer forests with a relatively open flight path between the canopy and subcanopy. For some species with home ranges that extend over several native plant communities, such as **timber wolves** and northern goshawks, the landscape mosaic is also important. Four-toed salamanders occur most frequently in mature upland forests on glacial moraine landscapes with frequent isolated wetlands that include an alder margin and moss hummocks adjacent to pockets of open water. Red-backed salamanders require decaying coarse woody debris on the forest floor for laying eggs.

Management Options to Support Species in Greatest Conservation Need

Explore opportunities to implement forest management practices that:

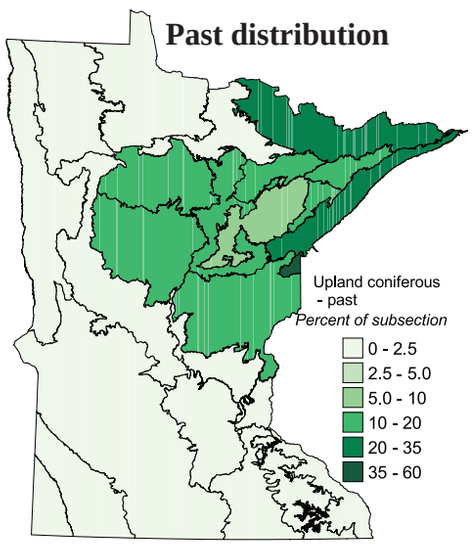
- Use natural disturbance return intervals to help guide rotation periods.
- Manage to maintain and create large patches of upland forest.
- Manage stands to retain biological legacies (at site level).
- Manage invasive plants and animals.
- Work with Minnesota DNR Division of Fish and Wildlife to determine ecologically and socially desirable deer population levels across the state.

Forest-Upland Coniferous

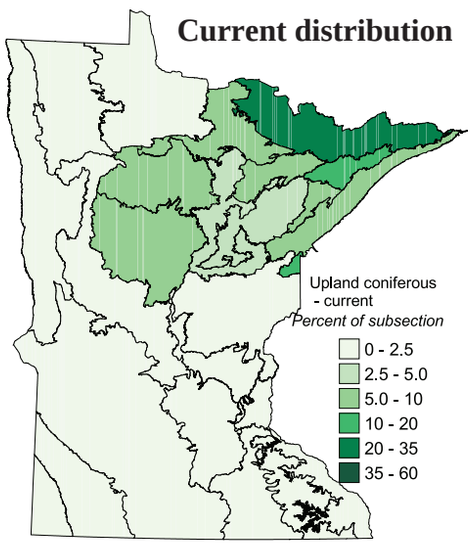
Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Fire-dependent Forest (FD)	Jack Pine Woodland (Sand)	FDn12a
	Red Pine Woodland (Sand)	FDn12b
	Jack Pine Woodland (Bedrock)	FDn22a
	Red Pine-White Pine Woodland (Northeastern Bedrock)	FDn22b
	Red Pine-White Pine Woodland (Eastcentral Bedrock)	FDn22c
	Red Pine-White Pine Woodland (Canadian Shield)	FDn32a
	Black Spruce-Jack Pine Woodland	FDn32c
	Jack Pine-Black Spruce Woodland (Sand)	FDn32d
	Spruce-Fir Woodland (North Shore)	FDn32e
	Red Pine-White Pine Woodland	FDn33a
	Black Spruce Woodland	FDn33c
	White Pine-Red Pine Forest	FDn43a
	Upland White Cedar Forest	FDn43c
	Jack Pine (Bearberry) Woodland	FDc12a
	Jack Pine (Yarrow) Woodland	FDc23a
	Jack Pine (Bush Honeysuckle) Woodland	FDc24a
	Jack Pine-Oak Woodland	FDc25a
	Red Pine-White Pine Forest	FDc34a
	Jack Pine-Oak Woodland (Sand)	FDs27a
	White Pine-Oak Woodland (Sand)	FDs27b
Mesic Hardwood Forest (MH)	White Pine-White Spruce-Paper Birch Forest	MHn44b
	White Cedar-Yellow Birch Forest	MHn45b

T.J. Whitfeld MN DNR

Red Pine-White Pine Forest (FDc34a)



Source: Marschner 1930



Source: MN GAP 1993

General Description

Upland coniferous forest habitats occur primarily on sites with coarse sandy or gravelly soils or with thin soils over bedrock in the Laurentian Mixed Forest Province; this habitat also occurs as small patches in the Blufflands Subsection. The dominant tree species are pines, spruce, balsam fir, or white cedar. These conifers often occur with hardwoods such as quaking aspen, paper birch, oaks, and red maple. The predominant ecological factor shaping this habitat is wildfire. Fires in this habitat vary greatly in intensity from severe crown fires, which kill most of the canopy trees, to moderate surface fires, which kill few canopy trees. The frequency of wildfires in this habitat historically varied from an average of every 20 years to every 100 years. (In upland coniferous forests in the Mesic Hardwood System, return intervals were longer.)

Historically, fire was the major source of plant species mortality, and it exerted a strong influence on the pattern of plant reproduction by exposing mineral soil seedbeds, triggering seed dispersal, and increasing the amount of light reaching the forest floor. Fires played a significant role in nutrient cycling and nutrient availability. Many plant species in upland coniferous forests have evergreen leaves as a response to low nutrient availability and droughty conditions.

Throughout the Laurentian Mixed Forest Province, the extent of upland conifer forest has been reduced by two-thirds since settlement by people of European descent, as upland conifer forests have been replaced by aspen-dominated forests. Fire has been replaced by clear-cut logging as the major stand-replacing disturbance. Most of the remaining upland conifer forests (pine) have been thinned or originated following clear-cutting and typically lack the structural diversity of stands originating following fire. Forest management has resulted in a decrease in the amount of old forests, a decline that will continue for decades. Management to reduce spruce budworm outbreaks (harvesting balsam fir at young ages) may reduce populations of the warblers that eat spruce budworms. Even in the Boundary Waters Canoe Area Wilderness, the huge blowdown of 1999 is resulting in the conversion of pine forests to forests dominated by other tree species.

Examples of Features Important for Species in Greatest Conservation Need

Historically, wildfire played an important role at both the site and landscape level in these forests, but due to land use changes and fire suppression, wildfire is not common today. Following a crown fire, a variety of biological legacies remain in the young regenerating forest. These biological legacies, which include standing dead trees, large trees that escaped the fire, down logs, and small patches of unburned vegetation, provide important habitat features for SGCN. At the landscape level, wildfires create a shifting mosaic of native plant communities with a variety of ages and structural characteristics that provide habitats for SGCN.

Black-backed woodpeckers are largely confined to recently burned coniferous forests, where they feed on wood-boring beetles. Prior to fire suppression, new patches of burned forest occurred near older burn areas within a decade or less, providing a fairly constant supply of optimal habitat for black-backed woodpeckers. Wildfires also created a mosaic of new patches of dense young forests of jack pine and spruce, ideal habitat for **spruce grouse,** which feed primarily on needles of these species. The fire regimes in upland coniferous forests allowed the development of extensive old-growth forests with habitat features such as large snags, down trees with root wads, stumps, very large trees, and small openings in the canopy, which provide optimal habitat for **winter wrens.** Older stands of white spruce and balsam fir provide optimal habitat for **bay-breasted warblers** and **Cape May warblers,** which feed on spruce budworms and increase during periodic outbreaks of budworm in older spruce and fir. Ericaceous shrubs, which require fire to thrive, are important for the **heather vole,** which feeds on their foliage, berries, and seeds. The **smokey shrew,** which has been documented in a variety of upland and lowland habitats in Lake and Cook counties, prefers a cool, damp forest floor with a thick litter layer, mossy covered rocks, and decaying debris (Owen 1984).

Management Options to Support Species in Greatest Conservation Need

Explore opportunities to implement forest management practices that:

- Use fire ("let burn" and prescribed fire), including in the 1999 blowdown in the BWCAW.
- Use natural disturbance return intervals to guide rotation periods.
- Mimic landscape disturbance patterns with timber harvest (e.g., more large patches).
- Manage stands to retain biological legacies (at site level).
- Increase the proportion of forest dominated by conifers.

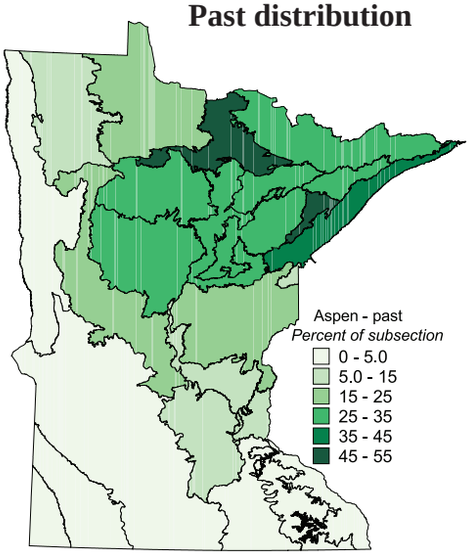
Forest-Upland Deciduous (Aspen)

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Fire-dependent Forest (FD)	Aspen-Birch Woodland	FDn33b
	Aspen-Birch Forest	FDn43b
	Aspen (Prairie Herb) Woodland	FDw34a
	Aspen (Beaked Hazel) Woodland	FDw34b
	Aspen (Cord grass) Woodland	FDw44a
	Aspen (Chokecherry) Woodland	FDw44b
Mesic Hardwood Forest (MH)	Aspen-Birch-Basswood Forest	MHn35a
	Aspen-Fir Forest	MHn44c
	Oak-Aspen-Red Maple Forest	MHc26a
	Aspen (Sugar Maple-Basswood) Forest	MHc37a

F. Harris MN DNR

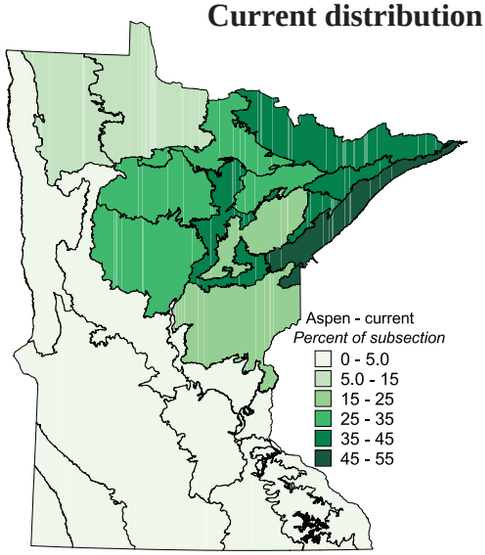
Aspen-Birch Forest (FDn43b)

Past distribution



Source: Marschner 1930

Current distribution



Source: MN GAP 1993

General Description

Upland hardwood forest (aspen) is characterized by a canopy dominated by quaking aspen (*Populus tremuloides*), big-toothed aspen (*P. grandidentata*), paper birch (*Betula papyrifera*), or a mixture of these species. These shade-intolerant tree species are the dominant trees in the early stages of a wide variety of native plant communities in fire-dependent and mesic hardwood forest systems. Thus, aspen forest is a cover type that may eventually develop into many other native plant communities.

Aspen forests typically have a nearly complete canopy of aspen or birch, but the canopy is not as dense as that of sugar maple. As a result of higher light levels penetrating the canopy, these forests usually have a well-developed shrub layer dominated by hazelnuts (*Corylus* spp.) or dogwoods (*Cornus* spp.). The coverage and diversity of the herbaceous plant layer are highly variable depending on site conditions and stand history.

As aspen forests age, they typically increase in structural diversity. Historically, most aspen stands in northern Minnesota had a conifer component, which increased as the stand aged. Today, most aspen stands have little or no conifer understory, due to past management and slash fires. Still, many older aspen stands are relatively structurally diverse, with large trees, snags, down logs, and an understory containing more shade-tolerant hardwoods or conifers that will become the canopy dominants if the forest does not experience a stand-replacing disturbance. Over the next two decades, most of these older aspen stands will be harvested or will succeed to upland conifer or upland hardwood forest habitats, resulting in a significant decline of old, structurally diverse aspen forest habitat.

Today, aspen forest habitat is the most abundant forest habitat in Minnesota and is several times more widespread than it was prior to settlement by people of European descent. An analysis of General Land Office bearing tree records from the late 1800s and Forest Inventory and Analysis plots from the 1990s shows that in the Laurentian Mixed Forest Province, aspen forest communities have increased nearly tenfold (Friedman and Reich 2005). At the same time, aspen forests are structurally less diverse than they were historically, and within two decades the average age of aspen forest habitat will be much younger than that of pre-European settlement aspen forests.

Examples of Features Important for Species in Greatest Conservation Need

Aspen forests support a variety of mammal, bird, and amphibian SGCN. Habitat features required by these species, with a few exceptions, are the same as those in other upland forest habitats. All of the SGCN listed under upland forests are found in this habitat and respond to the same habitat features as in upland forests.

Species that require particular elements of aspen forest habitat include **woodcocks,** which favor young aspen and paper birch stands with openings, especially on moist soils with alder (*Alnus* spp.) cover. **Boreal owls** require much older aspens; they also require cavities that they do not construct themselves and therefore may be limited by availability of nest sites in large old aspens, either in mixed conifer-hardwood forests or conifer forests adjacent to old aspen.
.

Management Options to Support Species in Greatest Conservation Need

Explore opportunities to implement forest management practices that:

- Use natural disturbance return intervals to guide rotation periods.
- Mimic landscape disturbance patterns with timber harvest (for example, more large patches).
- Manage stands to retain biological legacies (at site level).

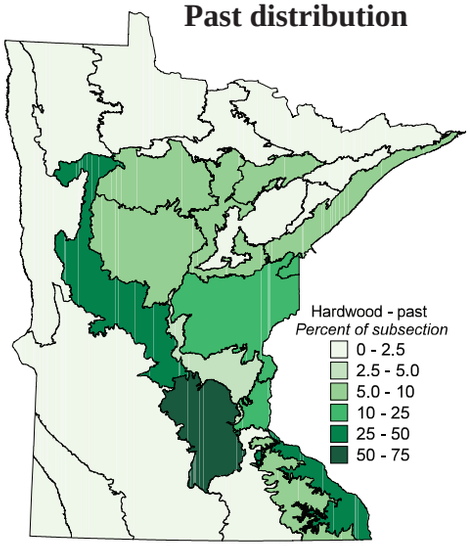
Forest-Upland Deciduous (Hardwood) (i.e., maple-basswood)

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Mesic Hardwood Forest (MH)	Paper Birch-Sugar Maple Forest (North Shore)	MHn45a
	Sugar Maple Forest (North Shore)	MHn45c
	Sugar Maple Basswood (Bluebead Lily) Forest	MHn47a
	Sugar Maple Basswood (Horsetail) Forest	MHn47b
	Red Oak-Basswood Forest (Calcareous Till)	MHc36b
	Sugar Maple-Basswood (Aspen) Forest	MHc37b
	White Pine-Sugar Maple-Basswood Forest (Cold Slope)	MHc38a
	Basswood-Black Ash Forest	MHc47a
	Sugar Maple-Basswood (Bitternut Hickory) Forest	MHs39a
	Sugar Maple-Basswood-Red Oak (Blue Beech) Forest	MHs39b
	Sugar Maple Forest (Big Woods)	MHs39c
	Elm-Basswood-Black Ash (Hackberry) Forest	MHs49a
	Elm-Basswood-Black Ash (Blue Beech) Forest	MHs49b

T.J. Whitfeld MN DNR

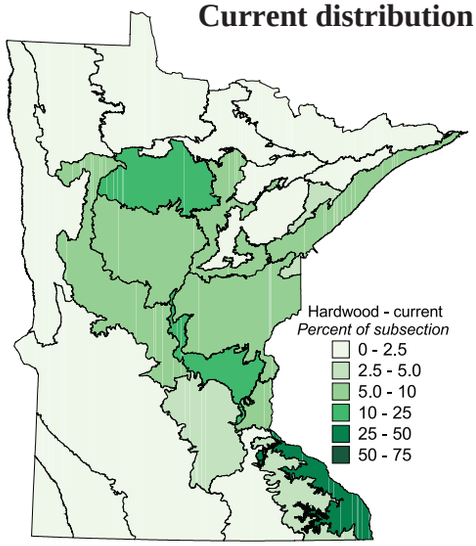
Sugar Maple-Basswood (Aspen) Forest (MHc37b)

Past distribution



Source: Marschner 1930

Current distribution



Source: MN GAP 1993

Forest-Upland Deciduous (Hardwood) (i.e., maple-basswood)

General Description

Upland deciduous hardwood forest habitat occurs on upland sites with soils that retain water and in settings where wildfires are infrequent. A continuous, often dense, canopy of deciduous trees, especially sugar maple, basswood, and red oak, characterizes this habitat. Other canopy trees include American elm, red elm, black ash, green ash, bitternut hickory, and hackberry. Older forests commonly have several nearly closed layers of woody plants, including a well-defined forest canopy, subcanopy, and shrub layer. These layers combine to produce continuous cover. Thus, most sunlight is filtered and attenuated before it reaches herbaceous plants and seedlings on the forest floor. The plants found in this habitat are adapted to the low intensity of light in these forests.

Natural disturbance in this habitat is characterized by the death of individual trees, which occurs at a rather constant rate in older forests. Stand-regenerating disturbances such as wildfires and catastrophic windthrow were rare historically in this mesic habitat, having average frequencies of once every 360 to more than 1,000 years. Disturbances that resulted in the partial loss of canopy trees, such as light surface fires and moderate windthrow, were far more frequent. Historically, surface fire was more important in the north, and wind was more important in central and southern Minnesota.

Typical sites are buffered from seasonal drought by fine-textured soils with impermeable soil horizons capable of retaining rainfall or snowmelt below the surface. Usually these soils are well drained and are waterlogged or saturated only after spring snowmelt or heavy, prolonged rains. Essential nutrients, especially nitrogen, are mineralized from decaying organic matter at relatively high rates and quickly become available again for uptake by plants during the spring and early summer months. As a result, nutrients and organic matter accumulate at the soil surface in leaf litter and humus.

Upland deciduous hardwood forest habitats in the Eastern Broadleaf Forest Province occur most often where rugged terrain, water bodies such as lakes and rivers, and moist soil provide protection from wildfires, whereas in the Laurentian Mixed Forest Province this habitat often occurs on level to rolling landscapes with fine-textured soils that retain water.

The extent of upland deciduous hardwood forests has been greatly reduced in southern and west-central Minnesota since settlement by people of European descent. The extensive mesic hardwood forests of the Big Woods Subsection have been reduced by a factor of more than 100. However, in the northern parts of the Laurentian Mixed Forest Province, the extent of maple-basswood forests has increased as a result of fire suppression. Like other forest habitats, most maple-basswood habitats in the Eastern Broadleaf Forest Province and southern and western portions of the Laurentian Mixed Forest Province have been fragmented by agriculture and development. In many locations, the remaining forests typically lack the ecological complexity of pre-European settlement forests because of a number of factors (for example, grazing, invasive plants and animals, edge effects, changes in native animal populations, and consumptive uses).

Examples of Features Important for Species in Greatest Conservation Need

Acadian flycatchers, cerulean warblers, hooded warblers, and **red-shouldered hawks** generally require large areas of contiguous mature to old-growth hardwood forest. Acadian flycatchers favor relatively undisturbed forests and experience high rates of brood parasitism and nest depredation in fragmented landscapes. Cerulean warblers need large, tall trees with horizontal heterogeneity in the canopy, and hooded warblers need mature forests with significant treefall gaps that provide shrubby undergrowth for nesting.

Woodland voles require moist, light soil or humus in forests to construct burrows. Grazing by cattle, which compacts the soil, and the presence of invasive non-native earthworms, which destroy the humus, may make forests within its limited range in southeastern Minnesota unsuitable for this species.

Hardwood forests also provide the same important habitat features for **wood thrushes, ovenbirds,** and **least flycatchers** statewide, and for **black-throated blue warblers, northern goshawks, four-toed salamanders,** and **red-backed salamanders,** which are described in the Upland Forest general description section.

Management Options to Support Species in Greatest Conservation Need

Unfragmented older mesic hardwood forests are a key habitat requirement for several SCGN found in the hardwood forest habitat. In addition to practicing sustainable forestry at the site level, collaborative management across ownerships can also create larger forest patches and reduce forest fragmentation.

Explore opportunities to implement forest management practices that:

- Use natural disturbance return intervals to guide rotation periods.
- Manage to maintain and create large patches of upland forest.
- Manage stands to retain biological legacies (at site level).
- Manage invasive plants and animals.
- Work with Minnesota DNR Division of Fish and Wildlife to determine ecologically and socially desirable deer population levels across the state.
- Collaborate management across ownerships to increase patch size.

Forest-Upland Deciduous (Oak) (i.e., dry-mesic and xeric hardwoods)

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Fire-dependent Forest (FD)	Pin Oak Woodland (Bedrock)	FDn22c
	Oak-Aspen Woodland	FDc25b
	Oak-Aspen Forest	FDc34b
	Black Oak-White Oak Woodland (Sand)	FDs27c
	Bur Oak-Aspen Forest	FDs36a
	Oak (Red Maple) Woodland	FDs37a
	Pin Oak-Bur Oak Woodland	FDs37b
	Oak-Shagbark Hickory Woodland	FDs38a
	Bur Oak (Prairie Herb) Woodland	FDw24a
	Bur Oak (Forest Herb) Woodland	FDw24b
Mesic Hardwood Forest (MH)	Red Oak-Sugar Maple-Basswood (Bluebead Lily) Forest	MHn35b
	Oak-Aspen-Red Maple Forest	MHc26a
	Red Oak-Sugar Maple-Basswood (Large-flowered Trillium) Forest	MHc26b
	Red Oak-Basswood Forest (Noncalcareous Till)	MHc36a
	Red Oak-White Oak Forest	MHs37a
	Red Oak-White Oak (Sugar Maple) Forest	MHs37b
	Green Ash-Bur Oak-Elm Forest	MHw36a

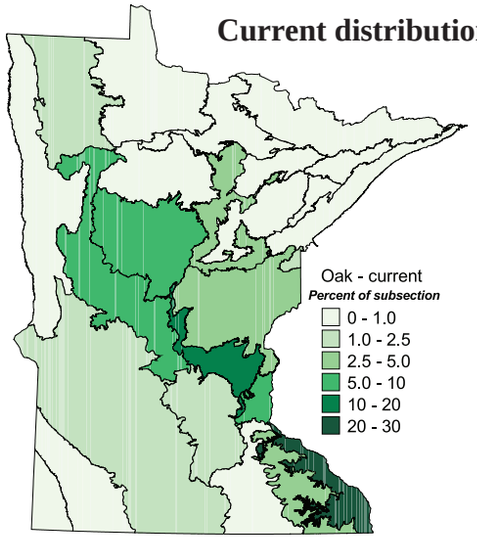
D.S. Wovcha MN DNR

Oak (Red Maple) Woodland (FDs37a)

Past distribution

Past distribution of upland deciduous oak forests is not available.

Current distribution



Source: MN GAP 1993

Forest-Upland Deciduous (Oak) (i.e., dry-mesic and xeric hardwoods)

General Description

Upland hardwood oak forest habitats occur on xeric (dry) to relatively mesic (moist) forest sites throughout the Eastern Broadleaf Forest Province. This habitat is found in portions of the western half of the Laurentian Mixed Forest Province but is uncommon in the northeast. On drier sites, northern pin oak, bur oak, white oak, and, in the southeast, black oak are important canopy species. Associated canopy trees include black cherry, paper birch, aspens, and shagbark hickory. These forests occur on nutrient-poor, well-drained sandy soils on outwash plains, river terraces, and beach ridges, and in the past were strongly influenced by fire. The canopy of modern dry oak forests is relatively open, allowing for a dense shrub layer, typically dominated by American hazel (*Corylus americana*). Many of the drier oak forests contain open-grown trees indicative of a more open woodland or savanna prior to fire suppression.

Historically, fires in the oak habitat were more regenerative than destructive. The typical cycle involved top-killing of plants and vegetative recovery by resprouting. Fires enhanced plant reproduction by exposing mineral soil, triggering seed dispersal, breaking seed dormancy, and increasing light and heat conditions on the ground. In the absence of fire, relatively mesic or fire-sensitive species such as bitternut hickory, basswood, and red maple are increasing in abundance in this habitat. Without fire, there is little natural oak regeneration in most dry oak stands.

The oak forest habitat on more mesic sites is dominated by northern red oak, white oak, and bur oak. Tall, straight, single-stemmed trees and a less dense shrub layer characterize the oak habitat on these sites. These sites had fewer severe fires prior to settlement by people of European descent than did dry oak forests, and more mesic, fire-sensitive trees such as basswood, green ash, bitternut hickory, and big-toothed aspen are usually present with the oaks. Nevertheless, those fires that did occur were responsible for the establishment and maintenance of oaks on these sites. Without fire or appropriate forest management to replace fire, most mesic oak forests will succeed to maple-basswood forests.

Most oak forest stands have been disturbed by grazing or selective logging, which facilitated the colonization of these stands by invasive species such as buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tartarica*). Like other forest habitats, most oak forest habitats in the Eastern Broadleaf Forest Province and southern and western portions of the Laurentian Mixed Forest Province have been fragmented by agriculture and development.

Examples of Features Important for Species in Greatest Conservation Need

Eastern hognose snakes are most common in and around woodland edge habitats. Key habitat features for these species include down woody debris (for cover, nesting sites, and basking sites) and burrows or crevices as overwintering sites.

Management Options to Support Species in Greatest Conservation Need

Explore opportunities to implement forest management practices that:

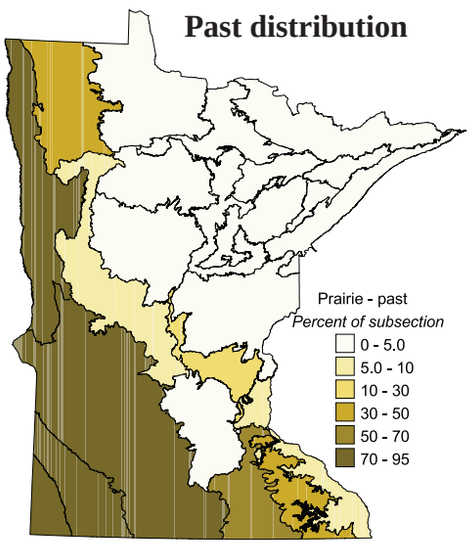
- Use natural disturbance return intervals to guide rotation periods.
- Mimic landscape disturbance patterns with timber harvest (for example, more large patches).
- Manage stands to retain biological legacies (at site level).

Prairie

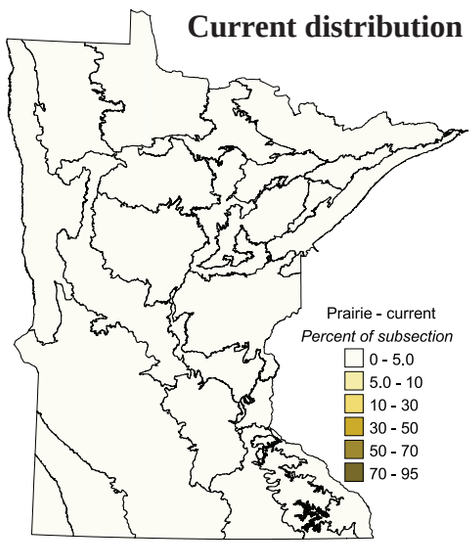
Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Upland Prairie (UP)	Dry Barrens Prairie (Northern)	UPn12a
	Dry Sand-Gravel Prairie (Northern)	UPn12b
	Dry Sand-Gravel Brush-Prairie (Northern)	UPn12c
	Dry Hill Prairie (Northern)	UPn12d
	Mesic Prairie (Northern)	Upn23b
	Dry Barrens Prairie (Southern)	Ups13a
	Dry Sand-Gravel Prairie (Southern)	Ups13b
	Dry Bedrock Bluff Prairie (Southern)	Ups13c
	Dry Hill Prairie (Southern)	Ups13d
	Mesic Prairie (Southern)	Ups23a
Wetland Prairie (WP)	Wet Seepage Prairie (Northern)	WPn53a
	Wet Prairie (Northern)	WPn53c
	Wet Saline Prairie (Northern)	WPn53d
	Wet Seepage Prairie (Southern)	WPs54a
	Wet Prairie (Southern)	WPs54b
	Wet Saline Prairie (Southern)	WPs54c

T.J. Whitfeld, MN DNR

Dry Sand-Gravel Prairie (Southern) (Ups13b)



Source: Marschner 1930



Source: MN GAP 1993

General Description

Prairie habitat is dominated by native grasses with a species -rich component of forbs (herbaceous plants other than grasses or sedges). The major grasses on upland sites are big bluestem (*Andropogon gerardii*), prairie dropseed (*Sporobolus heterolepis*), and little bluestem (*Schizachyrium scoparium*). Big bluestem and prairie cordgrass (*Spartina pectinata*) are the major species on wetter sites, which also support a variety of sedge (*Carex*) species. The most common forbs in terms of species number are in the families Asteraceae and Fabaceae. On upland sites woody species are limited to dwarf shrubs such as leadplant (*Amorpha canescens*) and prairie rose (*Rosa arkansana*), whereas lowland sites support both dwarf shrubs (e.g., prairie rose) and true shrubs such as red-osier dogwood (*Cornus sericea*) and willows (*Salix* spp.)

Frequent fire is essential to maintaining prairie in Minnesota. Without fire, trees and shrubs invade prairie areas throughout the state. Fire at intervals of 10 years or less, on average, prevents trees and shrubs from becoming large enough to survive fire, thus maintaining the dominance of herbaceous species. Grazing by bison and elk was an important ecological process on pre-European settlement prairies, but the role of grazing and browsing in maintaining prairie is unclear. Grasses, which grow from lateral meristems at the base of the plant, are well adapted to grazing, which generally removes only the upper portion of the plant.

Prior to settlement by people of European descent, prairie was the dominant habitat throughout the Prairie Parkland Province and in most of the southernmost portions of the Eastern Broadleaf Forest Province, with the exception of the deeply dissected eastern portion of the Paleozoic Plateau. Prairie also occurred in much of the Anoka Sand Plain Subsection of the Eastern Broadleaf Forest Province. The distribution of prairie was generally limited to landscapes with relatively gentle topography, with the exception of "goat" prairies on dry, steep south-facing slopes in southeastern Minnesota. Hilly topography, abundant lakes and rivers, and higher rainfall impeded the spread of fire in the woodlands and forests to the north and east. Today less than one percent of the pre-European settlement prairie habitat remains in the state.

Prairie native plant communities span the soil moisture spectrum from dry sand-gravel prairies on coarse, droughty soils to wet prairies on poorly drained sites with a variety of soil textures. Prairie soils, with the exception of sandy substrates on dry sites, are generally classified as mollisols, which are very dark, base-rich mineral soils.

Examples of Important Features for Species in Greatest Conservation Need

Prairie provides habitat features for a variety of insect SGCN that are not found in other grassland habitats. These insects, which include seven species of butterflies and a leafhopper, require a specific host plant or microhabitat structure limited to prairie. Insects that lay eggs on a specific host plant include the **regal fritillary** (bearded birdfoot violet [*Viola pedatifida*]); the **arogos skipper** (big bluestem [*Andropogon gerardii*]); the **uncas skipper** (hairy grama [*Bouteloua hirsuta*]); and the **red-tailed leafhopper** (prairie dropseed [*Sporobolus heterolepis*]). In addition, several of these butterflies may require a particular microhabitat structure. For example, several skippers (including the **Dakota skipper**) seem to require bunchgrasses characteristic of the prairie habitat as opposed to sod-forming grasses, which characterize other grasslands. All of the butterflies require a variety of flowering forbs as nectar sources on which adults feed.

Three bird SGCN, **chestnut-collared longspur, Sprague's pipit,** and **Baird's sparrow,** are native prairie specialists that were common in portions of western Minnesota prior to settlement by people of European descent and are now extremely rare as the result of the conversion of prairie to cropland. Chestnut-collared longspurs and Sprague's pipits prefer dry prairie sites with short grasses, which are maintained by fire or grazing. In North Dakota, pipit abundance is significantly correlated with native grasses; non-native plant mixes such as those sometimes used on lands enrolled in easements under the federal farm program provide very poor pipit (and Baird's sparrow) habitat. Baird's sparrows are sensitive to habitat fragmentation and prefer native prairie.

Management Options to Support Species in Greatest Conservation Need

- Support incentives that avoid conversion of grasslands into row crops where SGCN occur.
- Use mowing, cutting woody vegetation, prescribed fire, or careful use of herbicides to prevent the invasion of grasslands by trees and shrubs.
- Lengthen the cutting rotations for hay; avoid early-season mowing.
- Use light to moderate, rotational grazing programs to benefit SGCN
- Prevent fragmentation of grassland habitat.
- Avoid soil compaction in areas occupied by mammal SGCN.
- Increase native plant species components
- Control spread of invasive species to adjacent native-dominated sites.

Shoreline-Dunes-Cliff/Talus

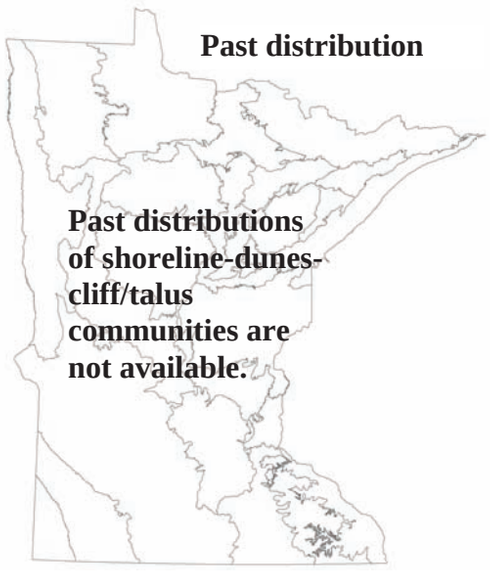
Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Lake Shore (LK)	Sand Beach (Inland Lake)	LKi32a
	Gravel/Cobble Beach (Inland Lake)	LKi32b
	Boulder Shore (Inland Lake)	LKi43a
	Bedrock Shore (Inland Lake)	LKi43b
	Clay/Mud Shore (Inland Lake)	LKi54a
	Mud Flat (Inland Lake)	LKi54b
	Beachgrass Dune (Lake Superior)	LKu32a
	Sand Beach (Lake Superior)	LKu32c
	Gravel/Cobble Beach (Lake Superior)	LKu32e
	Dry Bedrock Shore (Lake Superior)	LKu43a
	Wet Rocky Shore (Lake Superior)	LKu43b
River Shore (RV)	Willow Sandbar Shrubland (River)	RVx32a
	Sand Beach/Sandbar (River)	RVx32b
	Gravel/Cobble Beach (River)	RVx32c
	Bedrock/Boulder Shore (River)	RVx43a
	Slumping Clay/Mud Slope (River)	RVx54a
	Clay/Mud Shore (River)	RVx54b
Cliff/Talus (CT)	Dry Mafic Cliff (Northern)	CTn11a
	Dry Rove Cliff (Northern)	CTn11b
	Dry Thomson Cliff (Northern)	CTn11c
	Dry Felsic Cliff (Northern)	CTn11d
	Dry Sandstone Cliff (Northern)	CTn11e
	Dry Open Talus (Northern)	CTn12a
	Mesic Open Talus (Northern)	CTn12b
	Dry Scrub Talus (Northern)	CTn24a
	Mesic Scrub Talus (Northern)	CTn24b
	Mesic Mafic Cliff (Northern)	CTn32a
	Mesic Rove Cliff (Northern)	CTn32b
	Mesic Thomson Cliff (Northern)	CTn32c
	Mesic Felsic Cliff (Northern)	CTn32d
	Mesic Sandstone Cliff (Northern)	CTn32e
	Wet Mafic Cliff (Northern)	CTn42a
	Wet Rove Cliff (Northern)	CTn42b
	Wet Felsic Cliff (Northern)	CTn42c
	Wet Sandstone Cliff (Northern)	CTn42d
	Exposed Mafic Cliff (Lake Superior)	CTu22a
	Exposed Felsic Cliff (Lake Superior)	CTu22b
	Sheltered Mafic Cliff (Lake Superior)	CTu22c
	Dry Sandstone Cliff (Southern)	CTs12a
	Dry Limestone-Dolomite Cliff (Southern)	CTs12b
	Dry Sioux Quartzite Cliff (Southern)	CTs12c
	Dry Limestone-Dolomite Talus (Southern)	CTs23a
	Mesic Limestone-Dolomite Talus (Southern)	CTs23b
	Mesic Sandstone Cliff (Southern)	CTs33a
	Mesic Limestone-Dolomite Cliff (Southern)	CTs33b
	Maderate Cliff	CTs43a
	Algific Talus	CTs46a
	Wet Sandstone Cliff (Southern)	CTs53a
	Wet Limestone-Dolomite Cliff (Southern)	CTs53b
Rock Outcrop (RO)	Sandstone Outcrop (Northern)	ROn12a
	Crystalline Bedrock Outcrop (Northern)	ROn12b
	Crystalline Bedrock Outcrop (Prairie)	ROs12a
	Crystalline Bedrock Outcrop (Transition)	ROs12b
	Sedimentary Bedrock Outcrop (Southeast)	ROs12c

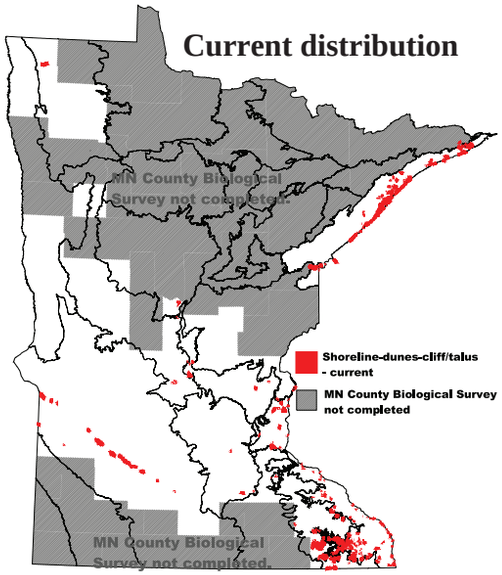
B.C. Delaney MN DNR

Mud Flat (Inland Lake) (LKi54b)

R. Fox MN DNR

Dry Limestone-Dolomite Cliff (Southern) (CTs12b)





Source: MN County Biological Survey 2005

Shoreline-Dunes-Cliff/Talus

General Description

The shoreline-dunes-cliff/talus habitat is composed of many sparsely vegetated native plant community types. These communities, which include lakeshores, river shores, sand dunes, cliffs, and rock outcrops, all have extensive areas of exposed substrate such as mud, sand, gravel, cobbles, or bedrock. This habitat occurs as small patches or long linear strips throughout the state.

Shoreline communities occur as linear strips along lakes, ponds, rivers, and streams. This group of communities also includes mudflats and sand dunes. Most of these communities are sparsely vegetated because of the absence of well-developed soils and frequent disturbance by waves, ice, and wind. In addition to these factors, changes in water levels contribute to communities that are dynamic—growing, shrinking, shifting, and even disappearing as water levels change seasonally and over longer periods of time.

Lakeshore communities are characterized by their exposed surface materials. Bedrock lakeshores are limited primarily to the Border Lakes and North Shore Highlands subsections, whereas sandy lakeshores are widespread in the Pine Moraines and Outwash Plains Subsection but are rare in the Border Lakes. Clay and mud shorelines are most common in the Prairie Parkland Province.

Although lakeshore communities once encircled each of Minnesota's more than 10,000 lakes, this habitat is severely threatened by development, primarily for second homes, in many parts of the state.

River shores, found along rivers and streams throughout Minnesota, are similar to lakeshore communities. Changes in water levels occur during spring flooding and following heavy rains in a river's watershed. Erosion and deposition from strong and shifting currents constantly alters the shoreline along many rivers. The most common disturbance pattern in these communities is repeated erosion and deposition of materials by currents and ice-scouring. Like lakeshores, river shore communities are threatened by development, agriculture, stream channelization, and human-caused water level fluctuations.

Cliff and talus communities are present on cliffs or talus slopes on steep-sided bluffs, along lakes and streams, on margins of bedrock ridges, and in other settings with sheer bedrock exposures. Cliffs and talus slopes are often associated with one another because talus slopes are composed of rock fractured either from cliffs or smaller areas of exposed bedrock on steep hillsides. The vegetation of these communities is generally open. Lichens and mosses are often the dominant life forms, and vascular plants are sparse or patchy because of scarcity of soil.

In the Laurentian Mixed Forest Province, cliffs and talus communities are mostly restricted to the North Shore Highlands and Border Lakes subsections, where the Precambrian bedrock is frequently at or just below the surface and rugged topography is common. In the Eastern Broadleaf Forest Province, these communities are abundant in the Blufflands Subsection, where sedimentary bedrock is typically at or near the surface and topography is rugged. Scattered cliffs are present on bedrock formations elsewhere in the state.

In the Blufflands Subsection, maderate cliffs and algific talus slopes provide the only habitat for several SGCN land snails. These communities provide a cool, moist, equable climate that allows the snail species to persist. A variety of human activities, either within these communities (such as rock climbing) or affecting the sinkholes on lands above these cliffs, may threaten these communities.

Rock outcrop communities are open plant communities on horizontal or sloping bedrock exposures. They are common in landscapes with thin soils over bedrock and tend to be small in size (that is, less than 25 acres (10 hectares)). Crustose and foliose lichens typically cover exposed rock surfaces, and fruticose lichens are also common. Vascular plant cover is sparse to patchy, depending on the amount of fracturing of the bedrock surface and accumulation of soil in cracks, crevices, and shallow depressions. Outcrops that have minimal fracturing and little accumulation of soil are dominated by lichens, with scattered shrubs and herbaceous plants.

Many plants on bedrock outcrops are adapted to frequent desiccation because of the low moisture-holding capacities of substrates and exposure to direct sunlight and strong winds. Plants must also withstand rapid fluctuations in substrate temperatures, which are significantly colder at night than in surrounding forests and much warmer during midafternoon on sunny days. Limited availability of nutrients in outcrop communities strongly influences community composition and limits growth rates of plants. Fire, as well as frequent drought and scarce soils, plays a role in maintaining the open vegetation characteristic of these communities. Rock outcrop communities are most common in the Border Lakes and North Shore Highlands subsections and in the upper Minnesota River valley. In northeastern Minnesota there is little threat to rock outcrop communities, but those along the Minnesota River are threatened with encroachment of junipers (*Juniperus virginiana*), mineral extraction, and residential development.

Examples of Important Features for Species in Greatest Conservation Need

Ruddy turnstones, whimbrels, American avocets, dunlins, white-rumped sandpipers, semipalmated sandpipers, and **greater yellowlegs** are shorebirds that migrate through Minnesota, and use shoreline communities as resting and feeding sites. Ruddy turnstones are found primarily along large lakes, such as Mille Lacs Lake, Leech Lake, and Lake Superior, where they use sand beaches. Whimbrels use rocky islands and, to a lesser extent, rocky shorelines of Lake Superior. Dunlins, white-rumped sandpipers, and greater yellowlegs use a variety of shoreline habitats, including sandy shores and mudflats, while American avocets favor mudflats and alkaline shores.

Northern rough-winged swallows nest in burrows in steep banks of clay, sand, or gravel. In Minnesota they are most frequent in the Blufflands Subsection, where they nest along rivers and streams. **Common nighthawks** were once common in urban areas, where they nested on flat, gravel roofs of buildings. Now less common in cities, nighthawks nest, as they did prior to settlement by people of European descent, primarily in natural habitats on sparsely vegetated sites, especially rock outcrops in the upper Minnesota River valley and the Border Lakes Subsection, as well as sites in prairies and oak savannas. Nighthawks also nest in recently burned or logged areas.

Although found in a variety of habitats in northeastern Minnesota, **rock voles** are most often associated with frost-fractured rock outcrops and rocky streambeds. Moist conditions and boulders or crevices seem to be important habitat features.

Piping plovers now nest sporadically in only one location in Minnesota, along the sand beach of Pine and Curry islands on the south shore of Lake of the Woods, although they once nested along the dunes of Lake Superior. Critical habitat for this species has been designated by the U.S. Fish and Wildlife Service on Pine and Curry islands and also in the Duluth Harbor area. **Common terns** nest in a handful of colonies on islands with rocky or sandy shorelines in large lakes such as Leech Lake, Mille Lacs Lake, Lake of the Woods, and Lake Superior (Duluth Harbor).

The **bluff vertigo** and other species of **Pleistocene land snails** are found on steep, moist, shaded, cool north-facing slopes and cliff faces in the Blufflands Subsection. This small land snail also occurs on algific slopes and maderate cliffs but generally avoids areas with continuous cooling from cold air or water discharge. Although researchers have raised questions recently about the taxonomic distinctness of some of the SGCN land snails, all are rare and associated with the same habitats.

Several species and subspecies of rare **tiger beetles** of the genus *Cicindela* are found in the shoreline-dunes-cliff/talus habitat. *C. denikei* is limited to rock outcrops and sandy openings in hardwood forests in the Border Lakes Subsection. *C. limbata nympha* is known from only one location in the state, sand dunes in Polk County. *C. macra macra* is known from several locations along moist, sandy stream shores in southeastern Minnesota. *C. splendida cyanocephala* requires steep clay embankments and is known from several locations in the Blufflands Subsection. The *C. fulgida fulgida* (one known location) and *C. f. westbournei* (two known locations) are restricted to alkaline shorelines and mudflats in western Minnesota.

Management Options to Support Species in Greatest Conservation Need

- Protect important shoreline migratory stops for shorebirds.
- Develop stronger shoreline protection regulations to ensure development setbacks and maintenance of natural shorelines.
- Protect algific talus and maderate cliffs and adjacent uplands.
- Manage rock outcrops in Minnesota River valley to prevent encroachment of junipers.
- Experiment with the use of gravel patches on asphalt or rubberized roof to provide potential nest sites for common nighthawks in urban areas.
- Manage existing nest sites for common terns.
- Conduct inventory on rare tiger beetles; protect important habitat.

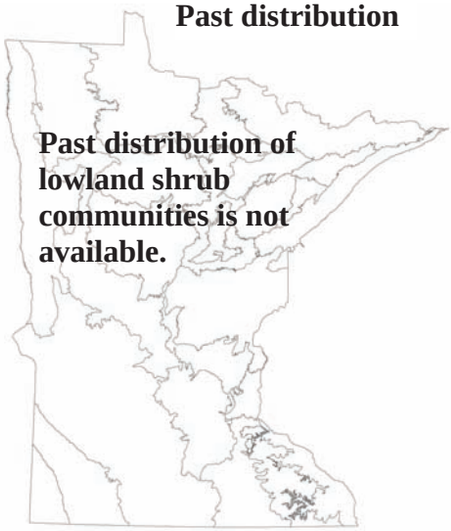
Lowland Shrub

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Open Rich Peatland (OP)	Bog Birch-Alder Shore Fen Leatherleaf-Sweet Gale Shore Fen Shrub Rich Fen (Water Track)	OPn81a OPn81b OPn91a
Acid Peatland (AP)	Low Shrub Bog Low Shrub Poor Fen	APn90a APn91a
Wet Forest (WF)	Alder (Red Currant-Meadow Rue) Swamp	WFn74
Forested Rich Peatland (FP)	Alder (Maple-Loosestrife Swamp) Swamp	FPn73a
Wet Meadow/Carr (WM)	Willow-Dogwood Shrub Swamp	WMn82a
Wetland Prairie (WP)	Wet Brush-Prairie (Northern)	WPn53b

F. Harris MN DNR

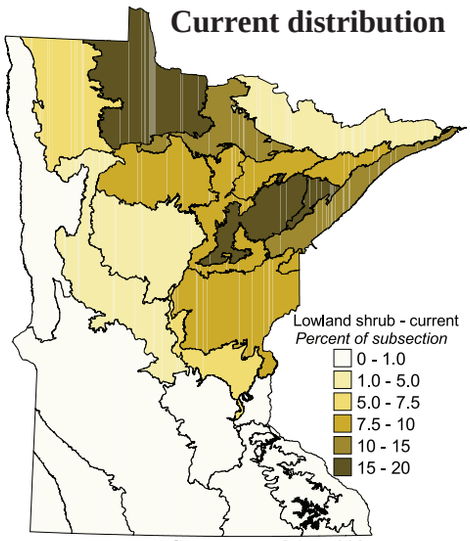
Wet Brush-Prairie (Northern) (WPn53b)

Past distribution



Past distribution of lowland shrub communities is not available.

Current distribution



Source: MN GAP 1993

General Description

The lowland shrub habitat occurs in areas with high water tables where broad-leaved shrubs are the dominant plant growth form. This habitat is found in basins, along streams and rivers, and around lakes and ponds. It is found throughout the state but is uncommon in the Blufflands Subsection. The dominant shrub species in the more acid wetlands include evergreen ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*) along with bog birch (*Betula pumila*). Willows (*Salix* spp.) and red-osier dogwood (*Cornus sericea*) are found across the state, whereas speckled alder (*Alnus incana*) is important primarily in the Laurentian Mixed Forest Province.

Lowland shrub habitats are a successional stage between wet meadows, wetland prairie, graminoid fens, bogs, lowland forests, and conifer swamps. For example, some alder swamps may succeed toward conifer swamps, whereas others on richer sites may succeed toward black ash swamps. Succession, however, is usually a very slow process in most lowland shrub habitats. The high water table impedes colonization by trees. In addition, natural disturbances such as wildfires, windstorms, and beaver activities often interrupt natural succession. As a result, lowland shrub habitats are often long-lived.

The lowland shrub habitat is most at risk in agricultural and exurban areas of the state, where extensive areas of this habitat have been drained for agricultural and other development. Extensive areas of this habitat remain in northern Minnesota; off-road vehicle use is a threat to the integrity of these ecosystems.

Examples of Important Features for Species in Greatest Conservation Need

The primary habitat for **golden-winged warblers** in Minnesota is the lowland shrub habitat, especially when associated with a low density of lowland conifers. **Sharp-tailed grouse** use a variety of open habitats, but in Minnesota large expanses of open brush and muskeg are the primary habitats for this species. **Swamp sparrows** inhabit a variety of open wetland habitats, including lowland shrub habitats.

Management Options to Support Species in Greatest Conservation Need

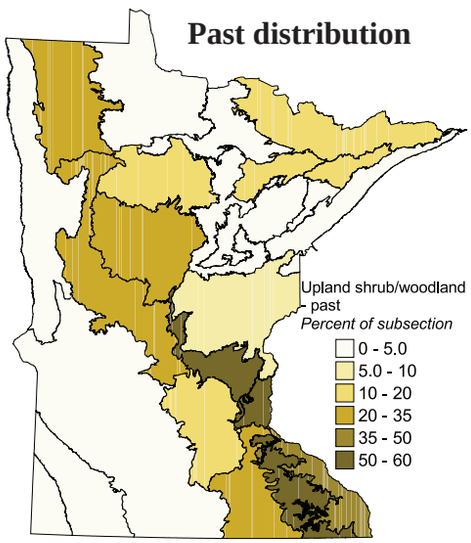
- Protect lowland shrub habitats from drainage and development.
- Manage lowland shrub habitats to maintain large expanses of open wetlands with few trees

Shrub/Woodland-Upland

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Upland Prairie (UP)	Dry Barrens Jack Pine Savanna (Northern)	UPn13a
	Dry Barrens Oak Savanna (Northern)	UPn13b
	Dry Sand-Gravel Oak Savanna (Northern)	UPn13c
	Dry Hill Oak Savanna (Northern)	UPn13d
	Mesic Brush-Prairie (Northern)	UPn23a
	Mesic Oak Savanna (Northern)	UPn24a
	Aspen Openings (Northern)	UPn24b
	Dry Barrens Oak Savanna (Southern)	UPs14a
	Dry Sand-Gravel Oak Savanna (Southern)	UPs14b
	Dry Hill Oak Savanna (Southern)	Ups14c
	Mesic Oak Savanna (Southern)	UPs24a
Lake Shore (LK)	Juniper Dune Shrubland (Lake Superior)	LKu32b
	Beach Ridge Shrubland (Lake Superior)	Lku32d
Rock Outcrop (RO)	Bedrock Shrubland (Inland)	Ron23a
	Bedrock Shrubland (Lake Superior)	Ron23b

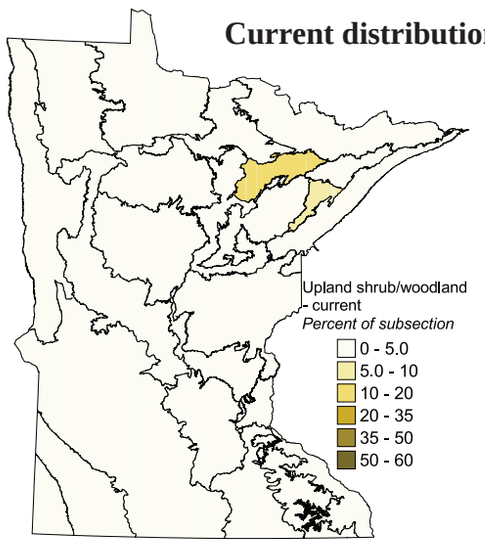
E. Fuge MN DNR

Dry Hill Oak Savanna (Southern) (UPs14c)



Past distribution

Source: Marschner 1930



Current distribution

Source: MN GAP 1993

General Description

The shrub/woodland-upland habitat is a combination of (1) savannas and brush-prairies, (2) bedrock shrublands, and (3) seral and edge upland shrub areas.

Savannas and brush-prairies typically occur where fire frequency or intensity is somewhat lower than in prairie landscapes, yet higher than in forested areas. At such sites, more fire-tolerant shrubs and trees can persist, forming brush-prairie and savanna communities. While savanna and brush-prairie communities intergrade, they are distinguished by certain characteristics. Savannas typically have scattered trees, sometimes clumps of trees, growing in a prairie matrix. Bur oak is the most common and widespread tree, but northern pin oak and, in the extreme southeastern part of the state, black oak are also typical. Small, open-grown, often gnarled bur oaks are the most distinctive savanna tree species. Savannas where jack pine is the predominant tree species occur on deep sand substrates in the northern half of the state. Brush-prairies are characterized by an abundance of taller shrubs, oak "grubs" and sprouts, and quaking aspen suckers. In brush-prairies, herbaceous prairie plants are still a major component of the vegetation, but the woody components are more prevalent than in prairie. In the absence of fire, both savannas and brush-prairies rapidly succeed to woodland; brush-prairie moves to woodland faster than does savanna. Today, most brush-prairies occur in the Tallgrass Aspen Parklands Province in northwestern Minnesota.

Bedrock shrublands are shrub-dominated plant communities on horizontal or sloping bedrock exposures. They are common in landscapes with thin soil over bedrock. This community is most common in the Border Lakes and North Shore Highlands subsections but also occurs in other locations where bedrock is at or near the surface, especially in other parts of the Laurentian Mixed Forest Province and along the Minnesota River in southwestern Minnesota. Characteristic shrub species in the Laurentian Mixed Forest Province include juneberries (*Amelanchier* spp.), bush honeysuckle (*Diervilla lonicera*), and shrubby northern red oaks (*Quercus borealis*) or northern pin oak (*Q. ellipsoidalis*). Bedrock shrublands appear to be long-lived successional communities that develop following intense fire in woodlands or forest. These communities are generally small (< 25 acres) and seldom provide large areas of contiguous shrub/woodland-upland habitat for birds and large vertebrates.

Although seral upland shrublands are short-lived, they occur in forested landscapes where most of the trees have been killed by natural or human disturbances. Prior to settlement by people of European descent, most seral shrublands in Minnesota occurred as the result of fires and windstorms. The resulting shrublands ranged in size from those produced when one to several canopy trees died to those covering tens of thousands of acres following large stand-replacing fires. Following the advent of fire suppression in the 20th century, clear-cut logging has replaced fire in the creation of shrublands. Upland shrub edge habitats that occur widely as ecotones between forests and open habitats, such as agricultural fields, open wetlands, and water bodies, are an important component of upland shrub habitats that are more long-lived than seral shrublands.

Examples of Important Features for Species in Greatest Conservation Need

Five-lined skinks, six-lined racerunners, eastern hognose snakes, milk snakes, and **lined snakes** are most common in and around woodland edge habitats and savannas. Five-lined skinks use rock fissures and cracks in bedrock outcrops as hibernacula, but the suitability of this habitat is threatened by the encroachment of eastern red cedar (*Juniperus virginiana*). Several of these reptiles (six-lined racerunners, **eastern racers,** and lined snakes) prefer more open areas. Other species (five-lined skinks, eastern hognose snakes, and milk snakes) prefer edges, using openings as basking areas. Key habitat features for these species include down woody debris (for cover, nesting sites, and basking sites) and burrows or crevices as overwintering sites.

The decline of **red-headed woodpeckers** has been linked to fire suppression and the decline of oak savanna habitat, changes in farming practices (such as shifts to larger monoculture fields and the lost of hedgerows), and removal of dead trees and branches in urban areas. Large snags without bark are an important habitat feature for this woodpecker. Brushy old fields and road or railroad rights-of-way near open fields provide key habitats for **field sparrows. Bell's vireos** breed in dense, low shrubby areas, primarily in southeastern Minnesota. **Brown thrashers** require shrubby edge habitats and are found across the state except in dense forests. Thrashers do, however, use clear-cuts in forested regions of the state, and in western Minnesota shrubby fencerows and shelterbelts provide good habitat for this species.

Management Options to Support Species in Greatest Conservation Need

- Protect savannas and bedrock shrublands from development.
- Restore fire to overgrown savannas and brush-prairies.
- Encourage landowners to let brushy old fields develop in fallow fields.
- Encourage managers of urban and suburban parks to maintain dead trees and trees with dead branches.

Surrogate Grassland

Ecological Systems
Not defined

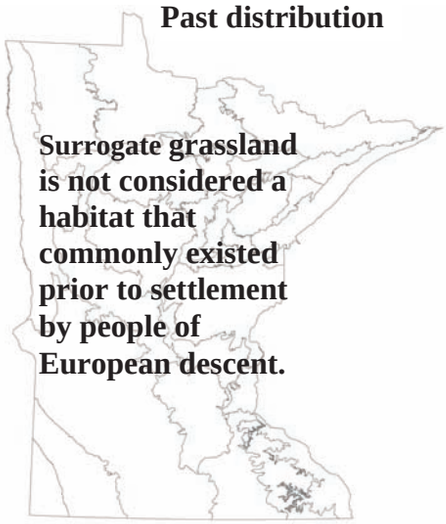
Native Plant Community Types (NPC)
Vegetation assemblages that dominate this habitat are not native plant communities.

NPC Codes
None

B. Bolduan MN DNR

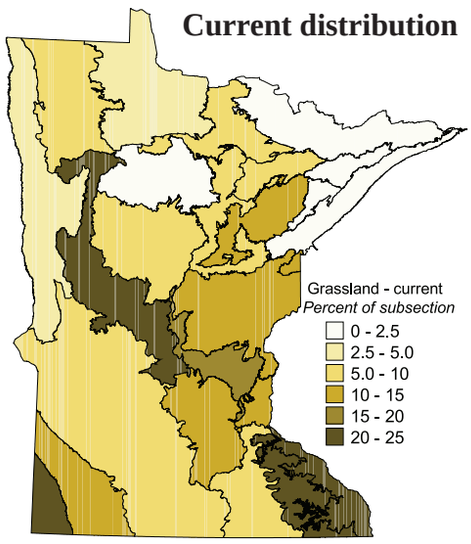
Horse pasture in MN River Prairie Subsection

Past distribution



Surrogate grassland is not considered a habitat that commonly existed prior to settlement by people of European descent.

Current distribution



Source: MN GAP 1993

General

Surrogate grasslands are grasslands that have developed as a result of human activities since settlement by people of European descent in Minnesota and are typically dominated by non-native, cool-season grasses. Surrogate grasslands include old fields, hayfields, pastures, and roadside grasslands (Sample and Mossman 1997). They occur on sites that once supported prairie or forest communities and are found across the state but are less common in the northeast. Dominant non-native grasses include smooth brome (*Bromus inermis*), quackgrass (*Agropyron repens*), redtop (*Agrostis stolonifera*), timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis*). Reed canary grass (*Phalaris arundinacea*), an non-native invasive species, dominates this habitat on wetter sites. The forb component of surrogate grasslands is also dominated by non-native species, including several species of legumes such as yellow sweet clover (*Melilotus officinalis*), white sweet clover (*M. alba*), alfalfa (*Medicago sativa*), bird's-foot trefoil (*Lotus corniculatus*), and Canada thistle (*Cirsium arvense*). Native forbs may also occur in these grasslands, especially goldenrods, milkweeds, and asters.

Unmanaged surrogate grasslands are usually invaded by native and non-native trees and shrubs. Invasion by non-native species such as Siberian elm (*Ulmus pumila*) and Russian olive (*Elaeagnus angustifolia*), and by natives such as green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), and sumacs (*Rhus* spp.), can convert grasslands to woodlands or shrublands, reducing or eliminating their habitat value for many grassland species.

Examples of Important Features for Species in Greatest Conservation Need

Surrogate grasslands in Minnesota, such as pastures and hayfields, provide habitat for a number of grassland mammal, bird, and reptile and amphibian SGCN. Most of these species are adapted to prairie but are able to find "adequate" habitat features in surrogate grasslands. The vegetation structure of surrogate grasslands appears to be the key element for mammal and bird species that breed there. In addition, many species select larger patches, avoiding fragmented grasslands. **Plain's pocket mice** require sparse grassland vegetation. **Prairie voles** prefer relatively dry upland prairies and pastures with a high diversity of forbs. **Grasshopper sparrows** forage exclusively on the ground and hence require more open sites in tallgrass grasslands and prairie. **Richardson's ground squirrels** are usually found in short grass prairie or pasture where they can see over the vegetation.

Henslow's sparrows require dense grasslands such as hayfields or tallgrass prairie with a certain height and density of stalks (especially standing dead vegetation) for singing perches; they rarely use fragmented grasslands (< 250 acres (100 hectares).

Some reptiles and mammals require certain soil textures for burrowing that are commonly associated with surrogate grasslands: plain's pocket mice need exposed, sandy soil, whereas **western hognose snakes** need well-drained loose loamy or sandy soil.

Management Options to Support Species in Greatest Conservation Need

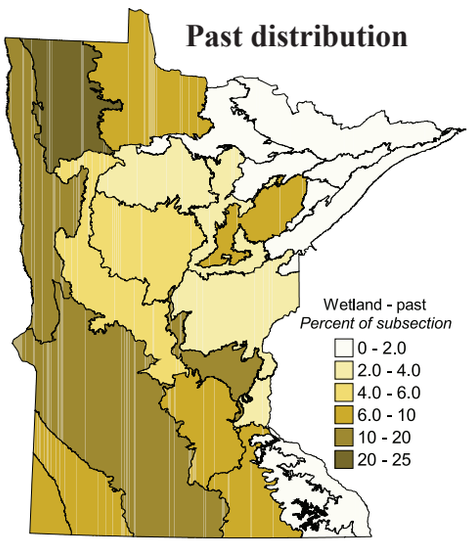
- Support incentives that avoid conversion of grasslands into row crops where SGCN occur.
- Use mowing, cutting woody vegetation, prescribed fire, or careful use of herbicides to prevent the invasion of grasslands by trees and shrubs.
- Lengthen the cutting rotations for hay; avoid early-season mowing.
- Use light to moderate, rotational grazing programs to benefit SGCN
- Prevent fragmentation of grassland habitat.
- Avoid soil compaction in areas occupied by mammal SGCN.
- Increase native plant species components
- Control spread of invasive species to adjacent native-dominated sites.

Nonforested wetlands

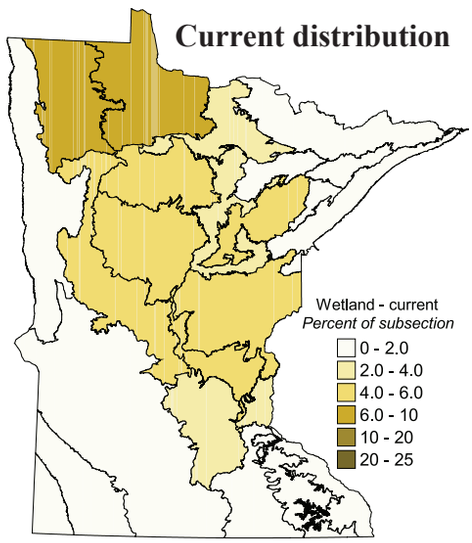
Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Marsh (MR)	Cattail-Sedge Marsh (Northern)	MRn83a
	Cattail Marsh (Northern)	MRn83b
	Bulrush Marsh (Northern)	MRn93a
	Spikerush-Bur Reed Marsh (Northern)	MRn93b
	Estuary Marsh (Lake Superior)	MRu94a
	Cattail-Sedge Marsh (Prairie)	MRp83a
	Cattail Marsh (Prairie)	MRp83b
	Bulrush Marsh (Prairie)	MRp93a
	Spikerush-Bur Reed Marsh (Prairie)	MRp93b
	Arrowhead Marsh (Prairie)	MRp93c
Wet Meadow/Carr (WM)	Sedge Meadow	WMn82b
	Seepage Meadow/Carr	WMs83a
	Basin Meadow/Carr	WMs92a
	Prairie Meadow/Carr	WMp73a
Open Rich Peatland (OP)	Graminoid Rich Fen (Water Track)	OPn91b
	Graminoid Rich Fen (Basin)	OPn92a
	Graminoid-Sphagnum Rich Fen (Basin)	OPn92b
	Spring Fen	OPn93a
	Rich Fen (Mineral Soil)	OPp91a
	Rich Fen (Peatland)	OPp91b
	Rich Fen (Prairie Seepage)	OPp91c
	Calcareous Fen (Northwestern)	OPp93a
	Calcareous Fen (Southwestern)	OPp93b
	Calcareous Fen (Southeastern)	OPp93c
Acid Peatland (AP)	Graminoid Bog	APn90b
	Graminoid Poor Fen (Basin)	APn91b
	Graminoid Poor Fen (Water Track)	APn91c

E.R. Rowe MN DNR

Sedge Meadow (WMn82b)



Source: Marschner 1930



Source: MN GAP 1993

General Description

The nonforested wetland habitat is a collection of wetland plant communities dominated by herbaceous plant species. Like all wetlands, this habitat occurs on sites with a high water table, and many nonforested wetland communities are flooded for most or all of the year. Because of the high water table or flooding, soils in these habitats are usually saturated for prolonged periods and are often anaerobic. Many dominant plants in wetland communities are tolerant of persistently deep water levels and have stems, leaves, and roots that contain intercellular air spaces (aerenchyma) that store oxygen and diffuse it from above-water structures to roots during waterlogged conditions. Nonforested wetlands are found throughout Minnesota and consist of several major types: marshes, wet meadows, fens, and bogs.

Marshes occur on permanently or periodically inundated sites. These communities are typically inundated by nutrient-rich water. They include emergent marshes and open marshes. Emergent marshes are dominated by vascular plants, such as cattails (*Typha* spp.), that can survive indefinitely with their roots and lower stem submerged and their aerial shoots above water. In addition to cattails, emergent marshes are characterized by perennial emergent plants, such as bulrushes (*Scirpus* spp.) and arrowheads (*Sagittaria* spp.), mixed with annual forbs during low-water periods when substrates are exposed, and with floating-leaved and submergent aquatic plants in settings with persistent standing water. Emergent plants provide important habitat for a variety of wetland bird species. Plants with floating leaves, such as water lilies, dominate open marshes, which are sometimes classified as aquatic communities. Variation in species composition over time in response to changes in hydrological conditions is common in marshes.

Wet meadows are graminoid-dominated wetlands that are annually subjected to moderate inundation following spring thaw and heavy rains, and to periodic drawdowns during summer. The dominant graminoids are broad-leaved species such as lake sedge (*Carex lacustris),* tussock sedge (*C. stricta*), and bluejoint (*Calamagrostis canadensis*). Peak water levels are high and persistent enough to prevent trees and most shrubs from becoming established. However, there may be little or no standing water present during much of the growing season. As a result, the substrate surface alternates between aerobic and anaerobic conditions. Any organic matter that accumulates over time is usually oxidized during periodic drawdowns and may even burn during severe droughts. Soils range from mineral soils to muck and peat. Because surface water is derived from runoff, stream flow, or groundwater, it is circumneutral (pH 6.0–8.0) and has high mineral and nutrient content. Wet meadows are present statewide in wetland basins, along streams and drainageways, in drained beaver ponds, in shallow bays, and as semifloating mats along sheltered lake shorelines. Wet meadows grade into lowland shrub communities where water levels are lower and less persistent.

Open rich peatland communities are graminoid- or low shrub-dominated wetlands on actively forming deep peat. The dominant graminoids are most often fine-leaved sedges (*Carex* spp.). Mosses, particularly brown mosses, are common in wet hollows. Open rich peatland communities are widespread in the Laurentian Mixed Forest Province, where cool climate, abundant precipitation, and the presence of poorly drained basins and glacial lake plains provide suitable conditions for peat development. They also occur throughout much of the Eastern Broadleaf Forest Province and into the Prairie Parkland and Tallgrass Aspen Parklands provinces. In these three provinces, open rich peatland communities are near the southern and western limits of the range of peatland development in Minnesota and are generally confined to floating mats or settings where groundwater discharge is sufficient to offset higher rates of evapotranspiration caused by warmer temperatures.

Examples of Important Features for Species in Greatest Conservation Need

Wet meadows and fens typically provide optimal habitat for **sedge wrens, yellow rails,** and **Nelson's sharp-tailed sparrows.** Permanent water a few centimeters in depth and dense vegetation less than 12 inches (30 centimeters) tall appear to be important habitat features for Nelson's sharp-tailed sparrows, whereas yellow rails use wet meadows with water depths ranging from moist soil to 12 inches (30 centimeters). A key habitat feature for the latter species is a canopy of dead sedges that allows the bird to move freely beneath. **Two-spotted skippers** are found in wet meadows, but little else is known about their habitat requirements.

Least bitterns, American bitterns, marsh wrens, and **Virginia rails** require emergent marshes as breeding habitat. Least bitterns show a strong association with cattails, preferring dense, tall stands interspersed with woody vegetation and open water. American bitterns use similar habitats but use less densely vegetated sites in shallower water. Both bitterns tend to be limited to wetlands greater than 25 acres (10 hectares) in size. Virginia rails need a mixture of emergent vegetation of cattails or bullrushes, open water, and mud flats for foraging. They frequent younger, earlier successional marshes, avoiding older marshes with dense vegetation.

Forster's terns require large deep-water marshes with considerable open water. Muskrat houses or floating mats of vegetation are important nest sites.

General Description (continued)

The plants characteristic of graminoid fens are adapted to full sunlight, sustained water levels, low nutrient levels, and high mineral levels. This environment is well suited to dominance by sun-loving herbaceous species, brown mosses, and minerotrophic *Sphagnum* species. The lack of shade from trees and shrubs favors dominance in the ground layer by shade-intolerant species, especially graminoids. Like many wetland plants, the characteristic species in these communities, such as sedges (*Carex* spp.) and buckbean (*Menyanthes trifoliata*), have aerenchyma to store oxygen. Other plants, such as tufted bulrush (*Scirpus cespitosus*), form hummocks that elevate the plant above persistently anaerobic peat surfaces.

Although nutrients are low in graminoid fen communities, concentrations of minerals such as calcium can be very high near groundwater discharge points, particularly where peatlands are underlain by calcareous glacial deposits. Plants that thrive in areas of calcareous groundwater discharge (e.g., calcareous fens) include tufted bulrush, Kalm's lobelia (*Lobelia kalmii*), and grass of Parnassus (*Parnassia* spp.), along with the rare species twig rush (*Cladium mariscoides*) and hairlike beak rush (*Rhynchospora capillacea*).

Nonforested wetlands have declined by more than 50 percent in 13 of the 25 Minnesota ecological classification subsections, most notably in the subsections of the Prairie Parkland Province, but also including the Anoka Sand Plain, Aspen Parklands, and Big Woods subsections. The Wetland Conservation Act regulates the alteration of wetlands through a variety of methods; however the common strategy of developing replacement wetlands often lacks the diversity and complexity of natural wetlands. Invasive species such as purple loosestrife (*Lythrum salicaria*) and glossy buckthorn (*Rhamnus cathartica*) threaten many remaining wetlands. Water appropriations may cause changes in hydrology that in turn cause shifts in the composition of plant species and decrease habitat suitability for animals.

Management Options to Support Species in Greatest Conservation Need

- Prevent loss or degradation of all types of nonforested wetlands.
- Preserve nonforested wetlands, especially in the Eastern Broadleaf Forest and Prairie Parkland provinces.
- Focus on protecting wetlands larger than 10 hectares (25 acres) and wetland complexes.
- Restore large wetland complexes, with attention to the habitat features required by SGCN.
- Avoid creating impoundments that flood wet meadows.
- Manage the invasions of invasive exotic plants in nonforested wetlands (e.g., purple loosestrife, *Phragmites*).
- Protect known nesting areas of Forster's terns.
- Enforce wetland protection regulations ("no-net loss").

D. Wovcha MN DNR

Graminoid Rich Fen (Water Track) (Opn91b)

D. Wovcha MN DNR

Cattail-Sedge Marsh (Prairie) (MRp83a)

Lake-Deep

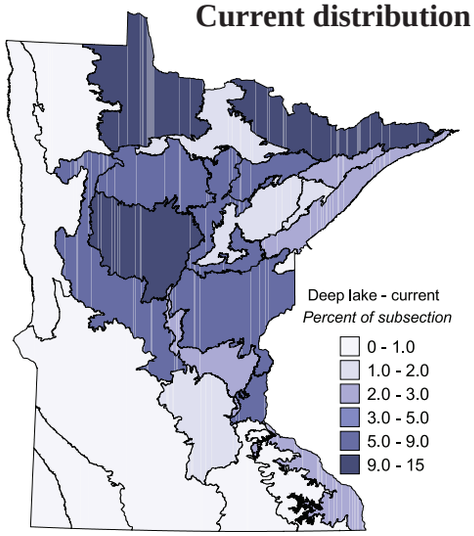
Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Not defined	Aquatic systems are not classified in the native plant communities system.	None

D. Carlson MN DNR

Swan Lake, Cook County, Border Lakes Subsection

Past distribution

Current distribution



Source: MN DNR 24k Lakes 1990

General Description

Generally, deep lakes are water bodies greater than 15 feet (5 meters) deep, and can be further classified into four types based on surface area and alkalinity (Table 6.2; Valley et al. 2004).

Table 6.2. Lake Classification Parameters

Area	Small: < 500 acres (200 hectares)	Large: > 500 acres (200 hectares)
Alkalinity	Alkaline: > 100 ppm mg/L $CaCO_3$	Not alkaline: < 100 ppm mg/L $CaCO_3$

Deep lakes also vary in productivity, ranging from the classic northeastern Minnesota lakes with clear water, cold temperatures, low productivity, and minimal aquatic vegetation to lakes in southern Minnesota with high productivity, low water clarity, and moderate to high levels of aquatic vegetation. A combination of factors related to climate, geology, land use, and land cover results in the general trend of lakes increasing in water clarity and decreasing in productivity and alkalinity from southwestern to northeastern Minnesota. Fish communities, and presumably other aquatic organisms, also vary along this distribution of lake types in Minnesota (Breining 1989).

Deep lakes are the most sought after recreational lakes in Minnesota, both in terms of water-based activities, such as fishing, and in the development of recreational homes along their shorelines. Shoreline development and the resulting loss of shoreline habitat, increased inputs of nutrients, and clearing of aquatic vegetation continue to negatively affect many of Minnesota's deep lakes. Stocking of game fish species has likely altered the native aquatic faunal communities, but little research is available about the effects of this activity. These lakes also face pressures from several non-native invasive species, such as Eurasian milfoil (Myriophyllum spicatum)and curly-leaf pondweed (*Potamogeton crispus*). These invasives can harm communities of native plants and hence animal habitat, as well as impact water quality and available dissolved oxygen.

Examples of Important Features for Species in Greatest Conservation Need

SGCN that use deep lakes are one of the least represented group of species in the set of species in greatest conservation need, reflecting our distinct lack of knowledge about the status of many of the organisms that inhabit deep lakes. A special group of very deep water species such as the **bloater, kiyi, nipigon cisco, shortjaw cisco, deepwater sculpin,** and **pygmy whitefish** all occur in water depths of at least 75 feet (25 m), with some in depths up to 1,200 feet (400 m). Most of these species are found in Lake Superior, many exclusively, but the nipigon cisco, shortjaw cisco, and deepwater sculpin also occur in some inland deep lakes. The nipigon cisco is found only in Lake Saganaga. Little is known about the habitat needs of these very deep water species, but given the relative rarity of both these species and their specialized habitat needs, further research into appropriate management actions is important.

Species such as the **least darter, longear sunfish,** and **pugnose shiner** are found in deep lakes, but need vegetated shallows as spawning habitat. The **piping plover** and the **Hariy-necked tiger beetle (***Cicindela hirticollis rhodensis)* both require undisturbed sandy shores of large lakes.

Management Options to Support Species in Greatest Conservation Need

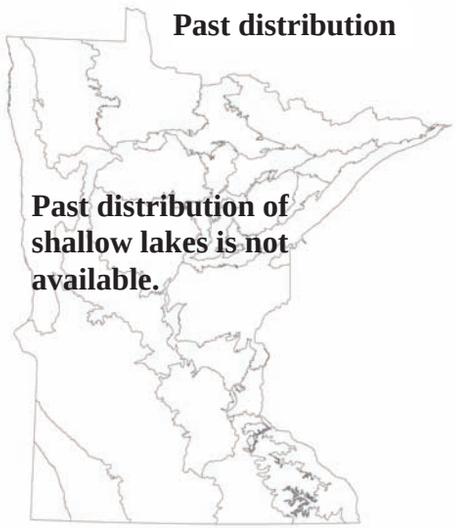
- Remove, manage, and reduce the spread of non-native invasive species, particularly in rare very deep-water habitats.
- Encourage shoreline restoration.
- Enforce shoreline development and aquatic vegetation removal restrictions.
- Continue research and survey into the status and trends of deep lake organisms.

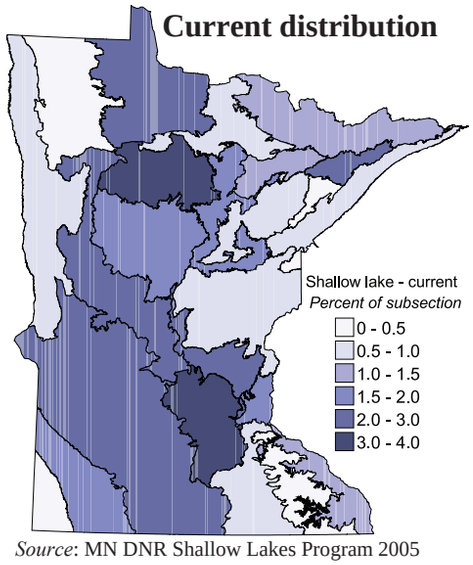
Lake-Shallow

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Not defined	Aquatic systems are not classified in the native plant communities system.	None

M. Lee MN DNR

Duck Slough, Stearns County.





Source: MN DNR Shallow Lakes Program 2005

General Description

Shallow lakes are permanent or semi-permanent water bodies less than 15 feet (5 meters) deep, and can be further classified into four types based on surface area and alkalinity (Table 6.3; Valley et al. 2004).

Table 6.3. Lake Classification Parameters

Area	Small: < 500 acres (200 hectares)	Large: > 500 acres (200 hectares)
Alkalinity	Alkaline: >100 ppm mg/L $CaCO_3$	Not Alkaline: < 100 ppm mg/L $CaCO_3$

Shallow lakes have abundant aquatic plant growth due to high nutrient content (phosphorus, nitrogen, and minerals) and the high sunlight availability in shallow water. Stands of emergent and floating-leaved aquatic plants such as cattails (*Typha* spp.), bulrush (several genera), water lily (*Nymphaea* spp.) and reeds (several genera), as well as submerged plants, such as coontail, are usually present throughout the entire basin, creating an extended littoral zone. These plants provide excellent food and habitat for zooplankton, insects, fish, waterfowl, and other wildlife. Aquatic vegetation also anchors sediments, maintaining water clarity (Conroy 2005).

Sediment and nutrients in shallow lakes, unlike in deeper lakes, are constantly mixing. Shallow lakes lack temperature stratification, and wind–wave action easily penetrates to the bottom of the shallow basin.

Shallow lakes can often benefit from periods of low water that stimulate beneficial aquatic plant growth. Persistent and high water levels restrict plant growth and reduce water quality, allowing significant algal growth. Low water conditions can help set the stage for winterkills that can decrease or eliminate populations of rough fish species, such as carp and black bullhead. While shallow lakes can support populations of game fish, low levels of dissolved oxygen and winterkills tend to limit their numbers.

Chemical, nutrient, and sediment inputs from agricultural practices and runoff from impervious sources, such as roads, parking lots, and roofs, can seriously degrade shallow lake habitats. Due to the low volume of water, shallow lakes can be more susceptible to such runoff than deep-water lakes. Surface water use can sometimes be as important as land use management in maintaining a healthy shallow lake. Aquatic vegetation can suffer from too many docks, boats, and outboard motors on a lake. Since settlement by people of European descent, hundreds of thousands of acres of Minnesota's shallow lakes have been ditched and drained.

Examples of Important Features for Species in Greatest Conservation Need

Shallow lakes are well recognized for their importance as breeding areas for waterfowl species, such as the **lesser scaup, northern pintail, and common moorhen.** They are also important for many other species.

Least bitterns, **American bitterns**, **marsh wrens**, and **Virginia rails** require emergent marshes as breeding habitat. Least bitterns show a strong association with cattails, preferring dense, tall stands interspersed with woody vegetation and open water. American bitterns use similar habitats but use less densely vegetated sites in shallower water. Both bitterns tend to be limited to wetlands greater than 4 acres (10 hectares) in size. Virginia rails need a mixture of emergent vegetation of cattails or bulrushes, open water, and mud flats for foraging. They frequent younger, earlier successional marshes, avoiding older marshes with dense vegetation.

Forster's terns require large deep-water marshes with considerable open water. Muskrat houses or floating mats of vegetation are important nest sites.

Management Options to Support Species in Greatest Conservation Need

- Prevent loss or degradation of all types of shallow lakes.
- Preserve shallow lakes and wetlands, especially in the Eastern Broadleaf Forest and Prairie Parkland provinces.
- Focus on protecting larger shallow lakes (> 4 acres (10 hectares)) and shallow lake and wetland complexes.
- Restore large complexes of shallow lakes and wetlands, with attention to the habitat features required by SGCN.
- Manage for a natural water regime in shallow lakes.
- Manage the invasions of invasive non-native plants in shallow lakes (for example, purple loosestrife).
- Protect known nesting areas of Forster's terns.
- Enforce wetland protection regulations ("no-net loss") as they pertain to shallow lakes.

MN DNR

Example of a very large river

F. Harris MN DNR

Example of a moderate river

Distribution

See individual distribution maps in the sections for:

River – Very large
River – Headwater to Large

General Description

Rivers are ribbons of life—complex, productive, valuable communities of terrestrial and aquatic plants and animals joined and sustained by the many forces, interactions, and pathways that make up a living stream. Five major components influence stream structure and function: hydrology, geomorphology, water quality, connectivity, and biology (Annear et al. 2004). Plant and animal communities have coevolved with these components. The diversity of aquatic plants and animals depends on the variety of stream habitats.

Hydrology refers to the source, amount, and rate of water, both spatially and temporally, in a stream channel. It impacts the development of aquatic and riparian vegetation, microhabitat features, as well as the other four main stream components. Human activities such as land use, wetland drainage, channelization, and water withdrawal alter the hydrology of streams.

Geomorphology refers to the shape of the stream channel itself, such as meanders, oxbows, backwater areas, secondary channels, and overbank flow areas (areas inundated during high-water events). It reflects the dynamic nature of stream systems and is important in the maintenance and creation of habitat necessary for many aquatic species. Stream geomorphology directly impacts a river's hydrology and water quality as well: An unaltered, complex geomorphology helps to attenuate sedimentation and river flooding downstream. Human activities such as channelization, dams, and alteration of stream bank vegetation can severely impact a stream's geomorphology and its concomitant impacts on other aspects of the stream system.

Water quality refers to the stream's chemical balance, water temperature, sediment load, chemical pollutants, and nutrient load. Aquatic species may be adapted to a certain set of water-quality conditions such as needing cold-water streams, or may be deleteriously impacted by unnatural water quality components, such as the input of estrogen-mimicking compounds. Water quality is impacted by a suite of human activities related both to direct stream impacts, such as discharge of nutrients or pollutants directly into the stream, and surrounding land-use practices, such as increased sediment and pollutant input from row crop agriculture.

Connectivity refers to the flow, exchange, and pathways of organisms, energy, and matter in a river system. Many aquatic organisms, such as mussels and fish, use different parts of a river system during different stages of their life cycle. Depending on the organism, connectivity can range in scale from a few feet to hundreds of miles. Barriers to connectivity are most often considered in terms of the physical effects of dams, but they can be other physical barriers such as flow reduction resulting from water withdrawal, chemical barriers such as zones of poor water quality, or biological barriers such as competition from invasive species or fragmented microhabitat.

The *biology* of river systems is both a reflection of, and an influence on, the other four river system components highlighted above. In addition, aquatic species require habitat components of water depth, water velocity, substrate, and cover. Pools, riffles, and runs have been well studied for fish communities, particularly game fish. The presence, amount, and arrangement of these microhabitat features are directly related to the river's hydrology and geomorphology. Water quality and connectivity also impact the presence and persistence of aquatic species. Plant communities form a mosaic, depending on conditions along the stream and in the floodplain. Terrestrial plants along the stream, in its floodplain, and in its valley are vital to the character of the stream. Plants are critical components of nitrogen, carbon, and oxygen cycles, serving as production sites and conversion centers for life-sustaining elements. Throughout a stream's length, the vegetation along the riparian corridor intercepts flows of incoming runoff, nutrients, and contaminants.

Examples of Important Features for Species in Greatest Conservation Need

In addition to purely aquatic species (e.g., fish and mussels) that benefit from good streams, many other species in greatest conservation need rely on a combination of upland and stream habitats to complete their life cycles. Both wetlands and sandy uplands are necessary for the **Blanding's turtle** to complete its life cycle. Fluvial outwash plains, such as those in Weaver Bottoms along the Mississippi River, provide nesting habitat for Blanding's turtles, **gopher snakes**, **hognose snakes**, **map turtles**, **tiger beetles**, **jumping spiders** and more. **Fox snakes** live in forested riparian habitats. The wood turtle hibernates in rivers, nests on undisturbed sandy banks, but spends much of its time in nearby upland forests.

Many birds are also attracted to the river corridor; the diversity of species depends on the plant diversity, age classes and width of the corridor. Research has shown that older, larger trees are important habitat for nesting **herons**, **egrets**, **eagles**, and a variety of declining songbirds such as the **wood thrush**.

Management Options to Support Species in Greatest Conservation Need

Since many animals require both upland and stream habitats for their life cycles, it is essential to keep these physical habitats connected. Management options include near shore riparian corridor conservation, as well as larger scale watershed actions.

It is important to also protect habitats along the river corridor to allow movement of wildlife and facilitate movement of nutrients and energy between the stream and surrounding landscape. Management options include modified lock or dam construction and operation, as well as removal of obsolete dam structures.

It is also important to protect and enhance water quality parameters, such as water temperature, sediment loads, and chemical pollution. Management options include improved stormwater systems, soil erosion control techniques, and point - nonpoint source pollution abatement.

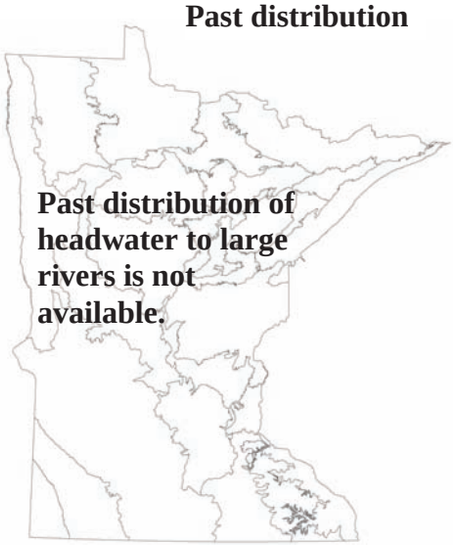
River-Headwater to Large

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Not defined	Aquatic systems are not classified in the native plant communities system.	None

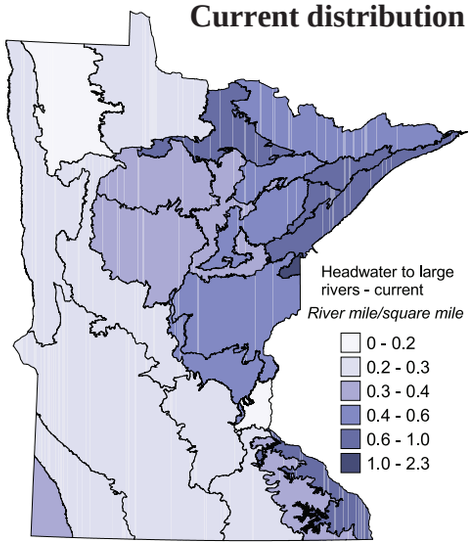
F. Harris MN DNR

Cottonwood River, Brown County

Past distribution



Current distribution



Source: MN DNR 24k Rivers and streams 1980

General Description

As the title of this category implies, headwater to large rivers encompass a large category of river habitats. The generality of this stream classification reflects our current lack of understanding and development in aquatic habitat classifications. The CWCS process initiated a simple classification of streams to provide more detail for this broad category of headwater to large rivers, but much work remains to be done.

Rivers in the headwater to large category range in size from just a few feet to more than 100 feet (30 m) wide. They can also be either warm or cold water, the latter often being designated trout streams. The CWCS process used information on species habitat needs and stream survey data from the Minnesota Pollution Control Agency (MPCA) to identify six different categories of river systems within this broader category:

1. Headwater, warm
2. Headwater, cold
3. Moderate, warm
4. Moderate, cold
5. Large, warm
6. Large, cold

Delineating the sizes of these rivers depended on the size of the watershed they drain which ranged from just a few square miles to over 200 square miles (520 km^2). The actual sizes of the streams in these categories were summarized using data from the MPCA (Table 6.1).

Table 6.1 River Size Descriptions

Stream Size	Watershed Area	Maximum Width
Headwater	< 25 mi^2 (65 km^2)	averages ~ 13 ft (4 m) across, varies from ~ 3–23 ft (1–7 m)
Moderate	25–200 mi^2 (65–520 $km^{2)}$	averages ~ 33 ft (10 m) across, varies from ~ 16–50 ft (5–15 m)
Large	> 200 mi^2 (520 km^2)	averages ~ 100 ft (30 m) across, varies from ~ 50–150 ft (15–45 m)

The relationship between watershed area and river size varies by watershed province in which the stream is located; in particular, rivers in the Minnesota River basin do not increase in size with watershed basin area as sharply as streams in the other watershed provinces (See Chapter 7, Figure 7.1). This variability should be considered during implementation of this strategy. The importance of watershed province extends beyond stream morphological characteristics. Aquatic species distributions are highly influenced by geographic barriers, and historical influences of glaciation and stream channel connections shaped the animal communities found in these different watershed provinces today.

Although there are important differences between the rivers in this broad category, they do share the five major components of hydrology, geomorphology, water quality, connectivity, and biology described in the Rivers Overview section.

The use of stream size and water temperature in the CWCS aquatic classification is an attempt to capture some of these components of river systems. Headwater streams tend to have cooler water, fast velocities, and shallower pools. As streams increase in size, the likelihood of cold water decreases, velocities are typically slower, and pools can be deeper. Larger streams tend to have a more complicated geomorphology, and are more likely to have dams that limit their connectivity. Water quality of headwater streams is often affected by human activities, particularly by chemical pollutants, but as streams increase in size, a greater number and variety of pollutant inputs further reduce water quality. However, larger streams tend naturally to have a higher sediment load, and species have adapted to such features; many headwater species require high water quality.

Examples of Important Features for Species in Greatest Conservation Need

The **redside dace,** a fish species in greatest conservation need, is most abundant in clear, spring-fed, coldwater streams. It typically occurs in pools with moderate current and overhanging vegetation and spawns in riffles or shallow flowing pools. Another fish SGCN, the **plains topminnow,** is also most common in headwater streams of high water quality but does not require cold water. In addition, it requires sandy to rocky substrates and moderate to rapid currents. The **creek heelsplitter** mussel is found in headwater to moderate sized, warmwater streams. It is usually found in swift currents with a substrate of sand, fine gravel, and mud, often downstream of riffles in small pools.

The **largescale stoneroller, black redhorse,** and **greater redhorse** are all found in moderate-sized warmwater streams. Largescale stonerollers require clear water with moderate to swift current, often in deep, fast riffles. They require gravel bottoms and are intolerant of siltation, as they feed by overturning small stones; hence the name stoneroller. Black redhorses prefer pools with gravelly to rocky, occasionally sandy and silty, bottoms. They spawn in gravel and fine rubble runs and riffles in water about 8 - 24 inches (20- 60 centimeters) deep. The greater redhorse also requires clear water with moderate to fast-flowing currents, and clean sand or gravel substrates.

The **least darter** occurs in moderate to large warmwater streams, as well as large, deep lakes. It prefers heavily vegetated areas with sluggish flow, immediately downstream of pools in the spawning and growing season, and overwinters in the deep water of pools.

The **crystal darter** occurs in large to very large, warmwater rivers. It is usually in water more than 24 inches (60 centimeters) deep with strong current, and along expanses of clean sand and gravel, where it buries itself in sand with only its eyes protruding.

Management Options to Support Species in Greatest Conservation Need

- Support the removal of dams where appropriate to restore movement corridors.
- Advocate for maintenance of natural flow regimes.
- Provide technical assistance and incentives to support best management practices and the maintenance of native vegetation in riparian areas.

M. Lee MN DNR

Seepage fed stream, Stearns County

D. Rose MN DNR

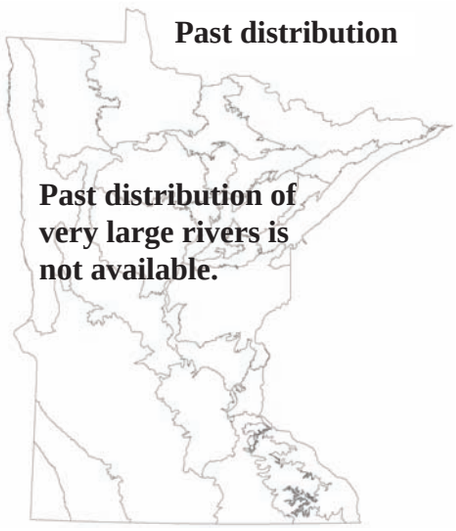
Root Rover, Fillmore County

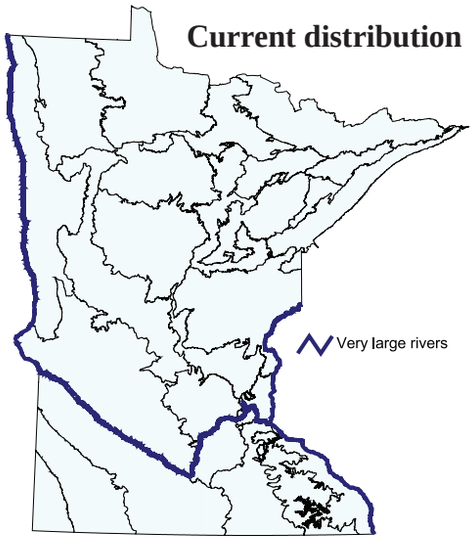
River-Very Large

Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Not defined	Aquatic systems are not classified in the native plant communities system.	None

MN DNR

Mississippi River – Anoka Sand Plains Subsection





Source: MN DNR 24k Streams 1990

General Description

Very large river systems are a unique river category that includes only the largest rivers in Minnesota. These are the Red River, the Minnesota River, the Lower St. Croix River, and the Mississippi River south of St. Anthony Falls. These river systems share several features that make them unique. They are of the highest orders (stream orders 7–10), meaning they are the terminus for several smaller streams, and can be quite wide and carry large volumes of water. Typically, current velocities in these rivers are slower than in their smaller counterparts, leading to the formation of meanders and oxbows, numerous islands, and significant backwater systems. These rivers periodically experience significant flooding events that maintain these channel characteristics. River portions that widen into large lakes, such as Lake Pepin or Lake St. Croix, are also part of the very large river system.

Very large rivers also share the five characteristics of hydrology, geomorphology, water quality, connectivity, and biology detailed in the Rivers overview section. Very large rivers tend to have a complex geomorphology and hydrology. Water quality issues are common in these rivers as their large watersheds provide many possible pollutant inputs. The usefulness as navigation channels has led to the development of numerous dam structures impacting connectivity. These very large rivers are also the most biologically diverse river systems in Minnesota.

Examples of Important Features for Species in Greatest Conservation Need

The backwater areas of these rivers are a biological "factory," providing important spawning areas for several species of fish, and are important refuge habitat for many other animal species, such as the **eastern massasauga** and **prothonotary warbler**. Connectivity of these rivers is also an important feature and historically influenced the distribution of fish populations and likely other taxa as well. St. Anthony Falls forms a natural barrier between the upper and lower Mississippi River in Minnesota for fish species, such as **yellow bass, pirate perch, pugnose minnow,** and **warmouth,** that occur only downstream of the falls.

Twenty-two of Minnesota's 48 native **freshwater mussel species** historically occurred in these very large river systems. Many of these mussel species are presently restricted to the lower St. Croix River and the Mississippi River below St. Anthony Falls, where water quality, flow regimes, and/or substrates such as boulders or gravel beds are present in sufficient quality and quantity to allow for their persistence.

Many of the important habitat features of these systems, such as connectivity, limited sediment in the substrates, and high water quality, are continually jeopardized by multiple human activities. Construction of dams has restricted movement of species, such as the **skipjack herring,** that otherwise would migrate significant distances. This restriction in motility of host fish has consequently restricted the distribution of freshwater mussels that rely on fish for completion of their life cycles. Dams and hydropower plants have also changed natural water flows, causing sedimentation in some areas and dewatering in others, and preventing seasonal flooding, which maintains the health of backwater areas. Since these rivers are the termini of many smaller-order streams, they can receive heavy amounts of sediments, nutrients, and pollutants from upland activities. This problem is most pronounced in the agricultural areas through which the Minnesota and Red Rivers flow. Many species in greatest conservation need have been extirpated from these two rivers, while relatively stable populations still occur in the St. Croix and Mississippi Rivers.

Management Options to Support Species in Greatest Conservation Need

- Support the removal of dams where appropriate to restore movement corridors.
- Advocate for maintenance of natural flow regimes.
- Provide technical assistance and incentives to support best management practices and the maintenance of native vegetation in riparian areas.

Chapter 7

Methods and Analyses

This chapter describes the methods of technical assessment used in *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* (referred to in this document as Minnesota's Comprehensive Wildlife Conservation Strategy or CWCS). We first explain the problem analysis for each of the 292 species in greatest conservation need (SGCN), examining the factors that led to their rarity, vulnerability, or decline. Habitat loss and degradation emerged as the predominant reasons for the designation. With this in mind, and factoring in the large number of species involved and the statewide scope of the plan, the project's technical team determined that a sound approach to better manage these species would be to identify the key habitats they use by Ecological Classification System (ECS) subsection (for more information on ECS, visit http://www.dnr.state.mn.us/ecs/index.html). The bulk of this chapter describes the methods used for determining these key habitats.

Focusing the attention and resources of CWCS partners on key habitats provides an efficient and effective approach to benefit the greatest number of SGCN for each conservation dollar spent. This will need to be coupled with a fine-filter species approach for those SGCN that do not benefit from conservation actions targeted at key habitats.

Species Problem Assessment

Each of the 292 species in greatest conservation need was evaluated to determine the factors influencing their rarity, vulnerability, or decline, using several sources of information, including Nature Serve Explorer; Revision Notes for Minnesota Endangered, Threatened, Special Concern Listing; Minnesota Rare Species Guide; and Partners in Flight, as well as various other published materials.

Each species was given a score of 0 to 3 across 9 categories based on the influence that each category has on the status of that species (Table 7.1). Each influence score (Table 7.2) was also given a level of confidence score from 1 to 3 (Table 7.3). Any category given an influence score of zero received a confidence score of 1. If no information was available about any influences, as was the case with some of the aquatic insects, then all categories were scored with a question mark ("?").

Table 7.1. Species Influence Categories

Category	Description
Habitat loss in Minnesota	Loss of habitat in Minnesota
Habitat degradation in Minnesota	Degradation of habitat in Minnesota, including loss of diversity, fragmentation, disruption of critical processes such as fire; also includes water quality degradation due to pollutant chemicals, nutrient input, or sedimentation/siltation
Habitat loss/degradation outside of Minnesota	Habitat loss or degradation outside of Minnesota that affects the population of the species within Minnesota; mainly applies to migratory species
Alien species and competition	Non-native invasive species or native species with populations outside of the natural range that occurred historically that affect the populations of species in greatest conservation need
Pollution	Contaminants such as pesticides, herbicides, and heavy metals; also includes sedimentation or siltation in river and stream systems.
Social tolerance/ persecution/exploitation	Recreational or commercial overexploitation, killing of individuals due to some perceived undesirable quality (such as large snakes thought to be venomous)
Disease	Introduced diseases or native diseases that are outside the natural range that occurred historically
Food source limitations	Predator species that rely on fluctuating prey cycles, or prey species that are influenced by fluctuating predator cycles
Other	Any factor that influences the species population that does not fall into the above categories (example: prescribed burning effects on prairie insects, road kills)
Peripheral (Y/N/E/D)	Species distribution in Minnesota relative to its entire range. Y = peripheral; N = not peripheral; E = endemic; D = disjunct (see Appendix K, Glossary of Terms, for a description of these designations)

Table 7.2. Species Influence Scores

Influence Score	Description
0	No indication of having an influence on species vulnerability/decline
1	Some indication of having an influence on species vulnerability/decline
2	Moderate influence on species vulnerability/decline
3	High influence on species vulnerability/decline
?	No information available about the species

Table 7.3. Confidence Scores

Confidence Score	Description
0	Not applicable
1	Some anecdotal evidence
2	Some published studies or general expert agreement
3	Several published studies or strong expert agreement
?	No information available about the species

The species assessment shows that the overwhelming influence on species vulnerability and decline is the loss or degradation of habitat in Minnesota (Table 7.4). A few species have other, specific issues that need individual attention.

Table 7.4. Results of the Species Assessment

	Percentage of Species with a Score of				
Influence Category	**3**	**2**	**1**	**0**	**?**
Habitat loss in Minnesota	10	33	33	14	10
Habitat degradation in Minnesota	18	37	28	7	10
Habitat loss/degradation out of Minnesota	1	8	15	71	5
Alien species and competition	2	10	12	70	6
Pollution	0	4	28	60	8
Social tolerance/persecution/exploitation	1	8	12	73	6
Disease	0	1	2	91	6
Food source limitations	0	1	2	91	6
Other	0	2	17	76	5

Note: Species were assigned an influence score from 0 to 3, or "?" if no information was available.

Key Habitat Analysis

The results of the assessment of the species in greatest conservation need clearly indicate the importance of identifying and conserving the habitats they use. Minnesota's 292 SGCN occupy a variety of habitats and are distributed across the entire state. Such a large number of species with a wide variety of needs poses the difficult task of developing strategies that benefit all. Given this challenge of managing for 292 species, CWCS conservation priorities focus primarily on a coarse-filter approach to conserving key habitats used by the SGCN.

Key habitats were identified using the following three methods, which are discussed below:

1. Species habitat use
2. Major changes in land cover
3. Identification of priority stream reaches based on analyses by The Nature Conservancy

Aquatic and terrestrial habitats were analyzed separately given that they differ in the type and availability of information, system characteristics, and associated species. Differences between the aquatic and terrestrial analyses are described as they arise in the sections below.

Species Habitat Use

In order to analyze habitat use by SGCN, we first needed to determine species–habitat relationships and species distributions. For this purpose, we adopted the approach developed by the MN GAP Analysis Program for terrestrial vertebrates and made several modifications and additions.

Species–Habitat Relationships

The GAP Level 4 land cover classes (49 categories; see Appendix D) were modified by the CWCS project. The nonforested wetlands portion of the GAP classes was matched to the Cowardin Wetland Classification used in the National Wetland Inventory (Wetlands classes 1 to 5; Table 7.5), including the NWI category, "Seasonally flooded basin or flat," which did not have a GAP equivalent. The addition of eight lake classes (Tables 7.5 and 7.6; Valley et al. 2004) and seven river classes (Tables 7.5 and 7.7) expanded the GAP Level 4 "aquatic" category. Specific terrestrial habitats that did not have a GAP equivalent were also included and are "cliff/talus slope," "shoreline/dune," "oak savanna," "oak woodland," and "jack pine woodland." River classes were developed using data on stream and watershed size from the Minnesota Pollution Control Agency (Scott Nemela, personal communication). Linear regression of drainage area versus stream size for streams with drainage areas less than 200 square miles was run to determine reasonable break points for the classifications and the average stream widths (Figure 7.1). The approach described here resulted in a total of 70 classes of habitat that were related to the SGCN.

Relating the invertebrate and aquatic species to the 70 CWCS habitat classes was accomplished using a variety of published materials and expert consultation. We made some modifications to the terrestrial species–habitat relationships, originally created by the GAP analysis project. These species-habitat relationships were developed for use in GIS models using buffers and adjacency of nonprimary habitat, whereas the CWCS species–habitat relationships were based on presence/absence in the primary habitat(s) used by species for breeding (or main migratory habitat for migrating shorebirds). The CWCS Feedback Teams (see chapter 2) reviewed all of the species–habitat relationships, and further changes were made following those reviews.

Table 7.5. CWCS–GAP Level 4 Habitat Categories

GAP 4 ID	GAP Level 4	CWCS Level 4
1	Mixed development	Mixed development
2	High-intensity urban	High-intensity urban
3	Low-intensity urban	Low-intensity Urban
4	Transportation	Transportation
5	Barren	Barren
6	Cropland	Cropland
7	Grassland	Grassland
8	Prairie	Prairie
9	Upland shrub	Upland Shrub
10	Lowland deciduous shrub	Lowland deciduous shrub
11	Lowland evergreen shrub	Lowland evergreen shrub
12	Water	Lake-Small, Shallow, not alkaline
12	Water	Lake-Large, Shallow, not alkaline
12	Water	Lake-Small, Shallow, alkaline
12	Water	Lake-Large, Shallow, alkaline
12	Water	Lake-Small, Deep, not alkaline
12	Water	Lake-Large, Deep, not alkaline
12	Water	Lake-Small, Deep, alkaline
12	Water	Lake-Large, Deep, alkaline
12	Water	River-Headwater, cold
12	Water	River- Moderate, cold
12	Water	River-Large, cold
12	Water	River-Headwater, warm
12	Water	River-Moderate, warm
12	Water	River-Large, warm
12	Water	River-Very large, warm
12	Water	Shallow open water
14	Sedge Meadow	Wet meadow
15	Broadleaf Sedge/Cattail	Shallow marsh
15	Broadleaf Sedge/Cattail	Deep marsh
16	Jack Pine	Jack Pine
17	Red/White Pine	Red/White Pine
18	Red Pine	Red Pine
19	White Pine mix	White Pine mix
20	Balsam Fir mix	Balsam Fir mix
21	White Spruce	White Spruce
22	Upland Black Spruce	Upland Black Spruce
23	Upland Northern White Cedar	Upland Northern White Cedar
24	Red cedar	Red cedar
25	Upland Conifer	Upland Conifer
26	Lowland Black Spruce	Lowland Black Spruce
27	Stagnant Black Spruce	Stagnant Black Spruce
28	Tamarack	Tamarack
29	Stagnant Tamarack	Stagnant Tamarack
30	Lowland Northern White-Cedar	Lowland Northern White Cedar
31	Stagnant Northern White-Cedar	Stagnant N White Cedar
32	Stagnant Conifer	Stagnant Conifer
33	Aspen/White Birch	Aspen/White Birch
34	White/red Oak	White/Red Oak
35	Bur/White Oak	Bur/White Oak
36	Red Oak	Red Oak
37	Northern Pin Oak	Northern Pin Oak
38	Maple/Basswood	Maple/Basswood
39	Upland Deciduous	Upland Deciduous mix
40	Black Ash	Black Ash
41	Silver Maple	Silver Maple
42	Cottonwood	Cottonwood
43	Lowland Deciduous	Lowland Deciduous Mix
44	Upland Coniferous-Deciduous mix	Upland Conifer/Deciduous Mix Forest
45	Jack Pine-Deciduous mix	Jack Pine-Deciduous mix
46	Red/White Pine-Deciduous mix	Red/White Pine-Deciduous mix
47	Spruce/Fir-Deciduous mix	Spruce/Fir-Deciduous mix
48	Redcedar-Deciduous mix	Red cedar-Deciduous mix
49	Lowland Conifer-Deciduous mix	Lowland Conifer/Decid. Mix Forest
NA	NA	Cliff/talus slope
NA	NA	Shoreline/dune
NA	NA	Seasonally flooded basin or flat
NA	NA	Jack pine woodland
NA	NA	Oak savanna
NA	NA	Oak woodland

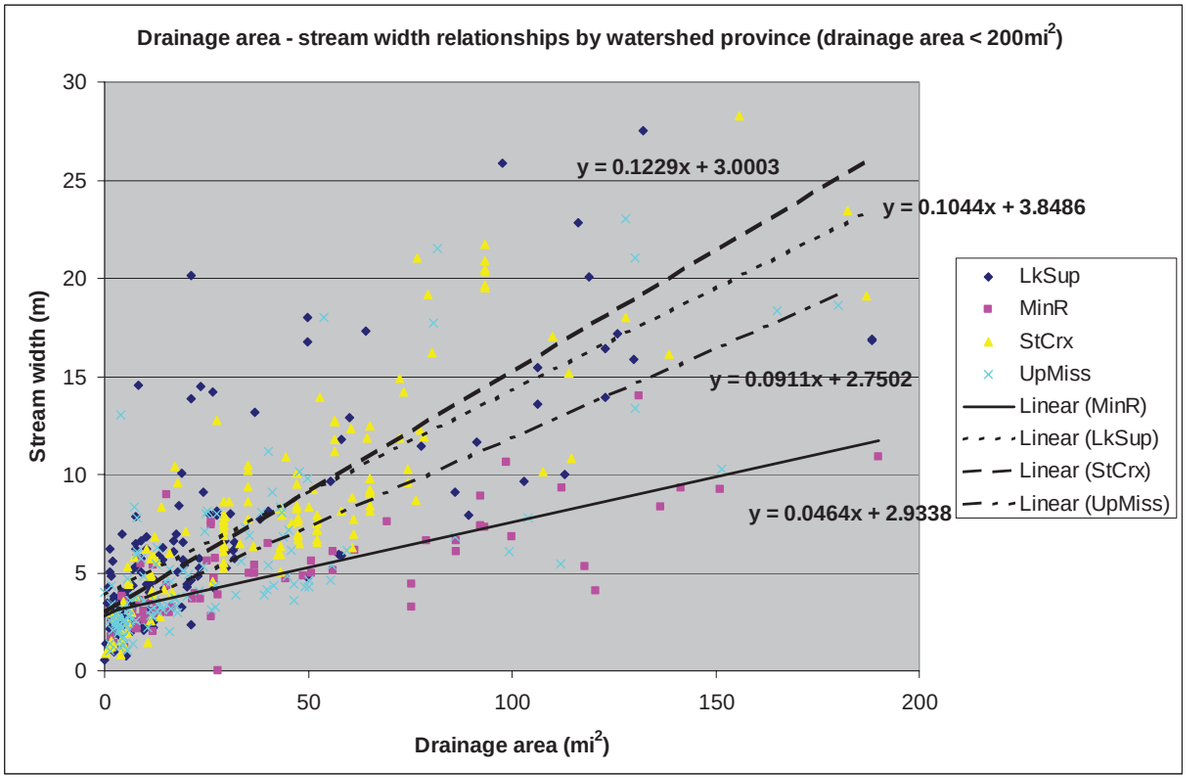
Table 7.6. Lake Parameter Descriptions

Parameter	Descriptions	
Area	Small: < 500 acres (200 hectares)	Large: > 500 acres (200 hectares)
Depth	Shallow: < 15 ft (5m) or > 80% littoral	Deep: > 15 ft (5 m) or < 80% littoral
Alkalinity	Alkaline: > 100 ppm mg/L $CaCO_3$	Not alkaline: < 100 ppm mg/L $CaCO_3$

Table 7.7. River Size Descriptions

Stream Size	Watershed Area	Maximum Width
Headwater	< 25 mi^2 (65 km^2)	averages ~ 13 ft (4 m) across, varies from ~ 3–23 ft (1–7 m)
Moderate	25–200 mi^2 (65–520 $km^{2)}$	averages ~ 33 ft (10 m) across, varies from ~ 16–50 ft (5–15 m)
Large	> 200 mi^2 (520 km^2)	averages ~ 100 ft (30 m) across, varies from ~ 50–150 ft (15–45 m)
Very large	Large rivers with backwater systems, as well as large, hybrid lake/river systems. These are the Lower Mississippi and Lake Pepin, lower St. Croix and Lake St. Croix, and lower Minnesota.	

Figure 7.1. Watershed Area and Stream Width Relationships of Streams with Drainage Areas < 200 Square Miles by Watershed Province (LkSup = Lake Superior province, MinR = Minnesota River province, StCrx = St. Croix River province, UpMiss = Upper Mississippi River province)

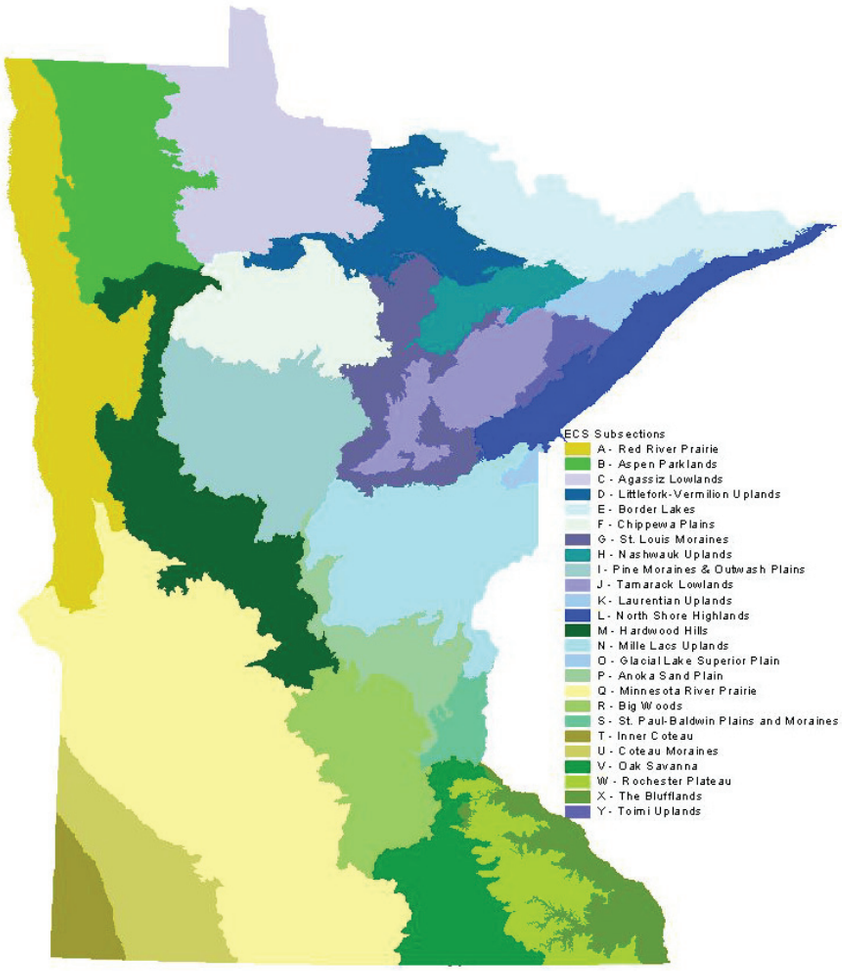


Species Distribution

To determine species distribution, we again used the data and process from the MN GAP Analysis Project and assigned each species a presence or absence in each of the 25 ecological subsections in Minnesota (Figure 7.2). Aquatic and invertebrate species were added, and a few adjustments to the existing terrestrial vertebrate distributions were made. Terrestrial vertebrates mapped at a detail finer than the subsection were scaled up to the subsection level. Aquatic species were first assigned to the eight major watersheds in Minnesota (Hatch et al., 2003). Intersecting the watersheds with the ecological subsections allowed assignment of aquatic species distribution to the ecological subsections. In some cases, a subsection included only a small part of a major watershed where the aquatic species was recorded to occur. For these cases, we checked the distribution of spatially located species occurrence records collected from a variety of surveys to determine whether the aquatic species had been found in that subsection. While there is not perfect overlap between the subsections and major watersheds, the distribution scores are sufficient for working at the scale of the state of Minnesota.

Upon completing the presence/absence scores for habitat and distribution, we then summed the number of species in each habitat in each subsection. This calculation resulted in a species use value for each habitat in a particular subsection, which was used to guide selection of key habitats.

Figure 7.2. Minnesota's ECS Subsections



Selection of Key Habitats Based on Habitat Use

Prior to selecting key habitats, we combined 66 of the 70 CWCS habitat classes (CWCS Level 4) into coarser categories (CWCS Level 2, Table 7.8). These categories were developed in order to have a manageable number of categories, to be able to compare them with the Marschner pre-1890s vegetation classes (see the section "Analysis of Major Changes in Land Cover," later in this chapter, for a description) used in the land cover change analysis, and to depict ecologically and managerially meaningful categories. Four of the categories, "upland coniferous/deciduous mix forest," "lowland coniferous/deciduous mix forest," "red cedar," and "red cedar-deciduous mix," were not included as they created some problematic categories when they were combined to a higher level. Careful examination showed that leaving these categories out of the Level 2 categories did not change any results. That is, no species was uniquely associated with any of the four omitted land cover categories.

Table 7.8. CWCS Level 2 Compared to CWCS Level 4

CWCS Level 2	CWCS Level 4	
Forest-Upland Deciduous (Aspen)	- Aspen/White Birch	
Forest-Upland Deciduous (Hardwood)	- White/Red Oak - Bur/White Oak - Red Oak	- N Pin Oak - Maple/Basswood - Upland Deciduous mix
Forest-Upland Conifer	- Jack Pine - Red/White Pine - Red Pine - White Pine mix - Balsam Fir mix - White Spruce	- Upland Black Spruce - Upland N White Cedar - Upland Conifer - Jack Pine-Deciduous mix - Red/White Pine-Deciduous mix - Spruce/Fir-Deciduous mix
Shrub/woodland-Upland	- Upland Shrub - Jack Pine woodland	- Oak Savanna - Oak Woodland
Prairie	- Prairie	
Forest-Lowland Deciduous	- Black Ash - Silver Maple	- Cottonwood - Lowland Deciduous Mix
Forest-Lowland Conifer	- Lowland Black Spruce - Stagnant Black Spruce - Tamarack - Stagnant Tamarack	- Lowland N White Cedar - Stagnant N White Cedar - Stagnant Conifer
Shrub-Lowland	- Lowland deciduous shrub - Lowland evergreen shrub	
Wetland-Nonforest	- Seasonally flooded basin or flat - Wet meadow - Shallow marsh	- Deep marsh - Shallow open water
Grassland	- Grassland	
Shoreline-dunes-cliff/talus	- Barren - Cliff/talus slope	- Shoreline/dunes
Cropland	- Cropland	
Developed	- Mixed Development - High-intensity Urban	- Low-intensity Urban - Transportation
Lake-Shallow	- Lake-Small, Shallow, not alkaline - Lake-Large, Shallow, not alkaline	- Lake-Small, Shallow, alkaline - Lake-Large, Shallow, alkaline
Lake-Deep	- Lake-Small, Deep, not alkaline - Lake-Large, Deep, not alkaline	- Lake-Small, Deep, alkaline - Lake-Large, Deep, alkaline
River-Headwater to Large	- River-Headwater, cold - River-Moderate, cold - River-Large, cold	- River-Headwater, warm - River-Moderate, warm - River-Large, warm
River-Very Large	- River-Very large, warm	

Terrestrial Habitats

Key terrestrial habitats used by species in greatest conservation need were identified using two methods: substantial habitat use and specialist habitat use. For both methods, habitats were included for analysis only if they made up at least 1 percent of the subsection, either historically or currently.

To determine habitats that have the most substantial number of species ("substantial habitat use"), we used a one-tailed z-test on the number of species in each habitat and subsection. This should not be considered a statistical test of significance; rather, it is a consistent method that considers the number of species by habitat "array" to determine a cutoff line for designating key habitats. The array of number of species by habitat followed roughly a normal distribution, thus validating the use of standard statistical sampling techniques. To guide the identification of key habitats, we chose to identify only those habitats with a $p < 0.01$ of the z-distribution (Table 7.9). Only those habitats that met the *p*-value cutoffs and made up more than 5 percent of the subsection, either historically or currently, were selected as a key habitat.

Table 7.9. Substantial Habitat Use Example from the Anoka Sand Plain Subsection

CWCS Level 2 Habitat	Number of Species	*p*
Forest-Upland Deciduous (Aspen)	15	0.9884
Forest-Upland Deciduous (Hardwood)	22	0.3270
Forest-Upland Conifer	22	0.3270
Shrub/woodland-Upland	30	0.0002
Prairie	34	0.0000
Forest-Lowland Deciduous	17	0.9324
Forest-Lowland Conifer	10	1.0000
Shrub-Lowland	19	0.7634
Wetland-Nonforest	36	0.0000
Grassland	31	0.0000
Shoreline-dunes-cliff/talus	15	0.9884
Cropland	11	0.9999
Developed	9	1.0000

Note: Z-test based on number of species in greatest conservation need using a particular habitat. **Gray-bold** indicates habitats that meet the $p < 0.01$ cutoff.

A second factor used in the identification of key habitats based on species habitat use was their importance to species that are habitat specialists. Habitat specialists were defined as those using two or fewer habitats (CWCS Level 2). The logic for including the second factor is that habitat specialists are both more vulnerable to habitat change and more likely to benefit greatly from conservation of their key habitats. The rule for selecting key habitats based on the number of specialist species depended on both the total number of species in a given habitat and the percentage that are "specialists." Habitats with at least 15 species of which at least 20 percent are specialists were selected as key habitats (Table 7.10). Again, habitats were selected only if they made up more than 5 percent of the subsection, either historically or currently.

Table 7.10. Unique Terrestrial Habitat Use Example from the Anoka Sand Plain Subsection

CWCS Level 2 Habitat	Number of Species	Percentage of Species Using ≤ 2 Habitats
Forest-Upland Deciduous (Aspen)	15	0
Forest-Upland Deciduous (Hardwood)	22	9
Forest-Upland Conifer	22	5
Shrub/woodland-Upland	30	13
Prairie	34	**21**
Forest-Lowland Deciduous	17	6
Forest-Lowland Conifer	10	10
Shrub-Lowland	19	5
Wetland-Nonforest	36	**44**
Grassland	31	6
Shoreline-dunes-cliff/talus	15	**60**
Cropland	11	0
Developed	9	22

Note: **Gray-bold** indicates habitats that have > 15 SGCN and at 20 percent "specialists" that make up more than 5 percent of the subsection, either currently or historically.

Aquatic Habitats

Because there are only four categories of aquatic habitats, it was not feasible to analyze among habitat types for each subsection as was done with the terrestrial habitats. Also, the broad habitat categories did not allow for a specialist aquatic habitat use analysis. Stream habitats are considered a priority in all subsections because generally they are highly imperiled and their condition is reflective of the condition of terrestrial habitats surrounding them. Priority stream reaches were identified using results from The Nature Conservancy's Ecoregional Assessments (see below, "Identification of Priority Stream Reaches"). However, preliminary examination of the data revealed that some subsections are clearly more important in terms of the number of species in greatest conservation need that potentially occur in aquatic habitats. Therefore, we conducted an analysis between subsections for each of the four aquatic habitat types.

For the analysis of aquatic habitats between subsections, we used the number of species in a habitat for each subsection. A standard z-test was then run, and subsections with $p < 0.0001$ were highlighted as having a substantial potential number of species in greatest conservation need for that particular habitat (Table 7.11). The strict *p*-value cutoff was used to keep the number of subsections with designated priority habitats to a minimum.

Table 7.11. Aquatic Substantial Habitat Use Analysis

Ecological Subsections	River-Very large		River-Headwater to large		Lake-Deep		Lake-Shallow	
	No. of Species	*p*	No. of Species	*p*	No. of Species	*p*	No. of Species	*p*
Agassiz Lowlands	5	0.9903	10	0.9967	5	0.7999	12	0.0463
Anoka Sand Plain	13	0.3221	16	0.3022	6	0.1422	**15**	**0.0000**
Aspen Parklands	5	0.9903	7	1.0000	5	0.7999	**19**	**0.0000**
Big Woods	**38**	**0.0000**	**26**	**0.0000**	7	0.0014	**17**	**0.0000**
Blufflands	**51**	**0.0000**	**35**	**0.0000**	4	0.9970	10	0.6824
Border Lakes	3	0.9988	8	0.9999	**9**	**0.0000**	5	1.0000
Chippewa Plains	3	0.9988	12	0.9495	7	0.0014	11	0.2730
Coteau Moraines	8	0.9011	14	0.7127	2	1.0000	13	0.0029
Glacial Lake Superior Plain	3	0.9988	7	1.0000	2	1.0000	7	0.9999
Hardwood Hills	7	0.9493	14	0.7127	7	0.0014	**18**	**0.0000**
Inner Coteau	9	0.8258	14	0.7127	2	1.0000	10	0.6824
Laurentian Uplands	2	0.9996	5	1.0000	3	1.0000	3	1.0000
Littlefork-Vermilion Uplands	3	0.9988	8	0.9999	4	0.9970	6	1.0000
Mille Lacs Uplands	**24**	**0.0000**	**34**	**0.0000**	**11**	**0.0000**	10	0.6824
Minnesota River Prairie	16	0.0653	17	0.1451	7	0.0014	**18**	**0.0000**
Nashwauk Uplands	3	0.9988	6	1.0000	3	1.0000	6	1.0000
North Shore Highlands	4	0.9964	12	0.9495	**11**	**0.0000**	8	0.9957
Oak Savanna	14	0.2084	**25**	**0.0000**	3	1.0000	8	0.9957
Pine Moraines & Outwash Plains	4	0.9964	14	0.7127	7	0.0014	11	0.2730
Red River Prairie	5	0.9903	8	0.9999	4	0.9970	13	0.0029
Rochester Plateau	14	0.2084	**27**	**0.0000**	3	1.0000	5	1.0000
St. Louis Moraines	3	0.9988	10	0.9967	**8**	**0.0000**	8	0.9957
St. Paul-Baldwin Plains	**50**	**0.0000**	**32**	**0.0000**	7	0.0014	**15**	**0.0000**
Tamarack Lowlands	3	0.9988	8	0.9999	5	0.7999	9	0.9397
Toimi Uplands	2	0.9996	7	1.0000	4	0.9970	4	1.0000
Mean	11.68		15.04		5.44		10.44	
Standard error	2.86		1.85		0.52		0.93	

Note: **Gray-bold** indicates those subsections where the number of species met the $p < 0.0001$ cutoff among all the subsections.

Analysis of Major Changes in Land Cover

The analysis of major changes in land cover is based on two premises:

1. The primary reason for the decline of the species in greatest conservation need is the loss of habitat (see earlier section titled “Species Assessments”).
2. These habitats were once arrayed on the landscape in an amount and configuration that supported the full assemblage of species in Minnesota, including those species currently in greatest conservation need.

A comparison of the habitat distribution and acreage from the original Public Land Survey records to the GAP land cover highlights changes to the distribution of habitat elements that were present prior to settlement by people of European descent (for information about Public Land Surveys, see Almendinger 1997; Friedman and Reich 2005). We recognize that species distributions and abundances have ebbed and flowed over time across the landscape, but we assert that diverse communities of wildlife in the recent past included most of the species in greatest conservation need today. We also recognize that the landscape was already inhabited by humans prior to settlement by people of European descent and do not interpret pre-European settlement as meaning a "natural state" unmodified by humans. Finally, reverting to presettlement conditions is not feasible, nor in many cases is it desirable. Rather, this information serves as a valuable conservation tool that helps identify the major landscape elements that have experienced the greatest changes in the past 100 years and are depended on by species in greatest conservation need.

The analysis of major changes in land cover was done for terrestrial habitats only and used two main sources of information: the presettlement vegetation map by Marschner (1930) ("1890s vegetation") and the MN GAP land cover classification map ("1990s vegetation"). A different analysis used for wetlands is described further below in this section. Categories between the two maps were crosswalked to allow for direct comparison between the data layers (Table 7.12). For information on the accuracy and development of these two data layers, see the Web links listed in the references at the end of this chapter.

In addition, other sources of information were used to check the results of these comparisons and to provide more detail (Figure 7.3). The results of these other analyses of information were similar to the Marschner–GAP comparison and generally allowed for a more detailed habitat breakdown in terms of composition, age, structure, or quality (see Appendix C, Links to Other Plans).

The one-square-mile resolution of Public Land Office bearing trees was not fine enough to determine the amount of pre–European settlement wetlands because wetlands are and were often present as small, isolated depressions. To account for this, we used the analysis of Anderson and Craig (1984) examining the distribution of hydric soils. Since this analysis dates from 1984, it is a conservative estimate of wetlands loss today as drainage and conversion of wetlands has continued since that time.

The amount of habitat in the two time periods (1890s and 1990s) was calculated for each ecological subsection. Substantial habitat change was defined as a habitat that made up more than 5 percent of the subsection in the 1890s and had declined by more than 50 percent by the 1990s. The same cutoffs were used for the wetland analysis.

Table 7.12. CWCS Level 2–Marschner Crosswalk

CWCS Level 2	Marschner Classes
Forest-Upland Deciduous (Aspen)	- Aspen-Oak Land
	- Aspen-Birch (trending to hardwoods)
	- Aspen-Birch (trending to conifers)
Forest-Upland Deciduous (Hardwood)	- Big Woods-Hardwoods (Oak, Maple, Basswood, Hickory) - Mixed Hardwood and Pine (Maple, White Pine, Basswood, etc.)
Forest-Upland Conifer	- White Pine
	- Mixed White Pine and Red Pine
	- Pine Flats (Hemlock, Spruce, Fir, White Pine, Aspen)
Shrub/woodland-Upland	- Brush-prairie
	- Oak openings and barrens
	- Jack Pine barrens and openings
Prairie	- Prairie
Forest-Lowland Deciduous	- River bottom forest
Forest-Lowland Conifer/shrubland	- Conifer bogs and swamps
Wetland-Nonforest	- Wet prairie
	- Open muskeg
Water	- Lakes (open water)

Figure 7.3. Additional Sources of Historic and Current Land Cover

Historic land cover data sources

Range of Natural Variation Models

Comparisons of Bearing Trees and Forest Inventory and Analysis (FIA); Friedman and Reich, 2005; Almendinger and Hanson, 2004

Current land cover data sources

Minnesota County Biological Survey (MN DNR), 1897–present

HAPET models of Grassland Bird Conservation Areas

Identification of Priority Stream Reaches

In addition to the habitat use analysis, we identified additional key streams and rivers, with associated lakes and wetlands, by adapting freshwater ecoregional assessment methods developed by The Nature Conservancy (TNC) (Higgins et al., 2005). Specific stream reaches within TNC-identified Areas of Biodiversity Significance were chosen as key stream habitats. Since TNC's methodology explicitly focuses on the best examples of representative habitat intended to encompass all biological diversity, their identified stream habitats were not necessarily most important for species in greatest conservation need. Our analysis therefore identified additional stream reaches with concentrated SGCN occurrences. A description of TNC's process follows.

General Methodology for Freshwater Habitat Assessments

The goal of ecoregional conservation assessments is the identification of a set of areas that together represent the best opportunities to conserve a full array of freshwater species, natural assemblages, and ecosystems within an ecoregion (Groves, 2003).

Ecoregional assessments begin by identifying important elements of biological diversity that ultimately will be used to select a set of conservation areas. Such important elements represent priority biological resources at multiple scales and include:

- aquatic ecological systems
- species assemblages
- animal and plant species of special concern

Once elements are selected, numeric goals for conservation are established for each. Goals represent the number of viable occurrences and spatial distribution of each element across the region that is needed to maintain populations or systems over the time span of a century. Aquatic ecological systems that encompass the most viable occurrences for each element are mapped as Areas of Biodiversity Significance (ABS). A final portfolio is then selected that includes areas that best meet numeric conservation goals.

Classification Methods and Framework

The classification methods used to generate the set of priority stream and river habitats were based on both physical and biological criteria. The classification framework was developed to be applicable across a large region, provide a biodiversity context, and use data that are readily available, at an appropriate scale, and mappable (Higgins et al., 2005).

The hierarchical classification framework consists of four nested spatial scales: aquatic zoogeographic unit, ecological drainage unit (EDU), aquatic ecological system (AES), and macrohabitat (listed from coarsest to finest). These four levels constitute a minimum set to reflect ecological patterns. Zoogeographic units, the highest level in the classification, are the overall planning units, which are used to delineate the classification area. EDUs represent finer scales of physiographic and zoogeographic diversity allowing the stratification of rivers and lakes that are potential conservation priorities. AESs and macrohabitats generate the conservation elements (conservation targets) by considering how local distribution patterns of aquatic species are shaped by the physical environment (Higgins et al., 2005).

The classification framework works both for data-rich (bottom–up) and data-poor (top–down) regions. Examples of attributes used in the classification of AESs and macrohabitats for streams and rivers include gradient, size, local connectivity/drainage network position, and hydrologic regime. Among the products generated by the classification process is a spatially comprehensive inventory of classified and mapped units that may be used in the remote classification of regional patterns of AESs or aquatic habitat. (Higgins et al., 2005).

Selecting the Conservation Portfolio

Within a given region, the classification is used to select a conservation portfolio, using AESs as the building blocks. During the portfolio selection process, information is gathered about target occurrences, threats, and viability for each AES. Priority aquatic habitats, or ABSs, are selected

using available information about target occurrences, threats, and viability for each AES (e.g., Gagnon et al. 2004). Among the attributes considered are species and assemblages, AES type, and landscape quality metrics, such as percentage cover in natural vegetation, percentage altered cover, percentage urban/road cover, stream sinuosity, point source pollution density, and dam density.

In addition to the data-based evaluations of each potential ABS, expert input is sought during the portfolio development process. For example, experts are often asked to rank the relative viability of species and assemblages. They further are asked to identify threats to each target occurrence. When available, expert opinion is integrated into the portfolio selection process.

The portfolio assembly process is iterative. Systems are progressively added to the network based on conservation value, and progress toward achieving numeric conservation goals is periodically assessed (Gagnon et al. 2004). In some instances, an ABS is included even if it has poor viability and few species or assemblage occurrences simply because it is the only representative example of that type within the classification.

How the TNC Aquatic Conservation Portfolios Appear in CWCS

Existing aquatic ecoregional assessments that included Minnesota were examined and merged to create a comprehensive, statewide layer of priority aquatic habitats. Information from five separate plans was integrated to provide a starting point for the Comprehensive Wildlife Conservation Strategy, including the following ecoregions: Northern Tallgrass Prairie, Prairie Forest Border, Superior Mixed Forest, and Great Lakes (The Nature Conservancy, Prairie Forest Border Ecoregional Planning Team 2000; Dephilip 2001; Superior Mixed Forest Ecoregional Planning Team 2002; Weitzell et al. 2003; Gagnon et al. 2004). Because TNC's methodology explicitly focuses on the best examples of representative habitat intended to encompass all biological diversity, not just SGCNs, the SGCNs were overlaid on the merged portfolio. Additional priority habitats were thus identified on the basis of concentrated SGCN occurrences alone. The results of this assessment are mapped and listed in the subsection profiles in chapter 5, An Ecological Assessment of Species in Greatest Conservation Need in Minnesota.

Tomorrow's Habitat for the Wild and Rare

An Action Plan for Minnesota Wildlife

Appendixes

A. Definition of Species in Greatest Conservation Need

B. Set of Species in Greatest Conservation Need

C. Links to Other Plans (available via web only)

D. MN GAP Level 4 Land Cover Class Descriptions

E. Occurrences of Species in Greatest Conservation Need by Ecological Subsection

F. Species in Greatest Conservation Need by ECS Province

G. Species in Greatest Conservation Need by ECS Subsection

H. Data Sources for Maps Used in the Subsection Profiles

I. Key River and Stream Reaches by Subsection

J. Wildlife Recreation and Tourism Considerations

K. Glossary of Terms

Appendix A
Definition of Species in Greatest Conservation Need

Species in greatest conservation need (SGCN) are animal species whose populations are rare, declining, or vulnerable in Minnesota and meet one or more of the following criteria:

A. Species whose populations are identified as being rare, declining, or vulnerable in Minnesota[1]

B. Species at risk because they depend upon rare, declining, or vulnerable habitats[2] (such as native prairies and grasslands; lakeshores and riparian corridors; wetlands; brushlands; unimpounded river and stream channels; unfragmented interior forest).

C. Species subject to other specific threats that make them vulnerable, such as:

- Over-exploitation
- Invasive species
- Disease
- Contaminants
- Lack of citizen understanding and stewardship (such as killing large snakes thought to be venomous)

D. Species with certain characteristics that make them vulnerable, such as species that:

- Require large home ranges/use multiple habitats
- Depend upon large habitat patch sizes
- Need special resources
- Depend upon an ecological process (such as fire) that no longer operates within the natural range of variation (RNV)
- Are limited in their ability to recover on their own due to low dispersal ability or low reproductive rate
- Have a highly localized or restricted distribution (Endemics).
- Concentrate their populations during some time of the year (such as bats clustering in hibernacula and migratory stop-overs).

E. Species whose Minnesota populations are stable, but are declining in a substantial part of their range outside of Minnesota (such as common loon or black tern)**.**

Criteria for adding to or removing from the set of Minnesota Species in Greatest Conservation Need
Minnesota Comprehensive Wildlife Conservation Strategy

Overview: The set of species in greatest conservation need is dynamic and can change over time as new information becomes available or the status of a species changes.

I. Criteria for adding species to the set of Minnesota Species in Greatest Conservation Need

a. Species identified on formal lists[3]:

- **Federally listed species**
- **Heritage Global Rank:** Species ranked G1,G2, or G3 (excluding bird species[4])
- **Minnesota's List of Endangered, Threatened, or Special Concern** species
- **Partners in Flight (PIF)[5] Continental Watch List** bird species that breed in Minnesota.
- **Partners in Flight (PIF) [5] Landbird Regional Plans:** Tier 1, 2A, and 2C species in at least one of Physiographic areas 16, 20, 32, and 40 and breed in Minnesota. (PA32 covers only a small portion of Minnesota and species were individually reviewed to determine if they meet the SGCN definition for Minnesota).
- **Regional Shorebird Conservation Plans:** Species identified as Highly Imperiled (5) or High Concern (4) in at least one of bird conservation regions (BCR) 11, 12, 22, 23, and either breed or are significant migrants in Minnesota.
- **Minnesota Waterbird Conservation Plan:** species identified as high or moderate concern in at least one of bird conservation regions (BCR) 11, 12, 22, 23 and breed in Minnesota.
- **US Fish and Wildlife Service Region 3 Species of Concern** (excluding bird species[4])
- **MN DNR Watch List** (excluding bird species[4])
- **Convention on International Trade in Endangered Species (CITES)** (excluding bird species[4])
- **The World Conservation Union (IUCN) Red List of Threatened Species** (excluding bird species[4])
- **NRRI Breeding Bird Monitoring:** Bird species showing significant ($P \leq 0.05$) declines in all 4 sample areas (Superior, Chippewa, Chequamegon/Nicolet National Forests and the St. Croix Region of E. Central MN) as well as overall regionally, and are supported by corroborative information from other regional surveys (e.g. PIF regional or continental plans).

b. Species, other than those on the above lists, identified through an expert review process to meet the CWCS Species in Greatest Conservation Need definition (items A-E).

II. Criteria for excluding species from the set of Minnesota Species in Greatest Conservation Need

a. Does not meet the definition of Species in Greatest Conservation Need (items A-E).
b. Species has not been documented to occur in Minnesota.
c. Species is presumed extirpated from Minnesota, with no expectation of it returning as a resident in the next 10 years.
d. Species is abundant in Minnesota and regionally, nationally, or globally
e. Species occurrence is occasional as a result of the wandering behavior of individuals and no resident populations are established or likely to become established in the next ten years. Regular migrating species that depend on habitat within Minnesota (such as shorebirds) are not included in this group.

SGCN Definition: Supporting information

[1] Rare Species: species whose low population densities, few occurrences, or restricted distributions warrant concern about their viability in Minnesota. Consider global population status for determining a species' inclusion in the set.
Declining species: Species whose populations have substantially declined, and declines are not part of a recognized population cycle.
Vulnerable species: Species with life-history, habitat needs, or other specific threats that make them vulnerable to population declines.

[2] Rare habitats: habitats with few occurrences or restricted distributions in Minnesota that may impact the viability of species that depend on them.
Declining habitats: Acreage or overall quality of habitat has substantially declined.
Vulnerable habitats: Habitats most likely to be altered or degraded.

[3] Use of the lists shown above were based on:

1. Geographical scale – selected lists that considered species populations at the global (Heritage Global Rank, CITES, and IUCN), Continental (PIF Continental Plan), National (Federal Endangered Species List), Regional (PIF Regional plans, Waterbird, Shorebird plans), and State (Minnesota's List of Endangered, Threatened, or Special Concern) scales.

2. Quantitative – preference given to lists that have an organized scoring system based on multiple attributes of species' populations, habitats, and threats. Included in this process is the use of groups with taxonomic expertise to conduct this scoring process.

3. Original – some lists are based on the results of other lists (such as the USFWS Species of Concern using results from PIF) and we limited use to the original sources of this information.

[4] Plans for bird species are the most developed in terms of population abundance and trends information. Therefore, after federal and state listed species, the PIF Landbird, Shorebird, and Waterbird plans, and NRRI Breeding Bird Monitoring are the sole lists used. Birds may be added through an expert review process if they meet the SGCN definition (items A-E) and criteria.

[5] Partners in Flight (PIF) Regional plans. See http://www.blm.gov/wildlife/pifplans.htm for information on the tiering criteria. Region plans that cover Minnesota are the following:

- PA20: Boreal Hardwood Transition or Physiographic Area 20. Roughly equivalent to the N. American Bird Conservation Initiative (NABCI) Bird Conservation Region 12 (BCR 12)
- PA40: Northern Tallgrass Prairie (~BCR11)
- PA16: Upper Great Lakes Plain (~BCR 23)
- PA32: Dissected Till Plains (~BCR 22).

For more information on the lists, please see the following websites.

-Heritage Global Rank: http://www.natureserve.org/explorer/ranking.htm
-Federal Endangered Species Act: http://endangered.fws.gov/
-Minnesota Endangered, Threatened & Special Concern Species: http://www.dnr.state.mn.us/ets/index.html
-Partners in Flight Regional Landbird Plans: http://www.blm.gov/wildlife/pifplans.htm
-Waterbird Conservation Plan: http://www.waterbirdconservation.org/
-US Fish and Wildlife Service Region 3 Resource Conservation Priorities:
http://midwest.fws.gov/Endangered/lists/concern.html
-U.S. Shorebird Conservation Plan: http://shorebirdplan.fws.gov/
-Convention on International Trade in Endangered Species(CITES): http://www.cites.org/
-IUCN Red List (The World Conservation Union): http://www.iucn.org/
-NRRI Breeding Bird Monitoring: http://www.nrri.umn.edu/mnbirds/default.htm

Tomorrow's Habitat for the Wild and Rare: an Action Plan for Minnesota Wildlife

Appendix B. Set of Species in Greatest Conservation Need

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Mammals				
Canis lupus	Gray Wolf	SPC	THR	Federally Threatened, MN Special Concern.
Cervus elaphus	Elk	SPC	NL	MN Special Concern.
Cryptotis parva	Least Shrew	SPC	NL	MN Special Concern.
Felis concolor	Mountain Lion	SPC	NL	MN Special Concern.
Lynx canadensis	Canada lynx	SPC	END	Federally Endangered.
Microtus chrotorrhinus	Rock Vole	NL	NL	Tracked in MN heritage database.
Microtus ochrogaster	Prairie Vole	SPC	NL	MN Special Concern.
Microtus pinetorum	Woodland Vole	SPC	NL	MN Special Concern.
Mustela nivalis	Least Weasel	SPC	NL	MN Special Concern.
Myotis septentrionalis	Northern Myotis	SPC	NL	MN Special Concern.
Onychomys leucogaster	Northern Grasshopper Mouse	NL	NL	Tracked in MN heritage database.
Perognathus flavescens	Plains Pocket Mouse	SPC	NL	MN Special Concern.
Phenacomys intermedius	Heather Vole	SPC	NL	MN Special Concern.
Pipistrellus subflavus	Eastern Pipistrelle	SPC	NL	MN Special Concern.
Reithrodontomys megalotis	Western Harvest Mouse	NL	NL	Tracked in MN heritage database.
Sorex fumeus	Smoky Shrew	SPC	NL	MN Special Concern.
Spermophilus franklinii	Franklin's Ground Squirrel	NL	NL	Stewardship species - stable pop in MN, declining in region.
Spermophilus richardsonii	Richardson's Ground Squirrel	NL	NL	Tracked in MN heritage database.
Spilogale putorius	Eastern Spotted Skunk	THR	NL	MN Threatened.
Synaptomys borealis	Northern Bog Lemming	SPC	NL	MN Special Concern.
Taxidea taxus	American Badger	NL	NL	Dependent on rare and declining grassland habitat, population numbers are not fully known, protected in WI, IL, MI.
Thomomys talpoides	Northern Pocket Gopher	SPC	NL	MN Special Concern.
Birds				
Accipiter gentilis	Northern Goshawk	NL	NL	Suggested addition by several people on feedback teams. On USFS sensitive spp list - vulnerable habitat (large patches of mature forest), may be regionally declining, tracked by MN DNR Heritage.
Aechmophorus occidentalis	Western Grebe	NL	NL	Suggested addition by several people on feedback teams. Declining MN population, with only 4 nesting colonies. Declining habitat. Been several nesting failures. Tracked in M DNR Heritage database.
Aegolius funereus	Boreal Owl	NL	NL	Suggested addition by several people on feedback teams. Meets several criteria - declining habitat, rare and declining in MN, not adequately surveyed by breeding bird survey, tracked by MN DNR heritage.
Ammodramus bairdii	Baird's Sparrow	END	NL	MN Endangered.
Ammodramus henslowii	Henslow's Sparrow	END	NL	MN Endangered.
Ammodramus leconteii	Le Conte's Sparrow	NL	NL	Highest Partners in Flight Priority (PIF 1) in the Boreal Hardwood Transition plan (BCR12).
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	SPC	NL	MN Special Concern.
Ammodramus savannarum	Grasshopper Sparrow	NL	NL	High Partners in Flight Priority (PIF 2) in several Bird Conservation Regions (BCRs).

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Birds				
Anas acuta	Northern Pintail	NL	NL	According to DNR Waterfowl Committee chair: Continental population stable since 1985, but significant long-term decline dating to the 1950s; MN population low and declining since 1986.
Anas rubripes	American Black Duck	NL	NL	According to DNR Waterfowl Committee chair: Continental population declining, MN population low (<1,000) based on 1991-93 Black Duck Survey.
Anthus spragueii	Sprague's Pipit	END	NL	MN Endangered.
Arenaria interpres	Ruddy Turnstone	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Asio flammeus	Short-eared Owl	SPC	NL	MN Special Concern.
Aythya affinis	Lesser Scaup	NL	NL	According to DNR Waterfowl Committee chair: Continental population declining since 1985 and long-term (Lesser and Greater combined), MN population stable but survey poorly timed for breeding scaup.
Bartramia longicauda	Upland Sandpiper	NL	NL	High Priority (4) in all Bird Conservation Regions of Shorebird Plans.
Botaurus lentiginosus	American Bittern	NL	NL	High priority in all Bird Conservation Regions of Waterbird plans.
Buteo lineatus	Red-shouldered Hawk	SPC	NL	MN Special Concern.
Buteo swainsoni	Swainson's Hawk	NL	NL	Partners in Flight Continental Watchlist.
Calcarius ornatus	Chestnut-collared Longspur	END	NL	MN Endangered.
Calidris alpina	Dunlin	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Calidris fuscicollis	White-rumped Sandpiper	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Calidris pusilla	Semipalmated Sandpiper	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Caprimulgus vociferus	Whip-poor-will	NL	NL	Suggested addition by several people on feedback teams. Not well monitored by breeding bird surveys. Declining populations, insectivore and aerial feeder - special resource needs. Id'd on USFWS reg. 3 concern list.
Catharus fuscescens	Veery	NL	NL	Highest Partners in Flight Priority (PIF 1) in the Boreal Hardwood Transition plan (BCR12).
Charadrius melodus	Piping Plover	END	END	Federally Endangered in Great Lakes watershed, Federally Threatened elsewhere. MN Endangered.
Chlidonias niger	Black Tern	NL	NL	High priority in all Bird Conservation Regions Waterbird plans.
Chordeiles minor	Common Nighthawk	NL	NL	Suggested addition by several people on feedback teams. Not well monitored by breeding bird surveys. Declining populations, insectivore and aerial feeder - special resource needs.
Circus cyaneus	Northern Harrier	NL	NL	High Partners in Flight Priority (PIF 2) in several Bird Conservation Regions (BCRs).
Cistothorus palustris	Marsh Wren	NL	NL	High Partners in Flight Priority (PIF 2) in several Bird Conservation Regions (BCRs).
Cistothorus platensis	Sedge Wren	NL	NL	Highest Partners in Flight Priority (PIF 1) in several Bird Conservation Regions (BCRs).
Coccyzus erythropthalmus	Black-billed Cuckoo	NL	NL	Highest Partners in Flight Priority (PIF 1) in several Bird Conservation Regions (BCRs).
Contopus cooperi	Olive-sided Flycatcher	NL	NL	Partners in Flight Continental Watchlist.
Contopus virens	Eastern Wood-pewee	NL	NL	High Partners in Flight Priority (PIF 2A) in the Boreal Hardwood Transition plan (BCR12). Also shows one of the most significant declines in the NRRI forest bird monitoring.
Coturnicops noveboracensis	Yellow Rail	SPC	NL	MN Special Concern, High priority in several BCRs of Waterbird Plans.
Cygnus buccinator	Trumpeter Swan	THR	NL	MN Threatened.
Dendroica caerulescens	Black-throated Blue Warbler	NL	NL	Highest Partners in Flight Priority (PIF 1) in the Boreal Hardwood Transition plan (BCR12).
Dendroica castanea	Bay-breasted Warbler	NL	NL	Partners in Flight Continental Watchlist.
Dendroica cerulea	Cerulean Warbler	SPC	NL	MN Special Concern.
Dendroica tigrina	Cape May Warbler	NL	NL	Highest Partners in Flight Priority (PIF 1) in the Boreal Hardwood Transition plan (BCR12).
Dolichonyx oryzivorus	Bobolink	NL	NL	Highest Partners in Flight Priority (PIF 1) in several Bird Conservation Regions (BCRs).
Empidonax minimus	Least Flycatcher	NL	NL	High Partners in Flight Priority (PIF 2A) in the Boreal Hardwood Transition plan (BCR12).
Empidonax traillii	Willow Flycatcher	NL	NL	Partners in Flight Continental Watchlist.

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Birds				
Empidonax virescens	Acadian Flycatcher	SPC	NL	MN Special Concern.
Euphagus carolinus	Rusty Blackbird	NL	NL	Partners in Flight Continental Watchlist.
Falcipennis canadensis	Spruce Grouse	NL	NL	Suggested addition by several people on feedback teams. Not well monitored by BBS, on USFS sensitive species list, vulnerable habitat, not much known about population trends, however.
Falco peregrinus	Peregrine Falcon	THR	NL	MN Threatened.
Gallinula chloropus	Common Moorhen	SPC	NL	MN Special Concern, Moderate concern in several BCRs of Waterbird Plans.
Gavia immer	Common Loon	NL	NL	High priority in several Bird Conservation Regions of Waterbird plans.
Haliaeetus leucocephalus	Bald Eagle	SPC	THR	Federally Threatened, MN Special Concern.
Hylocichla mustelina	Wood Thrush	NL	NL	Partners in Flight Continental Watchlist.
Ixobrychus exilis	Least Bittern	NL	NL	Moderate priority in all Bird Conservation Regions (BCRs) of Waterbird plan.
Lanius ludovicianus	Loggerhead Shrike	THR	NL	MN Threatened.
Larus pipixcan	Franklin's Gull	SPC	NL	MN Special Concern.
Limnodromus griseus	Short-billed Dowitcher	NL	NL	High Priority (4) in several Bird Conservation Regions of Shorebird Plans.
Limosa fedoa	Marbled Godwit	SPC	NL	MN Special Concern, Priority 4 on all BCRs of Shorebird plans.
Limosa haemastica	Hudsonian Godwit	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Melanerpes erythrocephalus	Red-headed Woodpecker	NL	NL	Partners in Flight Continental Watchlist.
Melospiza georgiana	Swamp Sparrow	NL	NL	High Partners in Flight Priority (PIF 2A) in the Prairie Hardwood Transition plan (BCR 23). Partners in Flight shows rangewide declines and also a continental stewardship species.
Numenius phaeopus	Whimbrel	NL	NL	High Priority (4) in all Bird Conservation Regions of Shorebird Plans.
Nycticorax nycticorax	Black-crowned Night-heron	NL	NL	Med to high priority in Waterbird plans.
Oporornis agilis	Connecticut Warbler	NL	NL	Highest Partners in Flight Priority (PIF 1) in the Boreal Hardwood Transition plan (BCR12).
Pelecanus erythrorhynchos	American White Pelican	SPC	NL	MN Special Concern.
Phalaropus tricolor	Wilson's Phalarope	THR	NL	MN Threatened, High Priority (4) in all Bird Conservation Regions (BCRs) of Shorebird Plans.
Pheucticus ludovicianus	Rose-breasted Grosbeak	NL	NL	High Partners in Flight Priority (PIF 2A) in the Boreal Hardwood Transition plan (BCR12) and also significant regional declines indicated in NRRI Forest Bird monitoring.
Picoides arcticus	Black-backed Woodpecker	NL	NL	High Partners in Flight Priority (PIF 2C) in the Boreal Hardwood Transition plan (BCR12). Range more extensive in MN than N 3-toed woodpecker and also has high regional threats (habitat needs of large burned areas).
Pluvialis dominica	American Golden-plover	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Podiceps auritus	Horned Grebe	THR	NL	MN Threatened. Moderate concern in several Bird Conservation Regions (BCRs) of Waterbird Plans.
Podiceps grisegena	Red-necked Grebe	NL	NL	High and medium priority in Waterbird Plans, uncommon, wetland habitat declining. Threatened in WI.
Podiceps nigricollis	Eared Grebe	NL	NL	Moderate concern in the Prairie Pothole (BCR 11) Waterbird plan.
Poecile hudsonica	Boreal Chickadee	NL	NL	Suggested addition by feedback team. Sharp continental population decline (PIF=5), threatened habitat.
Protonotaria citrea	Prothonotary Warbler	NL	NL	Partners in Flight Continental Watchlist.
Rallus elegans	King Rail	END	NL	MN Endangered.
Rallus limicola	Virginia Rail	NL	NL	Moderate concern in the Prairie Pothole (BCR 11) Waterbird plan.
Recurvirostra americana	American Avocet	NL	NL	High Priority (4) in the Prairie Pothole (BCR11) Shorebird Plan.
Scolopax minor	American Woodcock	NL	NL	High Priority (4) in all Bird Conservation Regions of Shorebird Plans.
Seiurus aurocapillus	Ovenbird	NL	NL	Suggested addition by feedback team.While does not meet PIF priority (2B), the NRRI Forest Bird monitoring shows highly sig. regional declines. Also vulnerable habitat (forest interior).
Seiurus motacilla	Louisiana Waterthrush	SPC	NL	MN Special Concern.

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Birds				
Speotyto cunicularia	Burrowing Owl	END	NL	MN Endangered.
Sphyrapicus varius	Yellow-bellied Sapsucker	NL	NL	High Partners in Flight Priority (PIF 2A) in the Boreal Hardwood Transition plan (BCR12). Also significant regional declines in NRRI Forest Brid Monitoring.
Spiza americana	Dickcissel	NL	NL	Partners in Flight Continental Watchlist.
Spizella pusilla	Field Sparrow	NL	NL	Highest Partners in Flight Priority (PIF 1) in several Bird Conservation Regions (BCRs). Significant population declines.
Stelgidopteryx serripennis	Northern Rough-winged Swallow	NL	NL	High Partners in Flight Priority (PIF 2) in several Bird Conservation Regions (BCRs).
Sterna forsteri	Forster's Tern	SPC	NL	MN Special Concern.
Sterna hirundo	Common Tern	THR	NL	MN Threatened, High priority in all Bird Conservation Regions (BCRs) of Waterbird plans.
Sturnella magna	Eastern Meadowlark	NL	NL	Id'd on USFWS reg. 3 concern list. Suggested addition. Precipitous continental population decline, habitat inperiled.
Toxostoma rufum	Brown Thrasher	NL	NL	Highest Partners in Flight Priority (PIF 2A) in several Bird Conservation Regions (BCRs).
Tringa melanoleuca	Greater Yellowlegs	NL	NL	High Priority (4) in several Bird Conservation Regions of Shorebird Plans.
Troglodytes troglodytes	Winter Wren	NL	NL	Suggested addition by feedback team. Highly significant population declines in NRRI Forest Bird Monitoring.
Tryngites subruficollis	Buff-breasted Sandpiper	NL	NL	High priority (4) in all Bird Conservation Regions of Shorebird Plans.
Tympanuchus cupido	Greater Prairie-chicken	SPC	NL	MN Special Concern.
Tympanuchus phasianellus	Sharp-tailed Grouse	NL	NL	Populations well below the range of natural variation in Minnesota. Historically was the dominant prairie Galliform.
Vermivora chrysoptera	Golden-winged Warbler	NL	NL	Partners in Flight Continental Watchlist.
Vermivora pinus	Blue-winged Warbler	NL	NL	Partners in Flight Continental Watchlist.
Vireo bellii	Bell's Vireo	NL	NL	Partners in Flight Continental Watchlist, Tracked in MN heritage database.
Wilsonia canadensis	Canada Warbler	NL	NL	Partners in Flight Continental Watchlist.
Wilsonia citrina	Hooded Warbler	SPC	NL	MN Special Concern.
Zonotrichia albicollis	White-throated Sparrow	NL	NL	Suggested addition. Highly significant regional population declines in NRRI Forest Bird Monitoring.
Reptiles				
Apalone mutica	Smooth Softshell	SPC	NL	MN Special Concern.
Chelydra serpentina	Common Snapping Turtle	SPC	NL	MN Special Concern.
Clemmys insculpta	Wood Turtle	THR	NL	MN Threatened.
Cnemidophorus sexlineatus	Six-lined Racerunner	NL	NL	Restricted to bluff prairie habitats and are uncommon even in appropriate habitats.
Coluber constrictor	Eastern Racer	SPC	NL	MN Special Concern.
Crotalus horridus	Timber Rattlesnake	THR	NL	MN Threatened.
Elaphe obsoleta	Eastern Rat Snake	SPC	NL	MN Special Concern.
Elaphe vulpina	Eastern Fox Snake	NL	NL	Tracked in MN heritage database.
Emydoidea blandingii	Blanding's Turtle	THR	NL	MN Threatened.
Eumeces fasciatus	Five-lined Skink	SPC	NL	MN Special Concern.
Heterodon nasicus	Western Hognose Snake	SPC	NL	MN Special Concern.
Heterodon platirhinos	Eastern Hognose Snake	NL	NL	Tracked in MN heritage database.
Lampropeltis triangulum	Milk Snake	NL	NL	Tracked in MN heritage database - vulnerable habitat - rock outcrops and hibernacula.
Liochlorophis vernalis	Smooth Green Snake	NL	NL	Suggested by herp subgroup, declines noted in adj. States, MN population and distribution info lacking.
Pituophis catenifer	Gopher Snake	SPC	NL	MN Special Concern.
Sistrurus catenatus	Eastern Massasauga	END	CAND	Candidate Federal ESA, MN Endangered.

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Reptiles				
Tropidoclonion lineatum	Lined Snake	SPC	NL	MN Special Concern.
Amphibians				
Acris crepitans	Northern Cricket Frog	END	NL	MN Endangered.
Ambystoma maculatum	Spotted Salamander	NL	NL	Tracked in MN heritage database.
Hemidactylium scutatum	Four-toed Salamander	SPC	NL	MN Special Concern.
Necturus maculosus	Common Mudpuppy	NL	NL	Suggested by aquatics group, host to threatened salamander mussel. Commercially exploited by biological supply companies that are hard to monitor; also vulnerable to the lampricide TFM.
Plethodon cinereus	Eastern Red-backed Salamander	NL	NL	Suggested by herp subgroup, info and status needed given loss of habitat.
Rana palustris	Pickerel Frog	NL	NL	Tracked in MN heritage database. Natural range is in MN, uses cold water streams, a vulnerable habitat.
Fishes				
Acipenser fulvescens	Lake Sturgeon	SPC	NL	MN Special Concern, generally recovering in historic drainages.
Alosa chrysochloris	Skipjack Herring	SPC	NL	MN Special Concern, absent for decades, but has been reported sporadically since 1986.
Ammocrypta asprella	Crystal Darter	SPC	NL	MN Special Concern, difficult to sample and assess.
Ammocrypta clara	Western Sand Darter	NL	NL	Preferred habitats rarely sampled.
Anguilla Rostrata	American Eel	NL	NL	catadromis, difficult to sample and assess, special concern in WI.
Aphredoderus sayanus	Pirate Perch	SPC	NL	MN Special Concern, preferred habitats rarely sampled.
Campostoma oligolepis	Largescale Stoneroller	NL	NL	secure in St. Croix and lower Mississippi drainages, rare in Minnesota drainage.
Clinostomus elongatus	Redside Dace	NL	NL	Reduced distribution, special concern in WI, extirpated in IA.
Coregonus hoyi	Bloater	NL	NL	Classified as Vulnerable in the IUCN Red List. Commercial species in Lake Superior, taxonomy of genus suspect.
Coregonus kiyi	Kiyi	SPC	NL	MN Special Concern, reported occasionally along North Shore of Lake Superior, taxonomy of genus suspect.
Coregonus nipigon	Nipigon cisco	NL	NL	Known distribution restricted to Saganaga Lake in far NE Minnesota/southern Ontario.
Coregonus zenithicus	Shortjaw Cisco	SPC	NL	MN Special Concern, reported rarely along North Shore of Lake Superior, and recently, in two inland lakes, taxonomy of genus suspect.
Cottus ricei	Spoonhead sculpin	NL	NL	Restricted to L. Superior and one inland lake.
Couesius plumbeus	Lake Chub	NL	NL	Secure in Lake Superior, reduced distribution in inland lakes and streams.
Cycleptus elongatus	Blue Sucker	SPC	NL	MN Special Concern, recovering and expanding range into Minnesota River.
Cyprinella lutrensis	Red Shiner	NL	NL	Restricted to Missouri drainage, far less common than federally endangered Topeka shiner.
Erimystax x-punctata	Gravel Chub	SPC	NL	MN Special Concern, restricted to Root and Upper and Iowa Rivers.
Etheostoma asprigene	Mud Darter	NL	NL	Secure in lower Mississippi River, rare in St. Croix River, special concern in WI.
Etheostoma chlorosoma	Bluntnose Darter	NL	NL	Tracked in MN heritage database, two collections since 1997, previously assumed extirpated.
Etheostoma microperca	Least Darter	SPC	NL	MN Special Concern, recently found at several new localities, possibly due to more effective sampling methods.
Fundulus sciadicus	Plains Topminnow	SPC	NL	MN Special Concern, restricted to Missouri drainage, far less common than federally endangered Topeka shiner.
Hybognathus nuchalis	Mississippi Silvery Minnow	NL	NL	Reduced distribution possibly due to reservoirs, similar decline reported in TVA reservoirs.
Ichthyomyzon fossor	Northern Brook Lamprey	SPC	NL	MN Special Concern, secure in Lake of the Woods drainage, one population remains in Lake Superior drainage while others possibly extirpated by lampricide used to control sea lampreys, rare in Zumbro and Upper Iowa Rivers.
Ichthyomyzon gagei	Southern Brook Lamprey	SPC	NL	MN Special Concern, restricted to, but secure, in the St. Croix drainage.
Ictiobus niger	Black Buffalo	SPC	NL	MN Special Concern, rarely reported, but recently has expanded range into Minnesota River.
Lampetra appendix	American Brook Lamprey	NL	NL	Tracked in MN heritage database, recently found at three localities in Minnesota River drainage where it had been absent for decades, secure in the lower Mississippi drainage.

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Fishes				
Lepomis gulosus	Warmouth	NL	NL	Restricted to Mississippi River in SE MN, one introduced population in Lake of the Woods drainage.
Lepomis megalotis	Longear Sunfish	NL	NL	Very spotty distribution, Threatened in WI.
Lythrurus umbratilis	Redfin Shiner	NL	NL	Reduced distribution, Threatened in WI.
Macrhybopsis aestivalis	speckled chub	NL	NL	Secure in MN and lower Miss rivers, found in St.Croix in 2004, threatened in WI.
Morone mississippiensis	Yellow Bass	SPC	NL	MN Special Concern, restricted distribution.
Moxostoma carinatum	River Redhorse	NL	NL	Secure in St. Croix and lower Mississippi Rivers, extirpated in Minnesota Rivers, threatened in WI.
Moxostoma duquesnei	Black Redhorse	NL	NL	Tracked in MN heritage database, restricted to the Zumbro, Root, and Upper Iowa Rivers.
Moxostoma valenciennesi	Greater Redhorse	NL	NL	Secure in upper Mississippi and St. Croix drainages, extirpated in Lake of the Woods drainage, threatened in WI.
Myoxocephalus thompsoni	Deepwater Sculpin	NL	NL	Restricted to Lake Superior and one inland lake.
Notropis amnis	Pallid Shiner	SPC	NL	MN Special Concern.
Notropis anogenus	Pugnose Shiner	SPC	NL	MN Special Concern, difficult to identify in field.
Notropis nubilus	Ozark Minnow	SPC	NL	MN Special Concern, restricted to the Zumbro, Root, and Cedar Rivers.
Notropis topeka	Topeka Shiner	SPC	END	Federally Endangered, historically occurred in the Mississippi River drainage in SE Minnesota south of St. Anthony falls.
Noturus exilis	Slender Madtom	SPC	NL	MN Special Concern, restricted to one stream.
Opsopoeodus emiliae	Pugnose Minnow	NL	NL	Exhibits wide fluctuation in abundance.
Percina evides	Gilt Darter	SPC	NL	MN Special Concern, restricted to, but secure, in the St. Croix drainage.
Phenacobius mirabilis	Suckermouth Minnow	NL	NL	Reduced distribution.
Platygobio gracilis	flathead chub	NL	NL	One collection from Red River of the North, additional occurrences in southern Manitoba.
Polyodon spathula	Paddlefish	THR	NL	MN Threatened, generally recovering in historic drainages.
Prosopium coulteri	pygmy whitefish	NL	NL	Disjunct population, difficult to sample and assess, Special Concern in WI.
Scaphirhynchus platorynchus	Shovelnose Sturgeon	NL	NL	Tracked in MN heritage database, rapidly recovering.
Spiders				
Habronattus texanus	A Jumping Spider	SPC	NL	MN Special Concern.
Marpissa grata	A Jumping Spider	SPC	NL	MN Special Concern.
Metaphidippus arizonensis	A Jumping Spider	SPC	NL	MN Special Concern.
Paradamoetas fontana	A Jumping Spider	SPC	NL	MN Special Concern.
Phidippus apacheanus	A Jumping Spider	SPC	NL	MN Special Concern.
Phidippus pius	A Jumping Spider	SPC	NL	MN Special Concern.
Sassacus papenhoei	A Jumping Spider	SPC	NL	MN Special Concern.
Tutelina formicaria	A Jumping Spider	SPC	NL	MN Special Concern.
Insects				
Aflexia rubranura	Red Tailed Prairie Leafhopper	SPC	NL	MN Special Concern.
Agapetus tomus	A Caddisfly	SPC	NL	MN Special Concern.
Allocapnia illinoensis	A Stonefly	NL	NL	Heritage global ranked (G3).
Asynarchus rossi	A Caddisfly	SPC	NL	MN Special Concern.
Atrytone arogos	Arogos Skipper	SPC	NL	MN Special Concern.
Ceraclea brevis	A Caddisfly	SPC	NL	MN Special Concern.
Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	SPC	NL	MN Special Concern.

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Insects				
Chilostigma itascae	Headwater Chilostigman Caddisfly	END	NL	MN Endangered.
Cicindela denikei	A Tiger Beetle	THR	NL	MN Threatened.
Cicindela fulgida fulgida	A Tiger Beetle	END	NL	MN Endangered.
Cicindela fulgida westbournei	A Tiger Beetle	THR	NL	MN Threatened.
Cicindela hirticollis rhodensis	A Tiger Beetle	SPC	NL	MN Special Concern.
Cicindela lepida	Little White Tiger Beetle	THR	NL	MN Threatened.
Cicindela limbata nympha	A Tiger Beetle	END	NL	MN Endangered.
Cicindela macra macra	A Tiger Beetle	SPC	NL	MN Special Concern.
Cicindela patruela patruela	A Tiger Beetle	SPC	NL	MN Special Concern.
Cicindela splendida cyanocephalata	A Tiger Beetle	SPC	NL	MN Special Concern.
Epidemia epixanthe michiganensis	Bog Copper	NL	NL	Tracked in MN heritage database.
Erebia disa mancinus	Disa Alpine	SPC	NL	MN Special Concern.
Erynnis persius	Persius Duskywing	END	NL	MN Endangered.
Euphyes bimacula illinois	Two-spotted Skipper	NL	NL	Tracked in MN heritage database.
Gomphus crassus	Handsome Clubtail	NL	NL	Heritage global ranked (G3).
Gomphus notatus	Elusive Clubtail	NL	NL	Possibly remove - not on MN dragonfly checklist. Heritage global ranked (G3).
Gomphus ventricosus	Skillet Clubtail	NL	NL	Heritage global ranked (G3).
Gomphus viridifrons	Green-faced Clubtail	NL	NL	Heritage global ranked (G3).
Hesperia comma assiniboia	Assiniboia Skipper	END	NL	MN Endangered.
Hesperia dacotae	Dakota Skipper	THR	CAND	MN Threatened. Federal candidate for listing under the ESA.
Hesperia leonardus leonardus	Leonard's Skipper	SPC	NL	MN Special Concern.
Hesperia leonardus pawnee	Pawnee Skipper	SPC	NL	MN Special Concern.
Hesperia ottoe	Ottoe Skipper	THR	NL	MN Threatened.
Hesperia uncas	Uncas Skipper	END	NL	MN Endangered.
Hydroptila metoeca	A Caddisfly	SPC	NL	MN Special Concern.
Hydroptila novicola	A Caddisfly	SPC	NL	MN Special Concern.
Hydroptila tortosa	A Caddisfly	SPC	NL	MN Special Concern.
Hygrotus sylvanus	Sylvan Hygrotus Diving Beetle	NL	NL	Heritage global ranked (G1).
Isogenoides olivaceus	A Perlid Stonefly	NL	NL	Heritage global ranked (G3).
Isogenoides varians	A Stonefly	NL	NL	Heritage global ranked (G3).
Lycaeides idas nabokovi	Nabokov's Blue	SPC	NL	MN Special Concern.
Lycaeides melissa samuelis	Karner Blue	END	END	Federally Endangered, MN Endangered.
Oarisma garita	Garita Skipper	THR	NL	MN Threatened.
Oarisma powesheik	Powesheik Skipper	SPC	NL	MN Special Concern.
Oeneis macounii	Macoun's Arctic	NL	NL	Tracked in MN heritage database.
Oeneis uhleri varuna	Uhler's Arctic	END	NL	MN Endangered.
Ophiogomphus anomalis	Extra-striped Snaketail	SPC	NL	MN Special Concern.
Ophiogomphus howei	Pygmy Snaketail	NL	NL	Heritage global ranked (G3).

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Insects				
Ophiogomphus susbehcha	St. Croix Snaketail	SPC	NL	MN Special Concern.
Oxyethira ecornuta	A Caddisfly	SPC	NL	MN Special Concern.
Oxyethira itascae	A Caddisfly	SPC	NL	MN Special Concern.
Papaipema beeriana	Blazing Star Stem Borer	NL	NL	Heritage global ranked (G3).
Phyciodes batesii	Tawny Crescent	NL	NL	Tracked in MN heritage database.
Polycentropus milaca	A Caddisfly	SPC	NL	MN Special Concern.
Protoptila talola	A Caddisfly	SPC	NL	MN Special Concern.
Pyrgus centaureae freija	Grizzled Skipper	SPC	NL	MN Special Concern.
Schinia indiana	Phlox Moth	SPC	NL	MN Special Concern.
Setodes guttatus	A Caddisfly	SPC	NL	MN Special Concern.
Speyeria idalia	Regal Fritillary	SPC	NL	MN Special Concern.
Mollusks				
Acella haldemani	Spindle Lymnaea	NL	NL	Heritage global ranked (G3), state occurrence uncertain, landsnail.
Actinonaias ligamentina	Mucket mussel	THR	NL	MN Threatened.
Alasmidonta marginata	Elktoe	THR	NL	MN Threatened.
Arcidens confragosus	Rock Pocketbook	END	NL	MN Endangered.
Campeloma spp.			NL	Suggested by aquatics expert group. A genus of aquatic snails, little is known, indications of decline.
Cumberlandia monodonta	Spectaclecase	THR	CAND	MN Threatened, Federal candidate.
Cyclonaias tuberculata	Purple Wartyback	THR	NL	MN Threatened.
Ellipsaria lineolata	Butterfly	THR	NL	MN Threatened.
Elliptio crassidens	Elephant-ear	END	NL	MN Endangered.
Elliptio dilatata	Spike	SPC	NL	MN Special Concern.
Epioblasma triquetra	Snuffbox	THR	NL	MN Threatened.
Fusconaia ebena	Ebonyshell	END	NL	MN Endangered.
Lampsilis higginsii	Higgins Eye	END	END	MN Endangered, Federally Endangered.
Lampsilis teres	Yellow Sandshell	END	NL	MN Endangered.
Lasmigona compressa	Creek Heelsplitter	SPC	NL	MN Special Concern.
Lasmigona costata	Fluted-shell	SPC	NL	MN Special Concern.
Ligumia recta	Black Sandshell	SPC	NL	MN Special Concern.
Megalonaias nervosa	Washboard	THR	NL	MN Threatened.
Novasuccinea n. sp. minnesota a	Minnesota Pleistocene Ambersnail	THR	NL	MN Threatened.
Novasuccinea n. sp. minnesota b	Iowa Pleistocene Ambersnail	END	NL	MN Endangered.
Obovaria olivaria	Hickorynut	SPC	NL	MN Special Concern.
Planorbella corpulenta	Corpulent Rams-horn	NL	NL	Heritage global ranked (G2).
Plethobasus cyphyus	Sheepnose	END	CAND	MN Endangered, Federal Candidate.
Pleurobema coccineum	Round Pigtoe	THR	NL	MN Threatened.
Pleurocera acuta	Sharp hornsnail	NL	NL	Suggested by aquatics expert group. Population appears to have greatly declined from early 70's surveys.
Quadrula fragosa	Winged Mapleleaf	END	END	MN Endangered, Federally Endangered.

Scientific Name	Common Name	State Status	Fed. Status	Rationale
Mollusks				
Quadrula metanevra	Monkeyface	THR	NL	MN Threatened.
Quadrula nodulata	Wartyback	END	NL	MN Endangered.
Simpsonaias ambigua	Salamander Mussel	THR	NL	MN Threatened.
Tritogonia verrucosa	Pistolgrip	THR	NL	MN Threatened.
Truncilla donaciformis	Fawnsfoot	NL	NL	Observed to be greatly diminished in numbers in the Mississippi and St Croix Rivers since the 1970s
Venustaconcha ellipsiformis	Ellipse	THR	NL	MN Threatened.
Vertigo bollesiana	Delicate Vertigo	NL	NL	Heritage global ranked (G3). Landsnail, found in southern Beltrami and Clearwater counties (Nekola 2002).
Vertigo brierensis	Briarton Pleistocene Snail	NL	NL	Heritage global ranked (G1), Globally, 2 occurrences from Iowa, range possibly extends into MN.
Vertigo hubrichti	Hubricht's Vertigo	NL	NL	Heritage global ranked (G2). Taxonomy uncertain.
Vertigo hubrichti hubrichti	Midwest Pleistocene Vertigo	END	NL	MN Endangered.
Vertigo hubrichti variabilis n. subsp.	Variable Pleistocene Vertigo	THR	NL	MN Threatened.
Vertigo meramecensis	Bluff Vertigo	THR	NL	MN Threatened.
Vertigo occulta		NL	NL	Heritage global ranked (G2). Taxonomy uncertain.

Status codes:

Fed. Status = Federal status on Endangered Species List
END = Endangered
THR = Threatened
SPC = Special Concern
CAND = Candidate species for listing
NL= Not listed

Appendix D: Minnesota GAP Level 4 Land Cover Class Descriptions

http://jmaps.dnr.state.mn.us/gis/ancillary/type_description6.htm

Non-Forest Classes

Code	*Type*	*Description*
1	Mixed Developed	Industrial, commercial and/or residential land use, >50% impervious surface. Generally nonurban.
2	High Intensity Urban	Chiefly industrial and commercial land use, >50% impervious surface.
3	Low Intensity Urban	Chiefly commercial and residential land use, < 50% impervious surface.
4	Transportation	Roads of all classes.
5	Barren	Sparsely vegetated (<33% vegetation, <10% tree crown cover) exposures of soil, sand or rock.
6	Cropland	Land under cultivation.
7	Grassland	Non-cultivated herbaceous upland vegetation dominated by grasses and forbs.
8	Prairie	Non-cultivated herbaceous upland vegetation dominated by native grasses and forbs.
9	Upland Shrub	Uplands with < 10% tree crown cover and >33% cover of low-growing deciduous woody plants. Includes much upland deciduous forest regeneration.
10	Lowland Deciduous Shrub	Lowlands with < 10% tree crown cover and >33% cover of low-growing deciduous woody plants such as alders and willows.
11	Lowland Evergreen Shrub	Lowlands with < 10% tree crown cover and >33% cover of low-growing nondeciduous woody plants such as leatherleaf and labrador-tea.
12	Water	Lakes, streams and open-water wetlands.
13	Floating Aquatic	Water bodies whose surface is covered by floating vegetation.
14	Sedge Meadow	Wetlands with <10% tree crown cover, dominated by emergent herbaceous vegetation such as fine-leaf sedges.
15	Broadleaf Sedge/Cattail	Wetlands with <10% crown cover, dominated by emergent herbaceous vegetation such as broadleaf sedges and/or cattails.

Upland Conifer Forest Classes (upland sites, > 10% tree cover, >33% of canopy conifer, <33% deciduous)

Code	*Type*	*Description*
16	Jack Pine	Jack pine predominates over other conifers.
17	Red/ White Pine	Mix of red and white pine predominates over other conifers.
18	Red Pine	Red pine predominates over other conifers.
19	White Pine mix	Type of special interest: white pine predominates over other conifers, but deciduous component may exceed 33%.
20	Balsam Fir mix	Type of special interest: balsam fir predominates over other conifers, but deciduous component may exceed 33%.
21	White Spruce	White spruce predominates over other conifers.
22	Upland Black Spruce	Black spruce (more usually a lowland species) predominates over other conifers; jack pine may also be present at significant levels.
23	Upland Northern white-cedar	Northern white-cedar predominates over other conifers.
24	Redcedar	Eastern redcedar predominates over other conifers.
25	Upland Conifer	Upland conifer type with no single conifer species predominant.

Lowland Conifer Forest Classes (lowland sites, > 10% tree cover, >33% of canopy conifer, <33% deciduous)

Code	*Type*	*Description*
26	Lowland Black Spruce	Black spruce predominates over other conifers.
27	Stagnant Black Spruce	Black spruce predominates over other conifers; site characterized by stunted trees, lowland shrubs, sedges and sphagnum mosses.
28	Tamarack	Tamarack predominates over other conifers.
29	Stagnant Tamarack	Tamarack predominates over other conifers; site characterized by stunted trees, lowland shrubs, sedges and sphagnum mosses.
30	Lowland Northern white-cedar	Northern white-cedar predominates over other conifers.
31	Stagnant Northern white-cedar	Northern white-cedar predominates over other conifers; site characterized by stunted trees, lowland shrubs, sedges and sphagnum mosses.
32	Stagnant Conifer	No single lowland conifer species predominant; site

		characterized by stunted trees, lowland shrubs, sedges and sphagnum mosses.

Upland Deciduous Forest Classes (upland sites, > 10% tree cover,>33% of canopy deciduous, <33% conifer)

Code	*Type*	*Description*
33	Aspen/ White Birch	Aspen, paper birch or balsam poplar predominate among deciduous trees.
34	White/ Red Oak	A mixture of oak species predominates among deciduous trees.
35	Bur/ White Oak	Bur and white oak predominate among deciduous trees.
36	Red Oak	Red oak predominates among deciduous trees.
37	Northern Pin Oak	Northern pin oak predominates among deciduous trees.
38	Maple/ Basswood	Maples and/or basswood predominate among deciduous trees.
39	Upland Deciduous	No single upland deciduous species predominant.

Lowland Deciduous Forest Classes (lowland sites, > 10% tree cover,>33% of canopy deciduous, <33% conifer)

Code	*Type*	*Description*
40	Black Ash	Black ash predominates among deciduous trees.
41	Silver Maple	Silver maple predominates among deciduous trees.
42	Cottonwood	Cottonwood predominates among deciduous trees.
43	Lowland Deciduous	No single lowland deciduous species predominant.

Mixed Forest Classes (> 10% tree cover, >33% of canopy deciduous, >33% conifer)

Code	*Type*	*Description*
44	Upland Conifer-Deciduous mix	Mixed upland conifers (pines, white spruce, balsam fir) predominate in conifer component. On upland sites.
45	Jack Pine- Deciduous mix	Jack pine predominates in conifer component.
46	Red/White Pine-Deciduous mix	Red and/or white pine predominate in conifer component.
47	Spruce/Fir- Deciduous mix	Upland spruce or balsam fir predominate in conifer component.
48	Redcedar- Deciduous mix	Eastern redcedar predominates in conifer component.
49	Lowland Conifer-Deciduous mix	Lowland conifers (black spruce, tamarack, white-cedar) predominate in conifer component. On lowland sites.

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
14	Ma	Canis lupus	Gray Wolf	X		X			X	X		X			X	X	X		X	3		X			X		X	X
2	Ma	Cervus elaphus	Elk	X		X																						
2	Ma	Cryptotis parva	Least Shrew					X						X														
10	Ma	Lynx canadensis	Lynx	X					X	X					X	X	X		X	X					X			X
3	Ma	Microtus chrotorrhinus	Rock Vole						42						32					13								
12	Ma	Microtus ochrogaster	Prairie Vole		2		1	X			13		X	1				19			3	11	5	X		X		
1	Ma	Microtus pinetorum	Woodland Vole					2																				
12	Ma	Mustela nivalis	Least Weasel	X	X	X	X				X		X	X			X	X			X		X			X		
5	Ma	Myotis septentrionalis	Northern Myotis		X			10		X										9						X		
4	Ma	Onychomys leucogaster	Northern Grasshopper Mouse								X			X				3					5					
5	Ma	Perognathus flavescens	Plains Pocket Mouse		7						X			X				X					1					
3	Ma	Phenacomys intermedius	Heather Vole						X						3					X								
7	Ma	Pipistrellus subflavus	Eastern Pipistrelle				1	13										X		1	X			5		X		
10	Ma	Reithrodontomys megalotis	Western Harvest Mouse		X		1	2			X		X	1				26			1			X		X		
3	Ma	Sorex fumeus	Smoky Shrew						14						9					6								
23	Ma	Spermophilus franklinii	Franklin's Ground Squirrel	X	X	X	X	X		X	X	X	X	X	X		X	1	X	1	X	X	X	X	1	X	X	X
4	Ma	Spermophilus richardsonii	Richardson's Ground Squirrel								X			X				4					1					
19	Ma	Spilogale putorius	Eastern Spotted Skunk		X	X	1	X		X	X	X	X	X			X	2		X	X	X	X	X	X	X	X	
3	Ma	Synaptomys borealis	Northern Bog Lemming	X												X									1			
24	Ma	Taxidea taxus	American Badger	X	1	X	X	X		X	X	X	X	X	X	X	X	1	X	X	X	X	X	X	X	X	X	X
2	Ma	Thomomys talpoides	Northern Pocket Gopher			X																	4					
13	Bi	Accipiter gentilis	Northern Goshawk	1					3	40		1			1	1	3		3	5		7			5		4	3
5	Bi	Aechmophorus occidentalis	Western Grebe			1	1				X		X					6										
4	Bi	Aegolius funereus	Boreal Owl	X					1						2					2								
2	Bi	Ammodramus bairdii	Baird's Sparrow			4																	2					
7	Bi	Ammodramus henslowii	Henslow's Sparrow				4	4										11			1		3	1		1		
17	Bi	Ammodramus leconteii	Le Conte's Sparrow	34	X	167			X	18		X	7		2	X	9		X	1		9	30		2		10	X
9	Bi	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	6		72				14			7				10					3	8		X		7	
14	Bi	Ammodramus savannarum	Grasshopper Sparrow		28	30	14	6			5		9	X			8	93			9	2	1	2		3		
9	Bi	Anas acuta	Northern Pintail		X	11	X				X		X	X				5					2			X		
10	Bi	Anas rubripes	American Black Duck	X					X	1					X	X			X	X					X		X	X
2	Bi	Anthus spragueii	Sprague's Pipit			3																	X					

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
20	Bi	Arenaria interpres	Ruddy Turnstone	X	X	X	X	X	X	X	X		X	X		X	X	X		X	X	X	X	X	X	X		
11	Bi	Asio flammeus	Short-eared Owl	7		13				X	1		X	X				2			1	X	1				3	
3	Bi	Aythya affinis	Lesser Scaup			7							1										X					
19	Bi	Bartramia longicauda	Upland Sandpiper	5	7	183	4	X		1	18	1	5	7			1	84			12	2	42	2	X	1	3	
21	Bi	Botaurus lentiginosus	American Bittern	23	18	152	3		16	27	3	X	10		1	21	12	17	3	3		12	19		10	X	12	X
12	Bi	Buteo lineatus	Red-shouldered Hawk		31		36	36		30		X	54				122				X	117		1	18	15		
6	Bi	Buteo swainsoni	Swainson's Hawk			X					X			X				X			X		X					
1	Bi	Calcarius ornatus	Chestnut-collared Longspur																				1					
24	Bi	Calidris alpina	Dunlin	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
20	Bi	Calidris fuscicollis	White-rumped Sandpiper	X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X	X	X	X		
25	Bi	Calidris pusilla	Semipalmated Sandpiper	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21	Bi	Caprimulgus vociferus	Whip-poor-will	1	X	6	X	1	X	X		X	1		X	X	X	1	X	X		1		X	X	X	X	X
22	Bi	Catharus fuscescens	Veery	48	44	187	26	25	6	22		12	97		6	X	205	26	X	64	2	86		4	14	6	20	X
1	Bi	Charadrius melodus	Piping Plover	3																								
18	Bi	Chlidonias niger	Black Tern	4	21	62	7	5	X	8	X	X	9	X			5	63				X	13		3	2	5	
25	Bi	Chordeiles minor	Common Nighthawk	X	2	2	1	X	X	X	X	X	1	X	X	X	1	5	X	1	X	6	X	X	X	X	X	X
25	Bi	Circus cyaneus	Northern Harrier	8	4	76	1	1	X	X	X	1	5	X	1	X	20	17	X	1	1	2	8	X	1	X	4	X
20	Bi	Cistothorus palustris	Marsh Wren	6	18	105	8	17		9	1	X	19	X			12	113		1	2	8	44	X	2	9	5	
25	Bi	Cistothorus platensis	Sedge Wren	71	39	290	27	15	2	34	3	X	38	X	3	X	93	158	X	1	6	30	48	3	9	9	30	X
25	Bi	Coccyzus erythropthalmus	Black-billed Cuckoo	29	15	127	6	20	X	1	1	1	20	X	1	X	33	19	X	3	5	10	3	X	X	5	3	X
14	Bi	Contopus cooperi	Olive-sided Flycatcher	7		4			X	X		X			4	X	1		X	1		2			3		2	X
25	Bi	Contopus virens	Eastern Wood-pewee	14	54	113	147	278	1	2	1	11	72	X	1	X	135	112	X	57	21	71	3	20	23	44	3	X
10	Bi	Coturnicops noveboracensis	Yellow Rail	28		140				25			5			X	6					16	9		X		16	
14	Bi	Cygnus buccinator	Trumpeter Swan	X	X	1	26			4			12			X	1	2				16	5		X	X	3	
3	Bi	Dendroica caerulescens	Black-throated Blue Warbler						15						12					88								
4	Bi	Dendroica castanea	Bay-breasted Warbler	1					X						X	X												
10	Bi	Dendroica cerulea	Cerulean Warbler		2		54	81					21				10	24			1	4		3		11		
10	Bi	Dendroica tigrina	Cape May Warbler	X					X	X					X	X	X		X	X							1	X
25	Bi	Dolichonyx oryzivorus	Bobolink	39	13	228	19	7	X	10	5	X	20	X	1	X	43	217	X	1	9	4	60	5	4	3	8	X
25	Bi	Empidonax minimus	Least Flycatcher	16	15	122	48	24	3	5	2	7	43	X	3	X	119	52	X	83	X	67	12	2	34	6	6	X
13	Bi	Empidonax traillii	Willow Flycatcher		11	32	17	27			4		9	X			1	70			2		13	2		14		
6	Bi	Empidonax virescens	Acadian Flycatcher				11	55										6			5			1		9		

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
1	Bi	Euphagus carolinus	Rusty Blackbird						X																			
6	Bi	Falcipennis canadensis	Spruce Grouse	1					X	X					X	X			X									
6	Bi	Falco peregrinus	Peregrine Falcon		10			6				X							1	17						10		
7	Bi	Gallinula chloropus	Common Moorhen		2		2	12										3			X			X		1		
18	Bi	Gavia immer	Common Loon	5	13	6	12		1	16			22		6	X	22	24	X	15		38			5	X	1	X
21	Bi	Haliaeetus leucocephalus	Bald Eagle	26	55	20	42	129	215	285		1	66		10	16	77	54	13	18		171	11		91	35	23	3
20	Bi	Hylocichla mustelina	Wood Thrush		5		26	70	X	X		4	8		1	X	66	30	X	6	9	7		7	16	11	3	X
16	Bi	Ixobrychus exilis	Least Bittern	X	3	3	X	3		2	X	X	1	X			X	3		X	X	X				1		
10	Bi	Lanius ludovicianus	Loggerhead Shrike		11		13	5			1			2				18			41		12	27		1		
3	Bi	Larus pipixcan	Franklin's Gull			72					X		1															
22	Bi	Limnodromus griseus	Short-billed Dowitcher	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	
4	Bi	Limosa fedoa	Marbled Godwit	2		178												33					35					
18	Bi	Limosa haemastica	Hudsonian Godwit	X	X	X	X	X		X	X	X	X	X			X	X		X	X	X	X	X		X		
22	Bi	Melanerpes erythrocephalus	Red-headed Woodpecker	X	1	2	5	19		X	X	X	5	X		X	9	12	X	X	3	2	X	1	X	1	X	
25	Bi	Melospiza georgiana	Swamp Sparrow	69	57	187	30	18	10	29	1	1	52	X	9	X	88	142	X	11	2	28	42	2	12	16	21	X
13	Bi	Numenius phaeopus	Whimbrel	X	X	X	X	X		X	X		X				X	X		X		X	X					
8	Bi	Nycticorax nycticorax	Black-crowned Night-heron		3	14	3				X		2	X				16								4		
14	Bi	Oporornis agilis	Connecticut Warbler	26		14			X	8		X			7	X	10		X	11		4			3		7	X
4	Bi	Pelecanus erythrorhynchos	American White Pelican	15			4											52				4						
9	Bi	Phalaropus tricolor	Wilson's Phalarope	2	4	31				4			2					7				2	9				1	
25	Bi	Pheucticus ludovicianus	Rose-breasted Grosbeak	21	26	165	80	154	3	10	1	5	22	X	3	X	77	87	X	22	20	36	4	6	21	29	12	X
10	Bi	Picoides arcticus	Black-backed Woodpecker	1					X	X					7	X	1		X						X		1	X
24	Bi	Pluvialis dominica	American Golden-plover	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
1	Bi	Podiceps auritus	Horned Grebe			3																						
17	Bi	Podiceps grisegena	Red-necked Grebe	1	X	6	1		X	1			1			X	1	12	X		X	X	2		X	X	X	
9	Bi	Podiceps nigricollis	Eared Grebe		X	3	X				X		1	X				3			X		1					
10	Bi	Poecile hudsonica	Boreal Chickadee	X					X	1					1	X			X	2					X		1	X
6	Bi	Protonotaria citrea	Prothonotary Warbler				11	18										3			X			X		5		
2	Bi	Rallus elegans	King Rail					X			X																	
23	Bi	Rallus limicola	Virginia Rail	5	2	22	2	4		1	X	X	4	X		X	1	10	X	X	X	X	10	X	X	X	X	X
16	Bi	Recurvirostra americana	American Avocet	X	X	X	X	X		X	X		X	X			X	X			X	X	X	X		X		
22	Bi	Scolopax minor	American Woodcock	2	3	8	1	1	X	X		X	1		X	X	3	X	X	X	1	2		X	2	X	2	X
22	Bi	Seiurus aurocapillus	Ovenbird	33	28	92	77	157	6	13		19	93		23	X	195	92	X	237	10	95		17	59	24	10	X

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
5	Bi	Seiurus motacilla	Louisiana Waterthrush		4			61									53							X		8		
4	Bi	Speotyto cunicularia	Burrowing Owl								1			3				1					X					
23	Bi	Sphyrapicus varius	Yellow-bellied Sapsucker	3	1	25	16	66	6	4		3	23		7	X	44	41	X	22	3	27	1	3	28	1	5	X
11	Bi	Spiza americana	Dickcissel		X		10	1			2		1	X				37			3		X	3		X		
13	Bi	Spizella pusilla	Field Sparrow		48		71	104			1		7	X			12	86			10	17	1	8		10		
25	Bi	Stelgidopteryx serripennis	Northern Rough-winged	X	4	1	7	42	X	X	1	X	3	X	X	X	4	15	X	X	X	2	2	2	X	6	X	X
11	Bi	Sterna forsteri	Forster's Tern	1		11	7			1	1		8	X			X	17					X			3		
4	Bi	Sterna hirundo	Common Tern	5													3			2		5						
20	Bi	Sturnella magna	Eastern Meadowlark		16		19	22	X	X		X	2		X	X	22	5	X	X	4	1		3	X	2	X	X
25	Bi	Toxostoma rufum	Brown Thrasher	X	6	43	15	14	X	X	1	X	2	X	X	X	3	38	X	1	4	4	5	X	X	6	X	X
25	Bi	Tringa melanoleuca	Greater Yellowlegs	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
18	Bi	Troglodytes troglodytes	Winter Wren	7		8		8	3	5		X	2		9	X	14	2	X	34		8			7	3	4	X
23	Bi	Tryngites subruficollis	Buff-breasted Sandpiper	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	
4	Bi	Tympanuchus cupido	Greater Prairie-chicken			151												9				55	306					
9	Bi	Tympanuchus phasianellus	Sharp-tailed Grouse	5		13				X						X	X		X			X			X		X	
14	Bi	Vermivora chrysoptera	Golden-winged Warbler	3					X	4		1	24		X	X	65		X	3		28			4		13	X
6	Bi	Vermivora pinus	Blue-winged Warbler		X		17	64										6						4		2		
6	Bi	Vireo bellii	Bell's Vireo				X	9										X			X			X		2		
13	Bi	Wilsonia canadensis	Canada Warbler	X					3	1		5			7	X	8		X	46		2			3		3	X
2	Bi	Wilsonia citrina	Hooded Warbler																			1				9		
15	Bi	Zonotrichia albicollis	White-throated Sparrow	63		68			9	23		3	11		24	X	28		X	80		9			7		7	X
3	Re	Apalone mutica	Smooth Softshell				9	37																		2		
25	Re	Chelydra serpentina	Common Snapping Turtle	X	15	X	6	X	X	X	X	5	5	X	X	X	5	X	X	X	X	3	X	X	X	14	X	X
11	Re	Clemmys insculpta	Wood Turtle		2		9	15				71					25			44	16			5		4	38	11
3	Re	Cnemidophorus sexlineatus	Six-lined Racerunner					X																X		X		
5	Re	Coluber constrictor	Eastern Racer				6	19													X			1		1		
3	Re	Crotalus horridus	Timber Rattlesnake					134																6		X		
1	Re	Elaphe obsoleta	Eastern Rat Snake					2																				
9	Re	Elaphe vulpina	Eastern Fox Snake		1		1	44			X			X				31			6			10		7		
13	Re	Emydoidea blandingii	Blanding's Turtle		207		30	26			X		38	6			86	10		5	12	155		12		83		
3	Re	Eumeces fasciatus	Five-lined Skink					6										3								X		
9	Re	Heterodon nasicus	Western Hognose Snake		9		1	X									2	6			X		3	X		X		
6	Re	Heterodon platirhinos	Eastern Hognose Snake		2			12									9					1		X		2		

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
6	Re	Lampropeltis triangulum	Milk Snake				3	61									1	4						4		X		
15	Re	Liochlorophis vernalis	Smooth Green Snake		X	X	X	X		X	X		X	X			X	X			X	X	X	X		X		
7	Re	Pituophis catenifer	Gopher Snake		3		18	28										2			2			X		1		
1	Re	Sistrurus catenatus	Eastern Massasauga					X																				
1	Re	Tropidoclonion lineatum	Lined Snake											1														
6	Am	Acris crepitans	Northern Cricket Frog					1						X			X				X			X		1		
2	Am	Ambystoma maculatum	Spotted Salamander									X					9											
4	Am	Hemidactylium scutatum	Four-toed Salamander														73			14					29	X		
14	Am	Necturus maculosus	Common Mudpuppy	X	X	X	X	X			X		X	X			1	X			X		X	X		X		
13	Am	Plethodon cinereus	Eastern Red-backed	X					X	X		X			X	X	27		X	31		X			X		X	X
2	Am	Rana palustris	Pickerel Frog					57																6				
14	Fi	Acipenser fulvescens	Lake Sturgeon	14	1	X	2	45	16				X			43	51	3					5		X	15	2	
4	Fi	Alosa chrysochloris	Skipjack Herring				X	18										X								X		
3	Fi	Ammocrypta asprella	Crystal Darter					53																X		X		
3	Fi	Ammocrypta clara	Western Sand Darter				X	250																		18		
3	Fi	Anguilla Rostrata	American Eel				X	35																		9		
2	Fi	Aphredoderus sayanus	Pirate Perch					43																		X		
5	Fi	Campostoma oligolepis	Largescale Stoneroller														29	9			3			41		X		
3	Fi	Clinostomus elongatus	Redside Dace					10													2			7				
1	Fi	Coregonus hoyi	Bloater																	1190								
1	Fi	Coregonus kiyi	Kiyi																	357								
1	Fi	Coregonus nipigon	Nipigon cisco						22																			
2	Fi	Coregonus zenithicus	Shortjaw Cisco						21											3								
2	Fi	Cottus ricei	Spoonhead sculpin						2											2								
4	Fi	Couesius plumbeus	Lake Chub						27											14							3	X
3	Fi	Cycleptus elongatus	Blue Sucker				10	136																		28		
2	Fi	Cyprinella lutrensis	Red Shiner								2			24														
3	Fi	Erimystax x-punctata	Gravel Chub					4													X			25				
3	Fi	Etheostoma asprigene	Mud Darter				X	375																		2		
2	Fi	Etheostoma chlorosoma	Bluntnose Darter					2																		X		
9	Fi	Etheostoma microperca	Least Darter				24			6			55				9	11			14	116		X	30			
2	Fi	Fundulus sciadicus	Plains Topminnow								X			32														
2	Fi	Hybognathus nuchalis	Mississippi Silvery Minnow					65																		X		
8	Fi	Ichthyomyzon fossor	Northern Brook Lamprey	8					9			14				43	18		6	X					X			

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
2	Fi	Ichthyomyzon gagei	Southern Brook Lamprey														94									4		
3	Fi	Ictiobus niger	Black Buffalo				6	13																		2		
7	Fi	Lampetra appendix	American Brook Lamprey				10	91									X	X			9			39		13		
2	Fi	Lepomis gulosus	Warmouth					88																		X		
6	Fi	Lepomis megalotis	Longear Sunfish						17	X							4					26			7	X		
3	Fi	Lythrurus umbratilis	Redfin Shiner					X													3			2				
5	Fi	Macrhybopsis aestivalis	speckled chub				5	73													1			X		X		
1	Fi	Morone mississippiensis	Yellow Bass					35																				
3	Fi	Moxostoma carinatum	River Redhorse				X	468																		26		
3	Fi	Moxostoma duquesnei	Black Redhorse					7													3			22				
11	Fi	Moxostoma valenciennesi	Greater Redhorse	X	28		2			3			10			X	94					32			1	1	1	
1	Fi	Myoxocephalus thompsoni	Deepwater Sculpin																	1								
2	Fi	Notropis amnis	Pallid Shiner					19																		X		
9	Fi	Notropis anogenus	Pugnose Shiner		X		12			9			30				4	19				26			2	X		
3	Fi	Notropis nubilus	Ozark Minnow					X													39			18				
2	Fi	Notropis topeka	Topeka Shiner								9			294														
1	Fi	Noturus exilis	Slender Madtom																		3							
2	Fi	Opsopoeodus emiliae	Pugnose Minnow					825																		5		
2	Fi	Percina evides	Gilt Darter														143									11		
4	Fi	Phenacobius mirabilis	Suckermouth Minnow				X	7													12			24				
1	Fi	Platygobio gracilis	flathead chub																				X					
3	Fi	Polyodon spathula	Paddlefish				4	91																		11		
1	Fi	Prosopium coulteri	pygmy whitefish																	X								
4	Fi	Scaphirhynchus platorynchus	Shovelnose Sturgeon				28	90													X					6		
2	Sp	Habronattus texanus	A Jumping Spider				X							X														
6	Sp	Marpissa grata	A Jumping Spider			X											X	1							X	1	X	
4	Sp	Metaphidippus arizonensis	A Jumping Spider		1			3															1			1		
5	Sp	Paradamoetas fontana	A Jumping Spider		X								X				X	1								X		
1	Sp	Phidippus apacheanus	A Jumping Spider					X																				
4	Sp	Phidippus pius	A Jumping Spider				X				X			X				X										
1	Sp	Sassacus papenhoei	A Jumping Spider					1																				
1	Sp	Tutelina formicaria	A Jumping Spider		X																							
10	In	Aflexia rubranura	Red Tailed Prairie Leafhopper			X	1	X			1			X				4			X		3	X		1		

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
2	In	Agapetus tomus	A Caddisfly		1												5											
1	In	Asynarchus rossi	A Caddisfly																							2		
9	In	Atrytone arogos	Arogos Skipper					X			4		X	3				7			X		X	X		X		
1	In	Ceraclea brevis	A Caddisfly														X											
3	In	Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly							1							X					X						
1	In	Chilostigma itascae	Headwater Chilostigman Caddisfly																			X						
4	In	Cicindela denikei	A Tiger Beetle	1					60						2	4												
1	In	Cicindela fulgida fulgida	A Tiger Beetle															X										
1	In	Cicindela fulgida westbournei	A Tiger Beetle																				X					
1	In	Cicindela hirticollis rhodensis	A Tiger Beetle																	X								
2	In	Cicindela lepida	Little White Tiger Beetle										1					X										
1	In	Cicindela limbata nympha	A Tiger Beetle										X															
1	In	Cicindela macra macra	A Tiger Beetle				1																					
5	In	Cicindela patruela patruela	A Tiger Beetle		2			3									2					4				X		
1	In	Cicindela splendida cyanocephalata	A Tiger Beetle					1																				
13	In	Epidemia epixanthe michiganensis	Bog Copper	4	X					X					X	X	X		X	X		X			X	X	X	X
8	In	Erebia disa mancinus	Disa Alpine	X					X						X	X			X	X							X	X
5	In	Erynnis persius	Persius Duskywing		X			1									X					X				X		
7	In	Euphyes bimacula illinois	Two-spotted Skipper		X			X									X				X	X		X		X		
1	In	Gomphus crassus	Handsome Clubtail					X																				
2	In	Gomphus ventricosus	Skillet Clubtail					X									X											
2	In	Gomphus viridifrons	Green-faced Clubtail														X									X		
2	In	Hesperia comma assiniboia	Assiniboia Skipper			4																	X					
5	In	Hesperia dacotae	Dakota Skipper			6					1			3				30					2					
7	In	Hesperia leonardus leonardus	Leonard's Skipper	1	1			2		X							X					3				X		
4	In	Hesperia leonardus pawnee	Pawnee Skipper								2			3				19					X					
6	In	Hesperia ottoe	Ottoe Skipper					3			X			3				X			X			X				
2	In	Hesperia uncas	Uncas Skipper		X									X														
1	In	Hydroptila metoeca	A Caddisfly														X											
1	In	Hydroptila novicola	A Caddisfly														X											

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
1	In	Hydroptila tortosa	A Caddisfly														X											
7	In	Lycaeides idas nabokovi	Nabokov's Blue	X					5						1	X			X	2								X
3	In	Lycaeides melissa samuelis	Karner Blue		X			1									X											
1	In	Oarisma garita	Garita Skipper			9																						
6	In	Oarisma powesheik	Powesheik Skipper			11					17			11				57			X		21					
11	In	Oeneis macounii	Macoun's Arctic	X					X	X					X	X	X		X	X		X			X		X	
1	In	Oeneis uhleri varuna	Uhler's Arctic																				X					
1	In	Ophiogomphus anomalis	Extra-striped Snaketail																	2								
1	In	Ophiogomphus howei	Pygmy Snaketail														X											
2	In	Ophiogomphus susbehcha	St. Croix Snaketail														7									1		
3	In	Oxyethira ecornuta	A Caddisfly							X			1									1						
6	In	Oxyethira itascae	A Caddisfly	10						1			1			1				2		X						
9	In	Papaipema beeriana	Blazing Star Stem Borer			X		X			X			X				X			X		X	X		X		
12	In	Phyciodes batesii	Tawny Crescent	X					X	X					X	X	X		X	X		X			X		X	X
2	In	Polycentropus milaca	A Caddisfly																			1			1			
1	In	Protoptila talola	A Caddisfly														X											
9	In	Pyrgus centaureae freija	Grizzled Skipper	X					X						X	X			X	X					X		X	X
5	In	Schinia indiana	Phlox Moth					X			X			X				X						X				
1	In	Setodes guttatus	A Caddisfly							X																		
11	In	Speyeria idalia	Regal Fritillary		X	X	X	X			11			22				85			X		8	X		X		
11	Mo	Actinonaias ligamentina	Mucket mussel		4		3	9			7		2	X			38	35			3			1		22		
7	Mo	Alasmidonta marginata	Elktoe		3		3	17									45	32						11		14		
3	Mo	Arcidens confragosus	Rock Pocketbook				2	17																		24		
3	Mo	Cumberlandia monodonta	Spectaclecase					X									5									8		
5	Mo	Cyclonaias tuberculata	Purple Wartyback		1		X	4									26									16		
4	Mo	Ellipsaria lineolata	Butterfly				1	22									6									20		
3	Mo	Elliptio crassidens	Elephant-ear				1	9																		13		
10	Mo	Elliptio dilatata	Spike		5		5	30			11			X			59	24			18			2		45		
3	Mo	Epioblasma triquetra	Snuffbox					X									5									12		
4	Mo	Fusconaia ebena	Ebonyshell				5	27									1									26		
4	Mo	Lampsilis higginsi	Higgins Eye				X	21									1									22		
3	Mo	Lampsilis teres	Yellow Sandshell				2	14																		2		
24	Mo	Lasmigona compressa	Creek Heelsplitter	2	39	30	2	6	2	31	4	3	39	3	5	10	55	66	2	19	42	52	14	16	16		7	4
12	Mo	Lasmigona costata	Fluted-shell	X		14	3	20			X		16	X				26			7		28	5		11		

Appendix E Occurrences of Species in Greatest Conservation Need by Ecological Subsection.

Numbers in columns indicate number of occurrences since 1990 based on the MN DNR Natural Heritage Database, MN DNR Fisheries Database, MCBS Surveys, or the Statewide Mussel Surveys. An "X" indicates that the species either was found in that subsection prior to 1990 or is expected to occur based on other information.

# of subsections	Taxa	Scientific Name	Common Name	Agassiz Lowlands	Anoka Sand Plain	Aspen Parklands	Big Woods	The Blufflands	Border Lakes	Chippewa Plains	Coteau Moraines	Glacial Lake Superior Plain	Hardwood Hills	Inner Coteau	Laurentian Uplands	Littlefork-Vermillion Uplands	Mille Lacs Uplands	Minnesota River Prairie	Nashwauk Uplands	North Shore Highlands	Oak Savanna	Pine Moraines & Outwash Plains	Red River Prairie	Rochester Plateau	St. Louis Moraines	St. Paul-Baldwin Plains	Tamarack Lowlands	Toimi Uplands
25	Mo	Ligumia recta	Black Sandshell	X	112	26	12	54	X	32	2	2	34	X	1	23	76	68	2	16	3	35	53	X	21	44	45	6
3	Mo	Megalonaias nervosa	Washboard				1	22																		3		
1	Mo	Novasuccinea n.sp. minnesota a	Minnesota Pleistocene Ambersnail					X																				
1	Mo	Novasuccinea n.sp. minnesota b	Iowa Pleistocene Ambersnail					X																				
5	Mo	Obovaria olivaria	Hickorynut				5	74									26	4								31		
4	Mo	Plethobasus cyphyus	Sheepnose				1	3													1					9		
6	Mo	Pleurobema coccineum	Round Pigtoe				3	44									53				8			X		50		
4	Mo	Quadrula fragosa	Winged Mapleleaf				1	1									2									4		
10	Mo	Quadrula metanevra	Monkeyface		X		5	33			1			X			5	3			1			X		42		
5	Mo	Quadrula nodulata	Wartyback		20		8	18									4									102		
4	Mo	Simpsonaias ambigua	Salamander Mussel					X									1	3								3		
5	Mo	Tritogonia verrucosa	Pistolgrip				6	12									5	3								27		
5	Mo	Truncilla donaciformis	Fawnsfoot		13		1	21										1								8		
8	Mo	Venustaconcha ellipsiformis	Ellipse				1	18			X			X				4			10			27		1		
1	Mo	Vertigo hubrichti	Hubricht's Vertigo					5																				
1	Mo	Vertigo hubrichti hubrichti	Midwest Pleistocene Vertigo					X																				
1	Mo	Vertigo hubrichti variabilis n. subsp.	Variable Pleistocene Vertigo					X																				
1	Mo	Vertigo meramecensis	Bluff Vertigo					3																				
		Key																										
	Ma	Mammals																										
	Bi	Birds																										
	Re	Reptiles																										
	Am	Amphibians																										
	Fi	Fish																										
	Sp	Spiders																										
	In	Insects																										
	Mo	Mollusks																										

Appendix F Species in Greatest Conservation Need by ECS Province

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Eastern Broadleaf Forest	Mammals	Cryptotis parva	Least Shrew	
Eastern Broadleaf Forest	Mammals	Microtus ochrogaster	Prairie Vole	
Eastern Broadleaf Forest	Mammals	Microtus pinetorum	Woodland Vole	Y
Eastern Broadleaf Forest	Mammals	Mustela nivalis	Least Weasel	
Eastern Broadleaf Forest	Mammals	Myotis septentrionalis	Northern Myotis	
Eastern Broadleaf Forest	Mammals	Perognathus flavescens	Plains Pocket Mouse	
Eastern Broadleaf Forest	Mammals	Pipistrellus subflavus	Eastern Pipistrelle	
Eastern Broadleaf Forest	Mammals	Reithrodontomys megalotis	Western Harvest Mouse	
Eastern Broadleaf Forest	Mammals	Spermophilus franklinii	Franklin's Ground Squirrel	
Eastern Broadleaf Forest	Mammals	Spilogale putorius	Eastern Spotted Skunk	
Eastern Broadleaf Forest	Mammals	Taxidea taxus	American Badger	
Eastern Broadleaf Forest	Birds	Aechmophorus occidentalis	Western Grebe	
Eastern Broadleaf Forest	Birds	Ammodramus henslowii	Henslow's Sparrow	
Eastern Broadleaf Forest	Birds	Ammodramus leconteii	Le Conte's Sparrow	
Eastern Broadleaf Forest	Birds	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	
Eastern Broadleaf Forest	Birds	Ammodramus savannarum	Grasshopper Sparrow	
Eastern Broadleaf Forest	Birds	Anas acuta	Northern Pintail	
Eastern Broadleaf Forest	Birds	Arenaria interpres	Ruddy Turnstone	
Eastern Broadleaf Forest	Birds	Asio flammeus	Short-eared Owl	
Eastern Broadleaf Forest	Birds	Aythya affinis	Lesser Scaup	
Eastern Broadleaf Forest	Birds	Bartramia longicauda	Upland Sandpiper	
Eastern Broadleaf Forest	Birds	Botaurus lentiginosus	American Bittern	
Eastern Broadleaf Forest	Birds	Buteo lineatus	Red-shouldered Hawk	
Eastern Broadleaf Forest	Birds	Buteo swainsoni	Swainson's Hawk	
Eastern Broadleaf Forest	Birds	Calidris alpina	Dunlin	
Eastern Broadleaf Forest	Birds	Calidris fuscicollis	White-rumped Sandpiper	
Eastern Broadleaf Forest	Birds	Calidris pusilla	Semipalmated Sandpiper	
Eastern Broadleaf Forest	Birds	Caprimulgus vociferus	Whip-poor-will	
Eastern Broadleaf Forest	Birds	Catharus fuscescens	Veery	
Eastern Broadleaf Forest	Birds	Chlidonias niger	Black Tern	
Eastern Broadleaf Forest	Birds	Chordeiles minor	Common Nighthawk	
Eastern Broadleaf Forest	Birds	Circus cyaneus	Northern Harrier	
Eastern Broadleaf Forest	Birds	Cistothorus palustris	Marsh Wren	
Eastern Broadleaf Forest	Birds	Cistothorus platensis	Sedge Wren	
Eastern Broadleaf Forest	Birds	Coccyzus erythropthalmus	Black-billed Cuckoo	
Eastern Broadleaf Forest	Birds	Contopus virens	Eastern Wood-pewee	
Eastern Broadleaf Forest	Birds	Coturnicops noveboracensis	Yellow Rail	
Eastern Broadleaf Forest	Birds	Cygnus buccinator	Trumpeter Swan	
Eastern Broadleaf Forest	Birds	Dendroica cerulea	Cerulean Warbler	
Eastern Broadleaf Forest	Birds	Dolichonyx oryzivorus	Bobolink	
Eastern Broadleaf Forest	Birds	Empidonax minimus	Least Flycatcher	
Eastern Broadleaf Forest	Birds	Empidonax traillii	Willow Flycatcher	
Eastern Broadleaf Forest	Birds	Empidonax virescens	Acadian Flycatcher	
Eastern Broadleaf Forest	Birds	Falco peregrinus	Peregrine Falcon	
Eastern Broadleaf Forest	Birds	Gallinula chloropus	Common Moorhen	
Eastern Broadleaf Forest	Birds	Gavia immer	Common Loon	
Eastern Broadleaf Forest	Birds	Haliaeetus leucocephalus	Bald Eagle	
Eastern Broadleaf Forest	Birds	Hylocichla mustelina	Wood Thrush	
Eastern Broadleaf Forest	Birds	Ixobrychus exilis	Least Bittern	
Eastern Broadleaf Forest	Birds	Lanius ludovicianus	Loggerhead Shrike	
Eastern Broadleaf Forest	Birds	Larus pipixcan	Franklin's Gull	
Eastern Broadleaf Forest	Birds	Limnodromus griseus	Short-billed Dowitcher	
Eastern Broadleaf Forest	Birds	Limosa haemastica	Hudsonian Godwit	
Eastern Broadleaf Forest	Birds	Melanerpes erythrocephalus	Red-headed Woodpecker	
Eastern Broadleaf Forest	Birds	Melospiza georgiana	Swamp Sparrow	
Eastern Broadleaf Forest	Birds	Numenius phaeopus	Whimbrel	
Eastern Broadleaf Forest	Birds	Nycticorax nycticorax	Black-crowned Night-heron	

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Eastern Broadleaf Forest	Birds	Pelecanus erythrorhynchos	American White Pelican	
Eastern Broadleaf Forest	Birds	Phalaropus tricolor	Wilson's Phalarope	
Eastern Broadleaf Forest	Birds	Pheucticus ludovicianus	Rose-breasted Grosbeak	
Eastern Broadleaf Forest	Birds	Pluvialis dominica	American Golden-plover	
Eastern Broadleaf Forest	Birds	Podiceps grisegena	Red-necked Grebe	
Eastern Broadleaf Forest	Birds	Podiceps nigricollis	Eared Grebe	
Eastern Broadleaf Forest	Birds	Protonotaria citrea	Prothonotary Warbler	
Eastern Broadleaf Forest	Birds	Rallus elegans	King Rail	
Eastern Broadleaf Forest	Birds	Rallus limicola	Virginia Rail	
Eastern Broadleaf Forest	Birds	Recurvirostra americana	American Avocet	
Eastern Broadleaf Forest	Birds	Scolopax minor	American Woodcock	
Eastern Broadleaf Forest	Birds	Seiurus aurocapillus	Ovenbird	
Eastern Broadleaf Forest	Birds	Seiurus motacilla	Louisiana Waterthrush	
Eastern Broadleaf Forest	Birds	Sphyrapicus varius	Yellow-bellied Sapsucker	
Eastern Broadleaf Forest	Birds	Spiza americana	Dickcissel	
Eastern Broadleaf Forest	Birds	Spizella pusilla	Field Sparrow	
Eastern Broadleaf Forest	Birds	Stelgidopteryx serripennis	Northern Rough-winged Swallow	
Eastern Broadleaf Forest	Birds	Sterna forsteri	Forster's Tern	
Eastern Broadleaf Forest	Birds	Sturnella magna	Eastern Meadowlark	
Eastern Broadleaf Forest	Birds	Toxostoma rufum	Brown Thrasher	
Eastern Broadleaf Forest	Birds	Tringa melanoleuca	Greater Yellowlegs	
Eastern Broadleaf Forest	Birds	Troglodytes troglodytes	Winter Wren	
Eastern Broadleaf Forest	Birds	Tryngites subruficollis	Buff-breasted Sandpiper	
Eastern Broadleaf Forest	Birds	Vermivora chrysoptera	Golden-winged Warbler	
Eastern Broadleaf Forest	Birds	Vermivora pinus	Blue-winged Warbler	
Eastern Broadleaf Forest	Birds	Vireo bellii	Bell's Vireo	
Eastern Broadleaf Forest	Birds	Wilsonia citrina	Hooded Warbler	
Eastern Broadleaf Forest	Birds	Zonotrichia albicollis	White-throated Sparrow	
Eastern Broadleaf Forest	Reptiles	Apalone mutica	Smooth Softshell	Y
Eastern Broadleaf Forest	Reptiles	Chelydra serpentina	Common Snapping Turtle	
Eastern Broadleaf Forest	Reptiles	Clemmys insculpta	Wood Turtle	
Eastern Broadleaf Forest	Reptiles	Cnemidophorus sexlineatus	Six-lined Racerunner	Y
Eastern Broadleaf Forest	Reptiles	Coluber constrictor	Eastern Racer	Y
Eastern Broadleaf Forest	Reptiles	Crotalus horridus	Timber Rattlesnake	Y
Eastern Broadleaf Forest	Reptiles	Elaphe obsoleta	Eastern Rat Snake	Y
Eastern Broadleaf Forest	Reptiles	Elaphe vulpina	Eastern Fox Snake	
Eastern Broadleaf Forest	Reptiles	Emydoidea blandingii	Blanding's Turtle	
Eastern Broadleaf Forest	Reptiles	Eumeces fasciatus	Five-lined Skink	
Eastern Broadleaf Forest	Reptiles	Heterodon nasicus	Western Hognose Snake	
Eastern Broadleaf Forest	Reptiles	Heterodon platirhinos	Eastern Hognose Snake	
Eastern Broadleaf Forest	Reptiles	Lampropeltis triangulum	Milk Snake	
Eastern Broadleaf Forest	Reptiles	Liochlorophis vernalis	Smooth Green Snake	
Eastern Broadleaf Forest	Reptiles	Pituophis catenifer	Gopher Snake	
Eastern Broadleaf Forest	Reptiles	Sistrurus catenatus	Eastern Massasauga	Y
Eastern Broadleaf Forest	Amphibians	Acris crepitans	Northern Cricket Frog	
Eastern Broadleaf Forest	Amphibians	Hemidactylium scutatum	Four-toed Salamander	
Eastern Broadleaf Forest	Amphibians	Necturus maculosus	Common Mudpuppy	
Eastern Broadleaf Forest	Amphibians	Rana palustris	Pickerel Frog	Y
Eastern Broadleaf Forest	Fish	Acipenser fulvescens	Lake Sturgeon	
Eastern Broadleaf Forest	Fish	Alosa chrysochloris	Skipjack Herring	
Eastern Broadleaf Forest	Fish	Ammocrypta asprella	Crystal Darter	Y
Eastern Broadleaf Forest	Fish	Ammocrypta clara	Western Sand Darter	Y
Eastern Broadleaf Forest	Fish	Anguilla Rostrata	American Eel	Y
Eastern Broadleaf Forest	Fish	Aphredoderus sayanus	Pirate Perch	Y
Eastern Broadleaf Forest	Fish	Campostoma oligolepis	Largescale Stoneroller	
Eastern Broadleaf Forest	Fish	Clinostomus elongatus	Redside Dace	Y
Eastern Broadleaf Forest	Fish	Cycleptus elongatus	Blue Sucker	Y
Eastern Broadleaf Forest	Fish	Erimystax x-punctata	Gravel Chub	Y
Eastern Broadleaf Forest	Fish	Etheostoma asprigene	Mud Darter	Y

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Eastern Broadleaf Forest	Fish	Etheostoma chlorosoma	Bluntnose Darter	Y
Eastern Broadleaf Forest	Fish	Etheostoma microperca	Least Darter	
Eastern Broadleaf Forest	Fish	Hybognathus nuchalis	Mississippi Silvery Minnow	Y
Eastern Broadleaf Forest	Fish	Ichthyomyzon gagei	Southern Brook Lamprey	
Eastern Broadleaf Forest	Fish	Ictiobus niger	Black Buffalo	Y
Eastern Broadleaf Forest	Fish	Lampetra appendix	American Brook Lamprey	
Eastern Broadleaf Forest	Fish	Lepomis gulosus	Warmouth	Y
Eastern Broadleaf Forest	Fish	Lepomis megalotis	Longear Sunfish	
Eastern Broadleaf Forest	Fish	Lythrurus umbratilis	Redfin Shiner	Y
Eastern Broadleaf Forest	Fish	Macrhybopsis aestivalis	speckled chub	Y
Eastern Broadleaf Forest	Fish	Morone mississippiensis	Yellow Bass	Y
Eastern Broadleaf Forest	Fish	Moxostoma carinatum	River Redhorse	Y
Eastern Broadleaf Forest	Fish	Moxostoma duquesnei	Black Redhorse	Y
Eastern Broadleaf Forest	Fish	Moxostoma valenciennesi	Greater Redhorse	
Eastern Broadleaf Forest	Fish	Notropis amnis	Pallid Shiner	Y
Eastern Broadleaf Forest	Fish	Notropis anogenus	Pugnose Shiner	
Eastern Broadleaf Forest	Fish	Notropis nubilus	Ozark Minnow	Y
Eastern Broadleaf Forest	Fish	Noturus exilis	Slender Madtom	Y
Eastern Broadleaf Forest	Fish	Opsopoeodus emiliae	Pugnose Minnow	Y
Eastern Broadleaf Forest	Fish	Percina evides	Gilt Darter	
Eastern Broadleaf Forest	Fish	Phenacobius mirabilis	Suckermouth Minnow	Y
Eastern Broadleaf Forest	Fish	Polyodon spathula	Paddlefish	Y
Eastern Broadleaf Forest	Fish	Scaphirhynchus platorynchus	Shovelnose Sturgeon	Y
Eastern Broadleaf Forest	Spiders	Habronattus texanus	A Jumping Spider	
Eastern Broadleaf Forest	Spiders	Marpissa grata	A Jumping Spider	
Eastern Broadleaf Forest	Spiders	Metaphidippus arizonensis	A Jumping Spider	
Eastern Broadleaf Forest	Spiders	Paradamoetas fontana	A Jumping Spider	
Eastern Broadleaf Forest	Spiders	Phidippus apacheanus	A Jumping Spider	Y
Eastern Broadleaf Forest	Spiders	Phidippus pius	A Jumping Spider	
Eastern Broadleaf Forest	Spiders	Sassacus papenhoei	A Jumping Spider	Y
Eastern Broadleaf Forest	Spiders	Tutelina formicaria	A Jumping Spider	Y
Eastern Broadleaf Forest	Insects	Aflexia rubranura	Red Tailed Prairie Leafhopper	
Eastern Broadleaf Forest	Insects	Agapetus tomus	A Caddisfly	
Eastern Broadleaf Forest	Insects	Asynarchus rossi	A Caddisfly	Y
Eastern Broadleaf Forest	Insects	Atrytone arogos	Arogos Skipper	
Eastern Broadleaf Forest	Insects	Cicindela lepida	Little White Tiger Beetle	
Eastern Broadleaf Forest	Insects	Cicindela limbata nympha	A Tiger Beetle	Y
Eastern Broadleaf Forest	Insects	Cicindela macra macra	A Tiger Beetle	Y
Eastern Broadleaf Forest	Insects	Cicindela patruela patruela	A Tiger Beetle	
Eastern Broadleaf Forest	Insects	Cicindela splendida cyanocephalata	A Tiger Beetle	Y
Eastern Broadleaf Forest	Insects	Epidemia epixanthe michiganensis	Bog Copper	
Eastern Broadleaf Forest	Insects	Erynnis persius	Persius Duskywing	
Eastern Broadleaf Forest	Insects	Euphyes bimacula illinois	Two-spotted Skipper	
Eastern Broadleaf Forest	Insects	Gomphus crassus	Handsome Clubtail	Y
Eastern Broadleaf Forest	Insects	Gomphus ventricosus	Skillet Clubtail	
Eastern Broadleaf Forest	Insects	Gomphus viridifrons	Green-faced Clubtail	
Eastern Broadleaf Forest	Insects	Hesperia leonardus leonardus	Leonard's Skipper	
Eastern Broadleaf Forest	Insects	Hesperia ottoe	Ottoe Skipper	
Eastern Broadleaf Forest	Insects	Hesperia uncas	Uncas Skipper	
Eastern Broadleaf Forest	Insects	Lycaeides melissa samuelis	Karner Blue	
Eastern Broadleaf Forest	Insects	Oarisma powesheik	Powesheik Skipper	
Eastern Broadleaf Forest	Insects	Ophiogomphus susbehcha	St. Croix Snaketail	
Eastern Broadleaf Forest	Insects	Oxyethira ecornuta	A Caddisfly	
Eastern Broadleaf Forest	Insects	Oxyethira itascae	A Caddisfly	
Eastern Broadleaf Forest	Insects	Papaipema beeriana	Blazing Star Stem Borer	
Eastern Broadleaf Forest	Insects	Schinia indiana	Phlox Moth	
Eastern Broadleaf Forest	Insects	Speyeria idalia	Regal Fritillary	
Eastern Broadleaf Forest	Mollusks	Actinonaias ligamentina	Mucket mussel	
Eastern Broadleaf Forest	Mollusks	Alasmidonta marginata	Elktoe	

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Eastern Broadleaf Forest	Mollusks	Arcidens confragosus	Rock Pocketbook	Y
Eastern Broadleaf Forest	Mollusks	Cumberlandia monodonta	Spectaclecase	
Eastern Broadleaf Forest	Mollusks	Cyclonaias tuberculata	Purple Wartyback	
Eastern Broadleaf Forest	Mollusks	Ellipsaria lineolata	Butterfly	
Eastern Broadleaf Forest	Mollusks	Elliptio crassidens	Elephant-ear	Y
Eastern Broadleaf Forest	Mollusks	Elliptio dilatata	Spike	
Eastern Broadleaf Forest	Mollusks	Epioblasma triquetra	Snuffbox	
Eastern Broadleaf Forest	Mollusks	Fusconaia ebena	Ebonyshell	
Eastern Broadleaf Forest	Mollusks	Lampsilis higginsi	Higgins Eye	
Eastern Broadleaf Forest	Mollusks	Lampsilis teres	Yellow Sandshell	Y
Eastern Broadleaf Forest	Mollusks	Lasmigona compressa	Creek Heelsplitter	
Eastern Broadleaf Forest	Mollusks	Lasmigona costata	Fluted-shell	
Eastern Broadleaf Forest	Mollusks	Ligumia recta	Black Sandshell	
Eastern Broadleaf Forest	Mollusks	Megalonaias nervosa	Washboard	Y
Eastern Broadleaf Forest	Mollusks	Novasuccinea n. sp. minnesota a	Minnesota Pleistocene Ambersnail	Y
Eastern Broadleaf Forest	Mollusks	Novasuccinea n. sp. minnesota b	Iowa Pleistocene Ambersnail	Y
Eastern Broadleaf Forest	Mollusks	Obovaria olivaria	Hickorynut	
Eastern Broadleaf Forest	Mollusks	Plethobasus cyphyus	Sheepnose	Y
Eastern Broadleaf Forest	Mollusks	Pleurobema coccineum	Round Pigtoe	
Eastern Broadleaf Forest	Mollusks	Quadrula fragosa	Winged Mapleleaf	
Eastern Broadleaf Forest	Mollusks	Quadrula metanevra	Monkeyface	
Eastern Broadleaf Forest	Mollusks	Quadrula nodulata	Wartyback	
Eastern Broadleaf Forest	Mollusks	Simpsonaias ambigua	Salamander Mussel	
Eastern Broadleaf Forest	Mollusks	Tritogonia verrucosa	Pistolgrip	
Eastern Broadleaf Forest	Mollusks	Truncilla donaciformis	Fawnsfoot	
Eastern Broadleaf Forest	Mollusks	Venustaconcha ellipsiformis	Ellipse	
Eastern Broadleaf Forest	Mollusks	Vertigo hubrichti	Hubricht's Vertigo	Y
Eastern Broadleaf Forest	Mollusks	Vertigo hubrichti hubrichti	Midwest Pleistocene Vertigo	Y
Eastern Broadleaf Forest	Mollusks	Vertigo hubrichti variabilis n. subsp.	Variable Pleistocene Vertigo	Y
Eastern Broadleaf Forest	Mollusks	Vertigo meramecensis	Bluff Vertigo	Y
Laurentian Mixed Forest	Mammals	Canis lupus	Gray Wolf	
Laurentian Mixed Forest	Mammals	Cervus elaphus	Elk	
Laurentian Mixed Forest	Mammals	Lynx canadensis	Canada lynx	Y
Laurentian Mixed Forest	Mammals	Microtus chrotorrhinus	Rock Vole	Y
Laurentian Mixed Forest	Mammals	Microtus ochrogaster	Prairie Vole	
Laurentian Mixed Forest	Mammals	Mustela nivalis	Least Weasel	
Laurentian Mixed Forest	Mammals	Myotis septentrionalis	Northern Myotis	
Laurentian Mixed Forest	Mammals	Phenacomys intermedius	Heather Vole	Y
Laurentian Mixed Forest	Mammals	Pipistrellus subflavus	Eastern Pipistrelle	
Laurentian Mixed Forest	Mammals	Sorex fumeus	Smoky Shrew	Y
Laurentian Mixed Forest	Mammals	Spermophilus franklinii	Franklin's Ground Squirrel	
Laurentian Mixed Forest	Mammals	Spilogale putorius	Eastern Spotted Skunk	
Laurentian Mixed Forest	Mammals	Synaptomys borealis	Northern Bog Lemming	Y
Laurentian Mixed Forest	Mammals	Taxidea taxus	American Badger	
Laurentian Mixed Forest	Birds	Accipiter gentilis	Northern Goshawk	Y
Laurentian Mixed Forest	Birds	Aegolius funereus	Boreal Owl	Y
Laurentian Mixed Forest	Birds	Ammodramus leconteii	Le Conte's Sparrow	
Laurentian Mixed Forest	Birds	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	
Laurentian Mixed Forest	Birds	Ammodramus savannarum	Grasshopper Sparrow	
Laurentian Mixed Forest	Birds	Anas rubripes	American Black Duck	Y
Laurentian Mixed Forest	Birds	Arenaria interpres	Ruddy Turnstone	
Laurentian Mixed Forest	Birds	Asio flammeus	Short-eared Owl	
Laurentian Mixed Forest	Birds	Bartramia longicauda	Upland Sandpiper	
Laurentian Mixed Forest	Birds	Botaurus lentiginosus	American Bittern	
Laurentian Mixed Forest	Birds	Buteo lineatus	Red-shouldered Hawk	
Laurentian Mixed Forest	Birds	Calidris alpina	Dunlin	
Laurentian Mixed Forest	Birds	Calidris fuscicollis	White-rumped Sandpiper	
Laurentian Mixed Forest	Birds	Calidris pusilla	Semipalmated Sandpiper	
Laurentian Mixed Forest	Birds	Caprimulgus vociferus	Whip-poor-will	

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Laurentian Mixed Forest	Birds	Catharus fuscescens	Veery	
Laurentian Mixed Forest	Birds	Charadrius melodus	Piping Plover	Y
Laurentian Mixed Forest	Birds	Chlidonias niger	Black Tern	
Laurentian Mixed Forest	Birds	Chordeiles minor	Common Nighthawk	
Laurentian Mixed Forest	Birds	Circus cyaneus	Northern Harrier	
Laurentian Mixed Forest	Birds	Cistothorus palustris	Marsh Wren	
Laurentian Mixed Forest	Birds	Cistothorus platensis	Sedge Wren	
Laurentian Mixed Forest	Birds	Coccyzus erythropthalmus	Black-billed Cuckoo	
Laurentian Mixed Forest	Birds	Contopus cooperi	Olive-sided Flycatcher	
Laurentian Mixed Forest	Birds	Contopus virens	Eastern Wood-pewee	
Laurentian Mixed Forest	Birds	Coturnicops noveboracensis	Yellow Rail	
Laurentian Mixed Forest	Birds	Cygnus buccinator	Trumpeter Swan	
Laurentian Mixed Forest	Birds	Dendroica caerulescens	Black-throated Blue Warbler	Y
Laurentian Mixed Forest	Birds	Dendroica castanea	Bay-breasted Warbler	Y
Laurentian Mixed Forest	Birds	Dendroica cerulea	Cerulean Warbler	
Laurentian Mixed Forest	Birds	Dendroica tigrina	Cape May Warbler	Y
Laurentian Mixed Forest	Birds	Dolichonyx oryzivorus	Bobolink	
Laurentian Mixed Forest	Birds	Empidonax minimus	Least Flycatcher	
Laurentian Mixed Forest	Birds	Empidonax traillii	Willow Flycatcher	
Laurentian Mixed Forest	Birds	Euphagus carolinus	Rusty Blackbird	Y
Laurentian Mixed Forest	Birds	Falcipennis canadensis	Spruce Grouse	Y
Laurentian Mixed Forest	Birds	Falco peregrinus	Peregrine Falcon	
Laurentian Mixed Forest	Birds	Gavia immer	Common Loon	
Laurentian Mixed Forest	Birds	Haliaeetus leucocephalus	Bald Eagle	
Laurentian Mixed Forest	Birds	Hylocichla mustelina	Wood Thrush	
Laurentian Mixed Forest	Birds	Ixobrychus exilis	Least Bittern	
Laurentian Mixed Forest	Birds	Limnodromus griseus	Short-billed Dowitcher	
Laurentian Mixed Forest	Birds	Limosa fedoa	Marbled Godwit	
Laurentian Mixed Forest	Birds	Limosa haemastica	Hudsonian Godwit	
Laurentian Mixed Forest	Birds	Melanerpes erythrocephalus	Red-headed Woodpecker	
Laurentian Mixed Forest	Birds	Melospiza georgiana	Swamp Sparrow	
Laurentian Mixed Forest	Birds	Numenius phaeopus	Whimbrel	
Laurentian Mixed Forest	Birds	Oporornis agilis	Connecticut Warbler	
Laurentian Mixed Forest	Birds	Pelecanus erythrorhynchos	American White Pelican	
Laurentian Mixed Forest	Birds	Phalaropus tricolor	Wilson's Phalarope	
Laurentian Mixed Forest	Birds	Pheucticus ludovicianus	Rose-breasted Grosbeak	
Laurentian Mixed Forest	Birds	Picoides arcticus	Black-backed Woodpecker	Y
Laurentian Mixed Forest	Birds	Pluvialis dominica	American Golden-plover	
Laurentian Mixed Forest	Birds	Podiceps grisegena	Red-necked Grebe	
Laurentian Mixed Forest	Birds	Poecile hudsonica	Boreal Chickadee	Y
Laurentian Mixed Forest	Birds	Rallus limicola	Virginia Rail	
Laurentian Mixed Forest	Birds	Recurvirostra americana	American Avocet	
Laurentian Mixed Forest	Birds	Scolopax minor	American Woodcock	
Laurentian Mixed Forest	Birds	Seiurus aurocapillus	Ovenbird	
Laurentian Mixed Forest	Birds	Seiurus motacilla	Louisiana Waterthrush	
Laurentian Mixed Forest	Birds	Sphyrapicus varius	Yellow-bellied Sapsucker	
Laurentian Mixed Forest	Birds	Spizella pusilla	Field Sparrow	
Laurentian Mixed Forest	Birds	Stelgidopteryx serripennis	Northern Rough-winged Swallow	
Laurentian Mixed Forest	Birds	Sterna forsteri	Forster's Tern	
Laurentian Mixed Forest	Birds	Sterna hirundo	Common Tern	Y
Laurentian Mixed Forest	Birds	Sturnella magna	Eastern Meadowlark	
Laurentian Mixed Forest	Birds	Toxostoma rufum	Brown Thrasher	
Laurentian Mixed Forest	Birds	Tringa melanoleuca	Greater Yellowlegs	
Laurentian Mixed Forest	Birds	Troglodytes troglodytes	Winter Wren	
Laurentian Mixed Forest	Birds	Tryngites subruficollis	Buff-breasted Sandpiper	
Laurentian Mixed Forest	Birds	Tympanuchus cupido	Greater Prairie-chicken	
Laurentian Mixed Forest	Birds	Tympanuchus phasianellus	Sharp-tailed Grouse	
Laurentian Mixed Forest	Birds	Vermivora chrysoptera	Golden-winged Warbler	
Laurentian Mixed Forest	Birds	Wilsonia canadensis	Canada Warbler	Y

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Laurentian Mixed Forest	Birds	Wilsonia citrina	Hooded Warbler	
Laurentian Mixed Forest	Birds	Zonotrichia albicollis	White-throated Sparrow	
Laurentian Mixed Forest	Reptiles	Chelydra serpentina	Common Snapping Turtle	
Laurentian Mixed Forest	Reptiles	Clemmys insculpta	Wood Turtle	
Laurentian Mixed Forest	Reptiles	Emydoidea blandingii	Blanding's Turtle	
Laurentian Mixed Forest	Reptiles	Heterodon nasicus	Western Hognose Snake	
Laurentian Mixed Forest	Reptiles	Heterodon platirhinos	Eastern Hognose Snake	
Laurentian Mixed Forest	Reptiles	Lampropeltis triangulum	Milk Snake	
Laurentian Mixed Forest	Reptiles	Liochlorophis vernalis	Smooth Green Snake	
Laurentian Mixed Forest	Amphibians	Acris crepitans	Northern Cricket Frog	
Laurentian Mixed Forest	Amphibians	Ambystoma maculatum	Spotted Salamander	Y
Laurentian Mixed Forest	Amphibians	Hemidactylium scutatum	Four-toed Salamander	
Laurentian Mixed Forest	Amphibians	Necturus maculosus	Common Mudpuppy	
Laurentian Mixed Forest	Amphibians	Plethodon cinereus	Eastern Red-backed Salamander	Y
Laurentian Mixed Forest	Fish	Acipenser fulvescens	Lake Sturgeon	
Laurentian Mixed Forest	Fish	Campostoma oligolepis	Largescale Stoneroller	
Laurentian Mixed Forest	Fish	Coregonus hoyi	Bloater	Y
Laurentian Mixed Forest	Fish	Coregonus kiyi	Kiyi	Y
Laurentian Mixed Forest	Fish	Coregonus nipigon	Nipigon cisco	Y
Laurentian Mixed Forest	Fish	Coregonus zenithicus	Shortjaw Cisco	Y
Laurentian Mixed Forest	Fish	Cottus ricei	Spoonhead sculpin	Y
Laurentian Mixed Forest	Fish	Couesius plumbeus	Lake Chub	Y
Laurentian Mixed Forest	Fish	Etheostoma microperca	Least Darter	
Laurentian Mixed Forest	Fish	Ichthyomyzon fossor	Northern Brook Lamprey	Y
Laurentian Mixed Forest	Fish	Ichthyomyzon gagei	Southern Brook Lamprey	
Laurentian Mixed Forest	Fish	Lampetra appendix	American Brook Lamprey	
Laurentian Mixed Forest	Fish	Lepomis megalotis	Longear Sunfish	
Laurentian Mixed Forest	Fish	Moxostoma valenciennesi	Greater Redhorse	
Laurentian Mixed Forest	Fish	Myoxocephalus thompsoni	Deepwater Sculpin	Y
Laurentian Mixed Forest	Fish	Notropis anogenus	Pugnose Shiner	
Laurentian Mixed Forest	Fish	Percina evides	Gilt Darter	
Laurentian Mixed Forest	Fish	Prosopium coulteri	pygmy whitefish	Y
Laurentian Mixed Forest	Spiders	Marpissa grata	A Jumping Spider	
Laurentian Mixed Forest	Spiders	Paradamoetas fontana	A Jumping Spider	
Laurentian Mixed Forest	Insects	Agapetus tomus	A Caddisfly	
Laurentian Mixed Forest	Insects	Ceraclea brevis	A Caddisfly	Y
Laurentian Mixed Forest	Insects	Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	Y
Laurentian Mixed Forest	Insects	Chilostigma itascae	Headwater Chilostigman Caddisfly	Y
Laurentian Mixed Forest	Insects	Cicindela denikei	A Tiger Beetle	Y
Laurentian Mixed Forest	Insects	Cicindela hirticollis rhodensis	A Tiger Beetle	Y
Laurentian Mixed Forest	Insects	Cicindela patruela patruela	A Tiger Beetle	
Laurentian Mixed Forest	Insects	Epidemia epixanthe michiganensis	Bog Copper	
Laurentian Mixed Forest	Insects	Erebia disa mancinus	Disa Alpine	Y
Laurentian Mixed Forest	Insects	Erynnis persius	Persius Duskywing	
Laurentian Mixed Forest	Insects	Euphyes bimacula illinois	Two-spotted Skipper	
Laurentian Mixed Forest	Insects	Gomphus ventricosus	Skillet Clubtail	
Laurentian Mixed Forest	Insects	Gomphus viridifrons	Green-faced Clubtail	
Laurentian Mixed Forest	Insects	Hesperia leonardus leonardus	Leonard's Skipper	
Laurentian Mixed Forest	Insects	Hydroptila metoeca	A Caddisfly	Y
Laurentian Mixed Forest	Insects	Hydroptila novicola	A Caddisfly	Y
Laurentian Mixed Forest	Insects	Hydroptila tortosa	A Caddisfly	Y
Laurentian Mixed Forest	Insects	Lycaeides idas nabokovi	Nabokov's Blue	Y
Laurentian Mixed Forest	Insects	Lycaeides melissa samuelis	Karner Blue	
Laurentian Mixed Forest	Insects	Oeneis macounii	Macoun's Arctic	Y
Laurentian Mixed Forest	Insects	Ophiogomphus anomalis	Extra-striped Snaketail	Y
Laurentian Mixed Forest	Insects	Ophiogomphus howei	Pygmy Snaketail	Y
Laurentian Mixed Forest	Insects	Ophiogomphus susbehcha	St. Croix Snaketail	
Laurentian Mixed Forest	Insects	Oxyethira ecornuta	A Caddisfly	
Laurentian Mixed Forest	Insects	Oxyethira itascae	A Caddisfly	

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Laurentian Mixed Forest	Insects	Phyciodes batesii	Tawny Crescent	Y
Laurentian Mixed Forest	Insects	Polycentropus milaca	A Caddisfly	Y
Laurentian Mixed Forest	Insects	Protoptila talola	A Caddisfly	Y
Laurentian Mixed Forest	Insects	Pyrgus centaureae freija	Grizzled Skipper	Y
Laurentian Mixed Forest	Insects	Setodes guttatus	A Caddisfly	Y
Laurentian Mixed Forest	Mollusks	Actinonaias ligamentina	Mucket mussel	
Laurentian Mixed Forest	Mollusks	Alasmidonta marginata	Elktoe	
Laurentian Mixed Forest	Mollusks	Cumberlandia monodonta	Spectaclecase	
Laurentian Mixed Forest	Mollusks	Cyclonaias tuberculata	Purple Wartyback	
Laurentian Mixed Forest	Mollusks	Ellipsaria lineolata	Butterfly	
Laurentian Mixed Forest	Mollusks	Elliptio dilatata	Spike	
Laurentian Mixed Forest	Mollusks	Epioblasma triquetra	Snuffbox	
Laurentian Mixed Forest	Mollusks	Fusconaia ebena	Ebonyshell	
Laurentian Mixed Forest	Mollusks	Lampsilis higginsi	Higgins Eye	
Laurentian Mixed Forest	Mollusks	Lasmigona compressa	Creek Heelsplitter	
Laurentian Mixed Forest	Mollusks	Lasmigona costata	Fluted-shell	
Laurentian Mixed Forest	Mollusks	Ligumia recta	Black Sandshell	
Laurentian Mixed Forest	Mollusks	Obovaria olivaria	Hickorynut	
Laurentian Mixed Forest	Mollusks	Pleurobema coccineum	Round Pigtoe	
Laurentian Mixed Forest	Mollusks	Quadrula fragosa	Winged Mapleleaf	
Laurentian Mixed Forest	Mollusks	Quadrula metanevra	Monkeyface	
Laurentian Mixed Forest	Mollusks	Quadrula nodulata	Wartyback	
Laurentian Mixed Forest	Mollusks	Simpsonaias ambigua	Salamander Mussel	
Laurentian Mixed Forest	Mollusks	Tritogonia verrucosa	Pistolgrip	
Prairie Parkland	Mammals	Canis lupus	Gray Wolf	
Prairie Parkland	Mammals	Cervus elaphus	Elk	
Prairie Parkland	Mammals	Cryptotis parva	Least Shrew	
Prairie Parkland	Mammals	Microtus ochrogaster	Prairie Vole	
Prairie Parkland	Mammals	Mustela nivalis	Least Weasel	
Prairie Parkland	Mammals	Onychomys leucogaster	Northern Grasshopper Mouse	Y
Prairie Parkland	Mammals	Perognathus flavescens	Plains Pocket Mouse	
Prairie Parkland	Mammals	Pipistrellus subflavus	Eastern Pipistrelle	
Prairie Parkland	Mammals	Reithrodontomys megalotis	Western Harvest Mouse	
Prairie Parkland	Mammals	Spermophilus franklinii	Franklin's Ground Squirrel	
Prairie Parkland	Mammals	Spermophilus richardsonii	Richardson's Ground Squirrel	Y
Prairie Parkland	Mammals	Spilogale putorius	Eastern Spotted Skunk	
Prairie Parkland	Mammals	Taxidea taxus	American Badger	
Prairie Parkland	Mammals	Thomomys talpoides	Northern Pocket Gopher	
Prairie Parkland	Birds	Aechmophorus occidentalis	Western Grebe	
Prairie Parkland	Birds	Ammodramus bairdii	Baird's Sparrow	
Prairie Parkland	Birds	Ammodramus henslowii	Henslow's Sparrow	
Prairie Parkland	Birds	Ammodramus leconteii	Le Conte's Sparrow	
Prairie Parkland	Birds	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	
Prairie Parkland	Birds	Ammodramus savannarum	Grasshopper Sparrow	
Prairie Parkland	Birds	Anas acuta	Northern Pintail	
Prairie Parkland	Birds	Anthus spragueii	Sprague's Pipit	
Prairie Parkland	Birds	Arenaria interpres	Ruddy Turnstone	
Prairie Parkland	Birds	Asio flammeus	Short-eared Owl	
Prairie Parkland	Birds	Aythya affinis	Lesser Scaup	
Prairie Parkland	Birds	Bartramia longicauda	Upland Sandpiper	
Prairie Parkland	Birds	Botaurus lentiginosus	American Bittern	
Prairie Parkland	Birds	Buteo swainsoni	Swainson's Hawk	
Prairie Parkland	Birds	Calcarius ornatus	Chestnut-collared Longspur	Y
Prairie Parkland	Birds	Calidris alpina	Dunlin	
Prairie Parkland	Birds	Calidris fuscicollis	White-rumped Sandpiper	
Prairie Parkland	Birds	Calidris pusilla	Semipalmated Sandpiper	
Prairie Parkland	Birds	Caprimulgus vociferus	Whip-poor-will	
Prairie Parkland	Birds	Catharus fuscescens	Veery	
Prairie Parkland	Birds	Chlidonias niger	Black Tern	

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Prairie Parkland	Birds	Chordeiles minor	Common Nighthawk	
Prairie Parkland	Birds	Circus cyaneus	Northern Harrier	
Prairie Parkland	Birds	Cistothorus palustris	Marsh Wren	
Prairie Parkland	Birds	Cistothorus platensis	Sedge Wren	
Prairie Parkland	Birds	Coccyzus erythropthalmus	Black-billed Cuckoo	
Prairie Parkland	Birds	Contopus cooperi	Olive-sided Flycatcher	
Prairie Parkland	Birds	Contopus virens	Eastern Wood-pewee	
Prairie Parkland	Birds	Coturnicops noveboracensis	Yellow Rail	
Prairie Parkland	Birds	Cygnus buccinator	Trumpeter Swan	
Prairie Parkland	Birds	Dendroica cerulea	Cerulean Warbler	
Prairie Parkland	Birds	Dolichonyx oryzivorus	Bobolink	
Prairie Parkland	Birds	Empidonax minimus	Least Flycatcher	
Prairie Parkland	Birds	Empidonax traillii	Willow Flycatcher	
Prairie Parkland	Birds	Empidonax virescens	Acadian Flycatcher	
Prairie Parkland	Birds	Gallinula chloropus	Common Moorhen	
Prairie Parkland	Birds	Gavia immer	Common Loon	
Prairie Parkland	Birds	Haliaeetus leucocephalus	Bald Eagle	
Prairie Parkland	Birds	Hylocichla mustelina	Wood Thrush	
Prairie Parkland	Birds	Ixobrychus exilis	Least Bittern	
Prairie Parkland	Birds	Lanius ludovicianus	Loggerhead Shrike	
Prairie Parkland	Birds	Larus pipixcan	Franklin's Gull	
Prairie Parkland	Birds	Limnodromus griseus	Short-billed Dowitcher	
Prairie Parkland	Birds	Limosa fedoa	Marbled Godwit	
Prairie Parkland	Birds	Limosa haemastica	Hudsonian Godwit	
Prairie Parkland	Birds	Melanerpes erythrocephalus	Red-headed Woodpecker	
Prairie Parkland	Birds	Melospiza georgiana	Swamp Sparrow	
Prairie Parkland	Birds	Numenius phaeopus	Whimbrel	
Prairie Parkland	Birds	Nycticorax nycticorax	Black-crowned Night-heron	
Prairie Parkland	Birds	Oporornis agilis	Connecticut Warbler	
Prairie Parkland	Birds	Pelecanus erythrorhynchos	American White Pelican	
Prairie Parkland	Birds	Phalaropus tricolor	Wilson's Phalarope	
Prairie Parkland	Birds	Pheucticus ludovicianus	Rose-breasted Grosbeak	
Prairie Parkland	Birds	Pluvialis dominica	American Golden-plover	
Prairie Parkland	Birds	Podiceps auritus	Horned Grebe	Y
Prairie Parkland	Birds	Podiceps grisegena	Red-necked Grebe	
Prairie Parkland	Birds	Podiceps nigricollis	Eared Grebe	
Prairie Parkland	Birds	Protonotaria citrea	Prothonotary Warbler	
Prairie Parkland	Birds	Rallus elegans	King Rail	
Prairie Parkland	Birds	Rallus limicola	Virginia Rail	
Prairie Parkland	Birds	Recurvirostra americana	American Avocet	
Prairie Parkland	Birds	Scolopax minor	American Woodcock	
Prairie Parkland	Birds	Seiurus aurocapillus	Ovenbird	
Prairie Parkland	Birds	Speotyto cunicularia	Burrowing Owl	Y
Prairie Parkland	Birds	Sphyrapicus varius	Yellow-bellied Sapsucker	
Prairie Parkland	Birds	Spiza americana	Dickcissel	
Prairie Parkland	Birds	Spizella pusilla	Field Sparrow	
Prairie Parkland	Birds	Stelgidopteryx serripennis	Northern Rough-winged Swallow	
Prairie Parkland	Birds	Sterna forsteri	Forster's Tern	
Prairie Parkland	Birds	Sturnella magna	Eastern Meadowlark	
Prairie Parkland	Birds	Toxostoma rufum	Brown Thrasher	
Prairie Parkland	Birds	Tringa melanoleuca	Greater Yellowlegs	
Prairie Parkland	Birds	Troglodytes troglodytes	Winter Wren	
Prairie Parkland	Birds	Tryngites subruficollis	Buff-breasted Sandpiper	
Prairie Parkland	Birds	Tympanuchus cupido	Greater Prairie-chicken	
Prairie Parkland	Birds	Tympanuchus phasianellus	Sharp-tailed Grouse	
Prairie Parkland	Birds	Vermivora pinus	Blue-winged Warbler	
Prairie Parkland	Birds	Vireo bellii	Bell's Vireo	
Prairie Parkland	Birds	Zonotrichia albicollis	White-throated Sparrow	
Prairie Parkland	Reptiles	Chelydra serpentina	Common Snapping Turtle	

Province	Taxa	Scientific Name	Common Name	Unique to Province?*
Prairie Parkland	Reptiles	Elaphe vulpina	Eastern Fox Snake	
Prairie Parkland	Reptiles	Emydoidea blandingii	Blanding's Turtle	
Prairie Parkland	Reptiles	Eumeces fasciatus	Five-lined Skink	
Prairie Parkland	Reptiles	Heterodon nasicus	Western Hognose Snake	
Prairie Parkland	Reptiles	Lampropeltis triangulum	Milk Snake	
Prairie Parkland	Reptiles	Liochlorophis vernalis	Smooth Green Snake	
Prairie Parkland	Reptiles	Pituophis catenifer	Gopher Snake	
Prairie Parkland	Reptiles	Tropidoclonion lineatum	Lined Snake	Y
Prairie Parkland	Amphibians	Acris crepitans	Northern Cricket Frog	
Prairie Parkland	Amphibians	Necturus maculosus	Common Mudpuppy	
Prairie Parkland	Fish	Acipenser fulvescens	Lake Sturgeon	
Prairie Parkland	Fish	Alosa chrysochloris	Skipjack Herring	
Prairie Parkland	Fish	Campostoma oligolepis	Largescale Stoneroller	
Prairie Parkland	Fish	Cyprinella lutrensis	Red Shiner	Y
Prairie Parkland	Fish	Etheostoma microperca	Least Darter	
Prairie Parkland	Fish	Fundulus sciadicus	Plains Topminnow	Y
Prairie Parkland	Fish	Lampetra appendix	American Brook Lamprey	
Prairie Parkland	Fish	Notropis anogenus	Pugnose Shiner	
Prairie Parkland	Fish	Notropis topeka	Topeka Shiner	Y
Prairie Parkland	Fish	Platygobio gracilis	flathead chub	Y
Prairie Parkland	Spiders	Habronattus texanus	A Jumping Spider	
Prairie Parkland	Spiders	Marpissa grata	A Jumping Spider	
Prairie Parkland	Spiders	Metaphidippus arizonensis	A Jumping Spider	
Prairie Parkland	Spiders	Paradamoetas fontana	A Jumping Spider	
Prairie Parkland	Spiders	Phidippus pius	A Jumping Spider	
Prairie Parkland	Insects	Aflexia rubranura	Red Tailed Prairie Leafhopper	
Prairie Parkland	Insects	Atrytone arogos	Arogos Skipper	
Prairie Parkland	Insects	Cicindela fulgida fulgida	A Tiger Beetle	Y
Prairie Parkland	Insects	Cicindela fulgida westbournei	A Tiger Beetle	Y
Prairie Parkland	Insects	Cicindela lepida	Little White Tiger Beetle	
Prairie Parkland	Insects	Hesperia comma assiniboia	Assiniboia Skipper	
Prairie Parkland	Insects	Hesperia dacotae	Dakota Skipper	
Prairie Parkland	Insects	Hesperia leonardus pawnee	Pawnee Skipper	Y
Prairie Parkland	Insects	Hesperia ottoe	Ottoe Skipper	
Prairie Parkland	Insects	Hesperia uncas	Uncas Skipper	
Prairie Parkland	Insects	Oarisma garita	Garita Skipper	Y
Prairie Parkland	Insects	Oarisma powesheik	Powesheik Skipper	
Prairie Parkland	Insects	Oeneis uhleri varuna	Uhler's Arctic	Y
Prairie Parkland	Insects	Papaipema beeriana	Blazing Star Stem Borer	
Prairie Parkland	Insects	Schinia indiana	Phlox Moth	
Prairie Parkland	Insects	Speyeria idalia	Regal Fritillary	
Prairie Parkland	Mollusks	Actinonaias ligamentina	Mucket mussel	
Prairie Parkland	Mollusks	Alasmidonta marginata	Elktoe	
Prairie Parkland	Mollusks	Elliptio dilatata	Spike	
Prairie Parkland	Mollusks	Lasmigona compressa	Creek Heelsplitter	
Prairie Parkland	Mollusks	Lasmigona costata	Fluted-shell	
Prairie Parkland	Mollusks	Ligumia recta	Black Sandshell	
Prairie Parkland	Mollusks	Obovaria olivaria	Hickorynut	
Prairie Parkland	Mollusks	Quadrula metanevra	Monkeyface	
Prairie Parkland	Mollusks	Simpsonaias ambigua	Salamander Mussel	
Prairie Parkland	Mollusks	Tritogonia verrucosa	Pistolgrip	
Prairie Parkland	Mollusks	Truncilla donaciformis	Fawnsfoot	
Prairie Parkland	Mollusks	Venustaconcha ellipsiformis	Ellipse	

* Unique to province? A "Y" indicates that the species occurs only in that province.

Appendix G Species in Greatest Conservation Need by ECS Subsection

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Anoka Sand Plain	MA	Microtus ochrogaster	Prairie Vole	12	2
EBF	Anoka Sand Plain	MA	Mustela nivalis	Least Weasel	12	
EBF	Anoka Sand Plain	MA	Myotis septentrionalis	Northern Myotis	5	
EBF	Anoka Sand Plain	MA	Perognathus flavescens	Plains Pocket Mouse	5	7
EBF	Anoka Sand Plain	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	
EBF	Anoka Sand Plain	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	Anoka Sand Plain	MA	Spilogale putorius	Eastern Spotted Skunk	19	
EBF	Anoka Sand Plain	MA	Taxidea taxus	American Badger	24	1
EBF	Anoka Sand Plain	BI	Ammodramus leconteii	Le Conte's Sparrow	17	
EBF	Anoka Sand Plain	BI	Ammodramus savannarum	Grasshopper Sparrow	14	28
EBF	Anoka Sand Plain	BI	Anas acuta	Northern Pintail	9	
EBF	Anoka Sand Plain	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	Anoka Sand Plain	BI	Bartramia longicauda	Upland Sandpiper	19	7
EBF	Anoka Sand Plain	BI	Botaurus lentiginosus	American Bittern	21	18
EBF	Anoka Sand Plain	BI	Buteo lineatus	Red-shouldered Hawk	12	31
EBF	Anoka Sand Plain	BI	Calidris alpina	Dunlin	24	
EBF	Anoka Sand Plain	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	Anoka Sand Plain	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	Anoka Sand Plain	BI	Caprimulgus vociferus	Whip-poor-will	21	
EBF	Anoka Sand Plain	BI	Catharus fuscescens	Veery	22	44
EBF	Anoka Sand Plain	BI	Chlidonias niger	Black Tern	18	21
EBF	Anoka Sand Plain	BI	Chordeiles minor	Common Nighthawk	25	2
EBF	Anoka Sand Plain	BI	Circus cyaneus	Northern Harrier	25	4
EBF	Anoka Sand Plain	BI	Cistothorus palustris	Marsh Wren	20	18
EBF	Anoka Sand Plain	BI	Cistothorus platensis	Sedge Wren	25	39
EBF	Anoka Sand Plain	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	15
EBF	Anoka Sand Plain	BI	Contopus virens	Eastern Wood-pewee	25	54
EBF	Anoka Sand Plain	BI	Cygnus buccinator	Trumpeter Swan	14	
EBF	Anoka Sand Plain	BI	Dendroica cerulea	Cerulean Warbler	10	2
EBF	Anoka Sand Plain	BI	Dolichonyx oryzivorus	Bobolink	25	13
EBF	Anoka Sand Plain	BI	Empidonax minimus	Least Flycatcher	25	15
EBF	Anoka Sand Plain	BI	Empidonax traillii	Willow Flycatcher	13	11
EBF	Anoka Sand Plain	BI	Falco peregrinus	Peregrine Falcon	6	10
EBF	Anoka Sand Plain	BI	Gallinula chloropus	Common Moorhen	7	2
EBF	Anoka Sand Plain	BI	Gavia immer	Common Loon	18	13
EBF	Anoka Sand Plain	BI	Haliaeetus leucocephalus	Bald Eagle	21	55
EBF	Anoka Sand Plain	BI	Hylocichla mustelina	Wood Thrush	20	5
EBF	Anoka Sand Plain	BI	Ixobrychus exilis	Least Bittern	16	3
EBF	Anoka Sand Plain	BI	Lanius ludovicianus	Loggerhead Shrike	10	11
EBF	Anoka Sand Plain	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	Anoka Sand Plain	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	Anoka Sand Plain	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	1
EBF	Anoka Sand Plain	BI	Melospiza georgiana	Swamp Sparrow	25	57
EBF	Anoka Sand Plain	BI	Numenius phaeopus	Whimbrel	13	
EBF	Anoka Sand Plain	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	3
EBF	Anoka Sand Plain	BI	Phalaropus tricolor	Wilson's Phalarope	9	4
EBF	Anoka Sand Plain	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	26
EBF	Anoka Sand Plain	BI	Pluvialis dominica	American Golden-plover	24	
EBF	Anoka Sand Plain	BI	Podiceps grisegena	Red-necked Grebe	17	
EBF	Anoka Sand Plain	BI	Podiceps nigricollis	Eared Grebe	9	
EBF	Anoka Sand Plain	BI	Rallus limicola	Virginia Rail	23	2
EBF	Anoka Sand Plain	BI	Recurvirostra americana	American Avocet	16	
EBF	Anoka Sand Plain	BI	Scolopax minor	American Woodcock	22	3
EBF	Anoka Sand Plain	BI	Seiurus aurocapillus	Ovenbird	22	28
EBF	Anoka Sand Plain	BI	Seiurus motacilla	Louisiana Waterthrush	5	4
EBF	Anoka Sand Plain	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	1
EBF	Anoka Sand Plain	BI	Spiza americana	Dickcissel	11	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Anoka Sand Plain	BI	Spizella pusilla	Field Sparrow	13	48
EBF	Anoka Sand Plain	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	4
EBF	Anoka Sand Plain	BI	Sturnella magna	Eastern Meadowlark	20	16
EBF	Anoka Sand Plain	BI	Toxostoma rufum	Brown Thrasher	25	6
EBF	Anoka Sand Plain	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	Anoka Sand Plain	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	Anoka Sand Plain	BI	Vermivora pinus	Blue-winged Warbler	6	
EBF	Anoka Sand Plain	RE	Chelydra serpentina	Common Snapping Turtle	25	15
EBF	Anoka Sand Plain	RE	Clemmys insculpta	Wood Turtle	11	2
EBF	Anoka Sand Plain	RE	Elaphe vulpina	Eastern Fox Snake	9	1
EBF	Anoka Sand Plain	RE	Elaphe vulpina	Eastern Fox Snake	9	1
EBF	Anoka Sand Plain	RE	Emydoidea blandingii	Blanding's Turtle	13	207
EBF	Anoka Sand Plain	RE	Heterodon nasicus	Western Hognose Snake	9	3
EBF	Anoka Sand Plain	RE	Heterodon nasicus	Western Hognose Snake	9	9
EBF	Anoka Sand Plain	RE	Heterodon platirhinos	Eastern Hognose Snake	6	2
EBF	Anoka Sand Plain	RE	Heterodon platirhinos	Eastern Hognose Snake	6	4
EBF	Anoka Sand Plain	RE	Liochlorophis vernalis	Smooth Green Snake	15	
EBF	Anoka Sand Plain	RE	Pituophis catenifer	Gopher Snake	7	3
EBF	Anoka Sand Plain	RE	Pituophis catenifer	Gopher Snake	7	26
EBF	Anoka Sand Plain	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	Anoka Sand Plain	FI	Acipenser fulvescens	Lake Sturgeon	14	1
EBF	Anoka Sand Plain	FI	Moxostoma valenciennesi	Greater Redhorse	11	28
EBF	Anoka Sand Plain	FI	Notropis anogenus	Pugnose Shiner	9	
EBF	Anoka Sand Plain	SP	Metaphidippus arizonensis	A Jumping Spider	4	1
EBF	Anoka Sand Plain	SP	Paradamoetas fontana	A Jumping Spider	5	
EBF	Anoka Sand Plain	SP	Tutelina formicaria	A Jumping Spider	1	
EBF	Anoka Sand Plain	IN	Agapetus tomus	A Caddisfly	2	1
EBF	Anoka Sand Plain	IN	Cicindela patruela patruela	A Tiger Beetle	5	2
EBF	Anoka Sand Plain	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
EBF	Anoka Sand Plain	IN	Erynnis persius	Persius Duskywing	5	
EBF	Anoka Sand Plain	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
EBF	Anoka Sand Plain	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	1
EBF	Anoka Sand Plain	IN	Hesperia uncas	Uncas Skipper	2	
EBF	Anoka Sand Plain	IN	Lycaeides melissa samuelis	Karner Blue	3	
EBF	Anoka Sand Plain	IN	Speyeria idalia	Regal Fritillary	11	
EBF	Anoka Sand Plain	MO	Actinonaias ligamentina	Mucket mussel	11	4
EBF	Anoka Sand Plain	MO	Alasmidonta marginata	Elktoe	7	3
EBF	Anoka Sand Plain	MO	Cyclonaias tuberculata	Purple Wartyback	5	1
EBF	Anoka Sand Plain	MO	Elliptio dilatata	Spike	10	5
EBF	Anoka Sand Plain	MO	Lasmigona compressa	Creek Heelsplitter	24	39
EBF	Anoka Sand Plain	MO	Ligumia recta	Black Sandshell	25	112
EBF	Anoka Sand Plain	MO	Quadrula metanevra	Monkeyface	10	
EBF	Anoka Sand Plain	MO	Quadrula nodulata	Wartyback	5	20
EBF	Anoka Sand Plain	MO	Truncilla donaciformis	Fawnsfoot	5	13
EBF	Big Woods	MA	Microtus ochrogaster	Prairie Vole	12	1
EBF	Big Woods	MA	Mustela nivalis	Least Weasel	12	
EBF	Big Woods	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	1
EBF	Big Woods	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	3
EBF	Big Woods	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	Big Woods	MA	Spilogale putorius	Eastern Spotted Skunk	19	1
EBF	Big Woods	MA	Taxidea taxus	American Badger	24	
EBF	Big Woods	BI	Aechmophorus occidentalis	Western Grebe	5	1
EBF	Big Woods	BI	Ammodramus henslowii	Henslow's Sparrow	7	4
EBF	Big Woods	BI	Ammodramus savannarum	Grasshopper Sparrow	14	14
EBF	Big Woods	BI	Anas acuta	Northern Pintail	9	
EBF	Big Woods	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	Big Woods	BI	Bartramia longicauda	Upland Sandpiper	19	4
EBF	Big Woods	BI	Botaurus lentiginosus	American Bittern	21	3
EBF	Big Woods	BI	Buteo lineatus	Red-shouldered Hawk	12	36
EBF	Big Woods	BI	Calidris alpina	Dunlin	24	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Big Woods	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	Big Woods	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	Big Woods	BI	Caprimulgus vociferus	Whip-poor-will	21	
EBF	Big Woods	BI	Catharus fuscescens	Veery	22	26
EBF	Big Woods	BI	Chlidonias niger	Black Tern	18	7
EBF	Big Woods	BI	Chordeiles minor	Common Nighthawk	25	1
EBF	Big Woods	BI	Circus cyaneus	Northern Harrier	25	1
EBF	Big Woods	BI	Cistothorus palustris	Marsh Wren	20	8
EBF	Big Woods	BI	Cistothorus platensis	Sedge Wren	25	27
EBF	Big Woods	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	6
EBF	Big Woods	BI	Contopus virens	Eastern Wood-pewee	25	147
EBF	Big Woods	BI	Cygnus buccinator	Trumpeter Swan	14	26
EBF	Big Woods	BI	Dendroica cerulea	Cerulean Warbler	10	54
EBF	Big Woods	BI	Dolichonyx oryzivorus	Bobolink	25	19
EBF	Big Woods	BI	Empidonax minimus	Least Flycatcher	25	48
EBF	Big Woods	BI	Empidonax traillii	Willow Flycatcher	13	17
EBF	Big Woods	BI	Empidonax virescens	Acadian Flycatcher	6	11
EBF	Big Woods	BI	Gallinula chloropus	Common Moorhen	7	2
EBF	Big Woods	BI	Gavia immer	Common Loon	18	12
EBF	Big Woods	BI	Haliaeetus leucocephalus	Bald Eagle	21	42
EBF	Big Woods	BI	Hylocichla mustelina	Wood Thrush	20	26
EBF	Big Woods	BI	Ixobrychus exilis	Least Bittern	16	
EBF	Big Woods	BI	Lanius ludovicianus	Loggerhead Shrike	10	13
EBF	Big Woods	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	Big Woods	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	Big Woods	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	5
EBF	Big Woods	BI	Melospiza georgiana	Swamp Sparrow	25	30
EBF	Big Woods	BI	Numenius phaeopus	Whimbrel	13	
EBF	Big Woods	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	3
EBF	Big Woods	BI	Pelecanus erythrorhynchos	American White Pelican	4	4
EBF	Big Woods	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	80
EBF	Big Woods	BI	Pluvialis dominica	American Golden-plover	24	
EBF	Big Woods	BI	Podiceps grisegena	Red-necked Grebe	17	1
EBF	Big Woods	BI	Podiceps nigricollis	Eared Grebe	9	
EBF	Big Woods	BI	Protonotaria citrea	Prothonotary Warbler	6	11
EBF	Big Woods	BI	Rallus limicola	Virginia Rail	23	2
EBF	Big Woods	BI	Recurvirostra americana	American Avocet	16	
EBF	Big Woods	BI	Scolopax minor	American Woodcock	22	1
EBF	Big Woods	BI	Seiurus aurocapillus	Ovenbird	22	77
EBF	Big Woods	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	16
EBF	Big Woods	BI	Spiza americana	Dickcissel	11	10
EBF	Big Woods	BI	Spizella pusilla	Field Sparrow	13	71
EBF	Big Woods	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	7
EBF	Big Woods	BI	Sterna forsteri	Forster's Tern	11	7
EBF	Big Woods	BI	Sturnella magna	Eastern Meadowlark	20	19
EBF	Big Woods	BI	Toxostoma rufum	Brown Thrasher	25	15
EBF	Big Woods	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	Big Woods	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	Big Woods	BI	Vermivora pinus	Blue-winged Warbler	6	17
EBF	Big Woods	BI	Vireo bellii	Bell's Vireo	6	
EBF	Big Woods	RE	Apalone mutica	Smooth Softshell	3	9
EBF	Big Woods	RE	Chelydra serpentina	Common Snapping Turtle	25	6
EBF	Big Woods	RE	Clemmys insculpta	Wood Turtle	11	9
EBF	Big Woods	RE	Coluber constrictor	Eastern Racer	5	6
EBF	Big Woods	RE	Elaphe vulpina	Eastern Fox Snake	9	1
EBF	Big Woods	RE	Elaphe vulpina	Eastern Fox Snake	9	20
EBF	Big Woods	RE	Emydoidea blandingii	Blanding's Turtle	13	30
EBF	Big Woods	RE	Heterodon nasicus	Western Hognose Snake	9	1
EBF	Big Woods	RE	Heterodon nasicus	Western Hognose Snake	9	1
EBF	Big Woods	RE	Lampropeltis triangulum	Milk Snake	6	3

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Big Woods	RE	Lampropeltis triangulum	Milk Snake	6	2
EBF	Big Woods	RE	Liochlorophis vernalis	Smooth Green Snake	15	
EBF	Big Woods	RE	Pituophis catenifer	Gopher Snake	7	18
EBF	Big Woods	RE	Pituophis catenifer	Gopher Snake	7	15
EBF	Big Woods	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	Big Woods	FI	Acipenser fulvescens	Lake Sturgeon	14	2
EBF	Big Woods	FI	Alosa chrysochloris	Skipjack Herring	4	
EBF	Big Woods	FI	Ammocrypta clara	Western Sand Darter	3	
EBF	Big Woods	FI	Anguilla Rostrata	American Eel	3	
EBF	Big Woods	FI	Cycleptus elongatus	Blue Sucker	3	10
EBF	Big Woods	FI	Etheostoma asprigene	Mud Darter	3	
EBF	Big Woods	FI	Etheostoma microperca	Least Darter	9	24
EBF	Big Woods	FI	Ictiobus niger	Black Buffalo	3	6
EBF	Big Woods	FI	Lampetra appendix	American Brook Lamprey	7	10
EBF	Big Woods	FI	Macrhybopsis aestivalis	speckled chub	5	5
EBF	Big Woods	FI	Moxostoma carinatum	River Redhorse	3	
EBF	Big Woods	FI	Moxostoma valenciennesi	Greater Redhorse	11	2
EBF	Big Woods	FI	Notropis anogenus	Pugnose Shiner	9	12
EBF	Big Woods	FI	Phenacobius mirabilis	Suckermouth Minnow	4	
EBF	Big Woods	FI	Polyodon spathula	Paddlefish	3	4
EBF	Big Woods	FI	Scaphirhynchus platorynchus	Shovelnose Sturgeon	4	28
EBF	Big Woods	SP	Habronattus texanus	A Jumping Spider	2	
EBF	Big Woods	SP	Phidippus pius	A Jumping Spider	4	
EBF	Big Woods	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	1
EBF	Big Woods	IN	Cicindela macra macra	A Tiger Beetle	1	1
EBF	Big Woods	IN	Speyeria idalia	Regal Fritillary	11	
EBF	Big Woods	MO	Actinonaias ligamentina	Mucket mussel	11	3
EBF	Big Woods	MO	Actinonaias ligamentina	Mucket mussel	11	11
EBF	Big Woods	MO	Alasmidonta marginata	Elktoe	7	3
EBF	Big Woods	MO	Arcidens confragosus	Rock Pocketbook	3	2
EBF	Big Woods	MO	Cyclonaias tuberculata	Purple Wartyback	5	
EBF	Big Woods	MO	Ellipsaria lineolata	Butterfly	4	1
EBF	Big Woods	MO	Elliptio crassidens	Elephant-ear	3	1
EBF	Big Woods	MO	Elliptio dilatata	Spike	10	5
EBF	Big Woods	MO	Fusconaia ebena	Ebonyshell	4	5
EBF	Big Woods	MO	Lampsilis higginsi	Higgins Eye	4	
EBF	Big Woods	MO	Lampsilis teres	Yellow Sandshell	3	2
EBF	Big Woods	MO	Lasmigona compressa	Creek Heelsplitter	24	2
EBF	Big Woods	MO	Lasmigona costata	Fluted-shell	12	3
EBF	Big Woods	MO	Ligumia recta	Black Sandshell	25	12
EBF	Big Woods	MO	Megalonaias nervosa	Washboard	3	1
EBF	Big Woods	MO	Obovaria olivaria	Hickorynut	5	5
EBF	Big Woods	MO	Plethobasus cyphyus	Sheepnose	4	1
EBF	Big Woods	MO	Pleurobema coccineum	Round Pigtoe	6	3
EBF	Big Woods	MO	Quadrula fragosa	Winged Mapleleaf	4	1
EBF	Big Woods	MO	Quadrula metanevra	Monkeyface	10	5
EBF	Big Woods	MO	Quadrula nodulata	Wartyback	5	8
EBF	Big Woods	MO	Tritogonia verrucosa	Pistolgrip	5	6
EBF	Big Woods	MO	Truncilla donaciformis	Fawnsfoot	5	1
EBF	Big Woods	MO	Venustaconcha ellipsiformis	Ellipse	8	1
EBF	Hardwood Hills	MA	Microtus ochrogaster	Prairie Vole	12	
EBF	Hardwood Hills	MA	Mustela nivalis	Least Weasel	12	
EBF	Hardwood Hills	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	
EBF	Hardwood Hills	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	Hardwood Hills	MA	Spilogale putorius	Eastern Spotted Skunk	19	
EBF	Hardwood Hills	MA	Taxidea taxus	American Badger	24	
EBF	Hardwood Hills	BI	Aechmophorus occidentalis	Western Grebe	5	
EBF	Hardwood Hills	BI	Ammodramus leconteii	Le Conte's Sparrow	17	7
EBF	Hardwood Hills	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	7
EBF	Hardwood Hills	BI	Ammodramus savannarum	Grasshopper Sparrow	14	9

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Hardwood Hills	BI	Anas acuta	Northern Pintail	9	
EBF	Hardwood Hills	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	Hardwood Hills	BI	Asio flammeus	Short-eared Owl	11	
EBF	Hardwood Hills	BI	Aythya affinis	Lesser Scaup	3	1
EBF	Hardwood Hills	BI	Bartramia longicauda	Upland Sandpiper	19	5
EBF	Hardwood Hills	BI	Botaurus lentiginosus	American Bittern	21	10
EBF	Hardwood Hills	BI	Buteo lineatus	Red-shouldered Hawk	12	54
EBF	Hardwood Hills	BI	Calidris alpina	Dunlin	24	
EBF	Hardwood Hills	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	Hardwood Hills	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	Hardwood Hills	BI	Caprimulgus vociferus	Whip-poor-will	21	1
EBF	Hardwood Hills	BI	Catharus fuscescens	Veery	22	97
EBF	Hardwood Hills	BI	Chlidonias niger	Black Tern	18	9
EBF	Hardwood Hills	BI	Chordeiles minor	Common Nighthawk	25	1
EBF	Hardwood Hills	BI	Circus cyaneus	Northern Harrier	25	5
EBF	Hardwood Hills	BI	Cistothorus palustris	Marsh Wren	20	19
EBF	Hardwood Hills	BI	Cistothorus platensis	Sedge Wren	25	38
EBF	Hardwood Hills	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	20
EBF	Hardwood Hills	BI	Contopus virens	Eastern Wood-pewee	25	72
EBF	Hardwood Hills	BI	Coturnicops noveboracensis	Yellow Rail	10	5
EBF	Hardwood Hills	BI	Cygnus buccinator	Trumpeter Swan	14	12
EBF	Hardwood Hills	BI	Dendroica cerulea	Cerulean Warbler	10	21
EBF	Hardwood Hills	BI	Dolichonyx oryzivorus	Bobolink	25	20
EBF	Hardwood Hills	BI	Empidonax minimus	Least Flycatcher	25	43
EBF	Hardwood Hills	BI	Empidonax traillii	Willow Flycatcher	13	9
EBF	Hardwood Hills	BI	Gavia immer	Common Loon	18	22
EBF	Hardwood Hills	BI	Haliaeetus leucocephalus	Bald Eagle	21	66
EBF	Hardwood Hills	BI	Hylocichla mustelina	Wood Thrush	20	8
EBF	Hardwood Hills	BI	Ixobrychus exilis	Least Bittern	16	1
EBF	Hardwood Hills	BI	Larus pipixcan	Franklin's Gull	3	1
EBF	Hardwood Hills	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	Hardwood Hills	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	Hardwood Hills	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	5
EBF	Hardwood Hills	BI	Melospiza georgiana	Swamp Sparrow	25	52
EBF	Hardwood Hills	BI	Numenius phaeopus	Whimbrel	13	
EBF	Hardwood Hills	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	2
EBF	Hardwood Hills	BI	Phalaropus tricolor	Wilson's Phalarope	9	2
EBF	Hardwood Hills	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	22
EBF	Hardwood Hills	BI	Pluvialis dominica	American Golden-plover	24	
EBF	Hardwood Hills	BI	Podiceps grisegena	Red-necked Grebe	17	1
EBF	Hardwood Hills	BI	Podiceps nigricollis	Eared Grebe	9	1
EBF	Hardwood Hills	BI	Rallus limicola	Virginia Rail	23	4
EBF	Hardwood Hills	BI	Recurvirostra americana	American Avocet	16	
EBF	Hardwood Hills	BI	Scolopax minor	American Woodcock	22	1
EBF	Hardwood Hills	BI	Seiurus aurocapillus	Ovenbird	22	93
EBF	Hardwood Hills	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	23
EBF	Hardwood Hills	BI	Spiza americana	Dickcissel	11	1
EBF	Hardwood Hills	BI	Spizella pusilla	Field Sparrow	13	7
EBF	Hardwood Hills	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	3
EBF	Hardwood Hills	BI	Sterna forsteri	Forster's Tern	11	8
EBF	Hardwood Hills	BI	Sturnella magna	Eastern Meadowlark	20	2
EBF	Hardwood Hills	BI	Toxostoma rufum	Brown Thrasher	25	2
EBF	Hardwood Hills	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	Hardwood Hills	BI	Troglodytes troglodytes	Winter Wren	18	2
EBF	Hardwood Hills	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	Hardwood Hills	BI	Vermivora chrysoptera	Golden-winged Warbler	14	24
EBF	Hardwood Hills	BI	Zonotrichia albicollis	White-throated Sparrow	15	11
EBF	Hardwood Hills	RE	Chelydra serpentina	Common Snapping Turtle	25	5
EBF	Hardwood Hills	RE	Emydoidea blandingii	Blanding's Turtle	13	38
EBF	Hardwood Hills	RE	Liochlorophis vernalis	Smooth Green Snake	15	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Hardwood Hills	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	Hardwood Hills	FI	Acipenser fulvescens	Lake Sturgeon	14	
EBF	Hardwood Hills	FI	Etheostoma microperca	Least Darter	9	55
EBF	Hardwood Hills	FI	Moxostoma valenciennesi	Greater Redhorse	11	10
EBF	Hardwood Hills	FI	Notropis anogenus	Pugnose Shiner	9	30
EBF	Hardwood Hills	SP	Paradamoetas fontana	A Jumping Spider	5	
EBF	Hardwood Hills	IN	Atrytone arogos	Arogos Skipper	9	
EBF	Hardwood Hills	IN	Cicindela lepida	Little White Tiger Beetle	2	1
EBF	Hardwood Hills	IN	Cicindela limbata nympha	A Tiger Beetle	1	
EBF	Hardwood Hills	IN	Oxyethira ecornuta	A Caddisfly	3	1
EBF	Hardwood Hills	IN	Oxyethira itascae	A Caddisfly	6	1
EBF	Hardwood Hills	MO	Actinonaias ligamentina	Mucket mussel	11	2
EBF	Hardwood Hills	MO	Lasmigona compressa	Creek Heelsplitter	24	39
EBF	Hardwood Hills	MO	Lasmigona costata	Fluted-shell	12	16
EBF	Hardwood Hills	MO	Ligumia recta	Black Sandshell	25	34
EBF	Oak Savanna	MA	Microtus ochrogaster	Prairie Vole	12	3
EBF	Oak Savanna	MA	Mustela nivalis	Least Weasel	12	
EBF	Oak Savanna	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	
EBF	Oak Savanna	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	1
EBF	Oak Savanna	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	4
EBF	Oak Savanna	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	Oak Savanna	MA	Spilogale putorius	Eastern Spotted Skunk	19	
EBF	Oak Savanna	MA	Taxidea taxus	American Badger	24	
EBF	Oak Savanna	BI	Ammodramus henslowii	Henslow's Sparrow	7	1
EBF	Oak Savanna	BI	Ammodramus savannarum	Grasshopper Sparrow	14	9
EBF	Oak Savanna	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	Oak Savanna	BI	Asio flammeus	Short-eared Owl	11	1
EBF	Oak Savanna	BI	Bartramia longicauda	Upland Sandpiper	19	12
EBF	Oak Savanna	BI	Buteo lineatus	Red-shouldered Hawk	12	
EBF	Oak Savanna	BI	Buteo swainsoni	Swainson's Hawk	6	
EBF	Oak Savanna	BI	Calidris alpina	Dunlin	24	
EBF	Oak Savanna	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	Oak Savanna	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	Oak Savanna	BI	Catharus fuscescens	Veery	22	2
EBF	Oak Savanna	BI	Chordeiles minor	Common Nighthawk	25	
EBF	Oak Savanna	BI	Circus cyaneus	Northern Harrier	25	1
EBF	Oak Savanna	BI	Cistothorus palustris	Marsh Wren	20	2
EBF	Oak Savanna	BI	Cistothorus platensis	Sedge Wren	25	6
EBF	Oak Savanna	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	5
EBF	Oak Savanna	BI	Contopus virens	Eastern Wood-pewee	25	21
EBF	Oak Savanna	BI	Dendroica cerulea	Cerulean Warbler	10	1
EBF	Oak Savanna	BI	Dolichonyx oryzivorus	Bobolink	25	9
EBF	Oak Savanna	BI	Empidonax minimus	Least Flycatcher	25	
EBF	Oak Savanna	BI	Empidonax traillii	Willow Flycatcher	13	2
EBF	Oak Savanna	BI	Empidonax virescens	Acadian Flycatcher	6	5
EBF	Oak Savanna	BI	Gallinula chloropus	Common Moorhen	7	
EBF	Oak Savanna	BI	Hylocichla mustelina	Wood Thrush	20	9
EBF	Oak Savanna	BI	Ixobrychus exilis	Least Bittern	16	
EBF	Oak Savanna	BI	Lanius ludovicianus	Loggerhead Shrike	10	41
EBF	Oak Savanna	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	Oak Savanna	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	Oak Savanna	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	3
EBF	Oak Savanna	BI	Melospiza georgiana	Swamp Sparrow	25	2
EBF	Oak Savanna	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	20
EBF	Oak Savanna	BI	Pluvialis dominica	American Golden-plover	24	
EBF	Oak Savanna	BI	Podiceps grisegena	Red-necked Grebe	17	
EBF	Oak Savanna	BI	Podiceps nigricollis	Eared Grebe	9	
EBF	Oak Savanna	BI	Protonotaria citrea	Prothonotary Warbler	6	
EBF	Oak Savanna	BI	Rallus limicola	Virginia Rail	23	
EBF	Oak Savanna	BI	Recurvirostra americana	American Avocet	16	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Oak Savanna	BI	Scolopax minor	American Woodcock	22	1
EBF	Oak Savanna	BI	Seiurus aurocapillus	Ovenbird	22	10
EBF	Oak Savanna	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	3
EBF	Oak Savanna	BI	Spiza americana	Dickcissel	11	3
EBF	Oak Savanna	BI	Spizella pusilla	Field Sparrow	13	10
EBF	Oak Savanna	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
EBF	Oak Savanna	BI	Sturnella magna	Eastern Meadowlark	20	4
EBF	Oak Savanna	BI	Toxostoma rufum	Brown Thrasher	25	4
EBF	Oak Savanna	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	Oak Savanna	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	Oak Savanna	BI	Vireo bellii	Bell's Vireo	6	
EBF	Oak Savanna	RE	Chelydra serpentina	Common Snapping Turtle	25	
EBF	Oak Savanna	RE	Clemmys insculpta	Wood Turtle	11	16
EBF	Oak Savanna	RE	Coluber constrictor	Eastern Racer	5	
EBF	Oak Savanna	RE	Elaphe vulpina	Eastern Fox Snake	9	6
EBF	Oak Savanna	RE	Emydoidea blandingii	Blanding's Turtle	13	12
EBF	Oak Savanna	RE	Heterodon nasicus	Western Hognose Snake	9	
EBF	Oak Savanna	RE	Liochlorophis vernalis	Smooth Green Snake	15	
EBF	Oak Savanna	RE	Pituophis catenifer	Gopher Snake	7	2
EBF	Oak Savanna	AM	Acris crepitans	Northern Cricket Frog	6	
EBF	Oak Savanna	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	Oak Savanna	FI	Campostoma oligolepis	Largescale Stoneroller	5	3
EBF	Oak Savanna	FI	Clinostomus elongatus	Redside Dace	3	2
EBF	Oak Savanna	FI	Erimystax x-punctata	Gravel Chub	3	
EBF	Oak Savanna	FI	Etheostoma microperca	Least Darter	9	14
EBF	Oak Savanna	FI	Lampetra appendix	American Brook Lamprey	7	9
EBF	Oak Savanna	FI	Lythrurus umbratilis	Redfin Shiner	3	3
EBF	Oak Savanna	FI	Macrhybopsis aestivalis	speckled chub	5	1
EBF	Oak Savanna	FI	Moxostoma duquesnei	Black Redhorse	3	3
EBF	Oak Savanna	FI	Notropis nubilus	Ozark Minnow	3	39
EBF	Oak Savanna	FI	Noturus exilis	Slender Madtom	1	3
EBF	Oak Savanna	FI	Phenacobius mirabilis	Suckermouth Minnow	4	12
EBF	Oak Savanna	FI	Scaphirhynchus platorynchus	Shovelnose Sturgeon	4	
EBF	Oak Savanna	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	
EBF	Oak Savanna	IN	Atrytone arogos	Arogos Skipper	9	
EBF	Oak Savanna	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
EBF	Oak Savanna	IN	Hesperia ottoe	Ottoe Skipper	6	
EBF	Oak Savanna	IN	Oarisma powesheik	Powesheik Skipper	6	
EBF	Oak Savanna	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
EBF	Oak Savanna	IN	Speyeria idalia	Regal Fritillary	11	
EBF	Oak Savanna	MO	Actinonaias ligamentina	Mucket mussel	11	4
EBF	Oak Savanna	MO	Actinonaias ligamentina	Mucket mussel	11	3
EBF	Oak Savanna	MO	Elliptio dilatata	Spike	10	18
EBF	Oak Savanna	MO	Lasmigona compressa	Creek Heelsplitter	24	42
EBF	Oak Savanna	MO	Lasmigona costata	Fluted-shell	12	7
EBF	Oak Savanna	MO	Ligumia recta	Black Sandshell	25	3
EBF	Oak Savanna	MO	Plethobasus cyphyus	Sheepnose	4	1
EBF	Oak Savanna	MO	Pleurobema coccineum	Round Pigtoe	6	8
EBF	Oak Savanna	MO	Quadrula metanevra	Monkeyface	10	1
EBF	Oak Savanna	MO	Venustaconcha ellipsiformis	Ellipse	8	10
EBF	Rochester Plateau	MA	Microtus ochrogaster	Prairie Vole	12	
EBF	Rochester Plateau	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	5
EBF	Rochester Plateau	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	
EBF	Rochester Plateau	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	Rochester Plateau	MA	Spilogale putorius	Eastern Spotted Skunk	19	
EBF	Rochester Plateau	MA	Taxidea taxus	American Badger	24	
EBF	Rochester Plateau	BI	Ammodramus henslowii	Henslow's Sparrow	7	1
EBF	Rochester Plateau	BI	Ammodramus savannarum	Grasshopper Sparrow	14	2
EBF	Rochester Plateau	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	Rochester Plateau	BI	Bartramia longicauda	Upland Sandpiper	19	2

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Rochester Plateau	BI	Buteo lineatus	Red-shouldered Hawk	12	1
EBF	Rochester Plateau	BI	Calidris alpina	Dunlin	24	
EBF	Rochester Plateau	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	Rochester Plateau	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	Rochester Plateau	BI	Caprimulgus vociferus	Whip-poor-will	21	
EBF	Rochester Plateau	BI	Catharus fuscescens	Veery	22	4
EBF	Rochester Plateau	BI	Chordeiles minor	Common Nighthawk	25	
EBF	Rochester Plateau	BI	Circus cyaneus	Northern Harrier	25	
EBF	Rochester Plateau	BI	Cistothorus palustris	Marsh Wren	20	
EBF	Rochester Plateau	BI	Cistothorus platensis	Sedge Wren	25	3
EBF	Rochester Plateau	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
EBF	Rochester Plateau	BI	Contopus virens	Eastern Wood-pewee	25	20
EBF	Rochester Plateau	BI	Dendroica cerulea	Cerulean Warbler	10	3
EBF	Rochester Plateau	BI	Dolichonyx oryzivorus	Bobolink	25	5
EBF	Rochester Plateau	BI	Empidonax minimus	Least Flycatcher	25	2
EBF	Rochester Plateau	BI	Empidonax traillii	Willow Flycatcher	13	2
EBF	Rochester Plateau	BI	Empidonax virescens	Acadian Flycatcher	6	1
EBF	Rochester Plateau	BI	Gallinula chloropus	Common Moorhen	7	
EBF	Rochester Plateau	BI	Hylocichla mustelina	Wood Thrush	20	7
EBF	Rochester Plateau	BI	Lanius ludovicianus	Loggerhead Shrike	10	27
EBF	Rochester Plateau	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	Rochester Plateau	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	Rochester Plateau	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	1
EBF	Rochester Plateau	BI	Melospiza georgiana	Swamp Sparrow	25	2
EBF	Rochester Plateau	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	6
EBF	Rochester Plateau	BI	Pluvialis dominica	American Golden-plover	24	
EBF	Rochester Plateau	BI	Protonotaria citrea	Prothonotary Warbler	6	
EBF	Rochester Plateau	BI	Rallus limicola	Virginia Rail	23	
EBF	Rochester Plateau	BI	Recurvirostra americana	American Avocet	16	
EBF	Rochester Plateau	BI	Scolopax minor	American Woodcock	22	
EBF	Rochester Plateau	BI	Seiurus aurocapillus	Ovenbird	22	17
EBF	Rochester Plateau	BI	Seiurus motacilla	Louisiana Waterthrush	5	
EBF	Rochester Plateau	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	3
EBF	Rochester Plateau	BI	Spiza americana	Dickcissel	11	3
EBF	Rochester Plateau	BI	Spizella pusilla	Field Sparrow	13	8
EBF	Rochester Plateau	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	2
EBF	Rochester Plateau	BI	Sturnella magna	Eastern Meadowlark	20	3
EBF	Rochester Plateau	BI	Toxostoma rufum	Brown Thrasher	25	
EBF	Rochester Plateau	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	Rochester Plateau	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	Rochester Plateau	BI	Vermivora pinus	Blue-winged Warbler	6	4
EBF	Rochester Plateau	BI	Vireo bellii	Bell's Vireo	6	
EBF	Rochester Plateau	RE	Chelydra serpentina	Common Snapping Turtle	25	
EBF	Rochester Plateau	RE	Clemmys insculpta	Wood Turtle	11	5
EBF	Rochester Plateau	RE	Cnemidophorus sexlineatus	Six-lined Racerunner	3	
EBF	Rochester Plateau	RE	Coluber constrictor	Eastern Racer	5	1
EBF	Rochester Plateau	RE	Crotalus horridus	Timber Rattlesnake	3	6
EBF	Rochester Plateau	RE	Elaphe vulpina	Eastern Fox Snake	9	10
EBF	Rochester Plateau	RE	Emydoidea blandingii	Blanding's Turtle	13	12
EBF	Rochester Plateau	RE	Heterodon nasicus	Western Hognose Snake	9	
EBF	Rochester Plateau	RE	Heterodon platirhinos	Eastern Hognose Snake	6	
EBF	Rochester Plateau	RE	Lampropeltis triangulum	Milk Snake	6	4
EBF	Rochester Plateau	RE	Liochlorophis vernalis	Smooth Green Snake	15	
EBF	Rochester Plateau	RE	Pituophis catenifer	Gopher Snake	7	
EBF	Rochester Plateau	AM	Acris crepitans	Northern Cricket Frog	6	
EBF	Rochester Plateau	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	Rochester Plateau	AM	Rana palustris	Pickerel Frog	2	6
EBF	Rochester Plateau	FI	Ammocrypta asprella	Crystal Darter	3	
EBF	Rochester Plateau	FI	Campostoma oligolepis	Largescale Stoneroller	5	41
EBF	Rochester Plateau	FI	Clinostomus elongatus	Redside Dace	3	7

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	Rochester Plateau	FI	Erimystax x-punctata	Gravel Chub	3	25
EBF	Rochester Plateau	FI	Etheostoma microperca	Least Darter	9	
EBF	Rochester Plateau	FI	Lampetra appendix	American Brook Lamprey	7	39
EBF	Rochester Plateau	FI	Lythrurus umbratilis	Redfin Shiner	3	2
EBF	Rochester Plateau	FI	Macrhybopsis aestivalis	speckled chub	5	
EBF	Rochester Plateau	FI	Moxostoma duquesnei	Black Redhorse	3	22
EBF	Rochester Plateau	FI	Notropis nubilus	Ozark Minnow	3	18
EBF	Rochester Plateau	FI	Phenacobius mirabilis	Suckermouth Minnow	4	24
EBF	Rochester Plateau	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	
EBF	Rochester Plateau	IN	Atrytone arogos	Arogos Skipper	9	
EBF	Rochester Plateau	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
EBF	Rochester Plateau	IN	Hesperia ottoe	Ottoe Skipper	6	
EBF	Rochester Plateau	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
EBF	Rochester Plateau	IN	Schinia indiana	Phlox Moth	5	
EBF	Rochester Plateau	IN	Speyeria idalia	Regal Fritillary	11	
EBF	Rochester Plateau	MO	Actinonaias ligamentina	Mucket mussel	11	1
EBF	Rochester Plateau	MO	Alasmidonta marginata	Elktoe	7	11
EBF	Rochester Plateau	MO	Elliptio dilatata	Spike	10	2
EBF	Rochester Plateau	MO	Lasmigona compressa	Creek Heelsplitter	24	16
EBF	Rochester Plateau	MO	Lasmigona costata	Fluted-shell	12	5
EBF	Rochester Plateau	MO	Ligumia recta	Black Sandshell	25	
EBF	Rochester Plateau	MO	Pleurobema coccineum	Round Pigtoe	6	
EBF	Rochester Plateau	MO	Quadrula metanevra	Monkeyface	10	
EBF	Rochester Plateau	MO	Venustaconcha ellipsiformis	Ellipse	8	27
EBF	St. Paul-Baldwin Plains	MA	Microtus ochrogaster	Prairie Vole	12	
EBF	St. Paul-Baldwin Plains	MA	Mustela nivalis	Least Weasel	12	
EBF	St. Paul-Baldwin Plains	MA	Myotis septentrionalis	Northern Myotis	5	
EBF	St. Paul-Baldwin Plains	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	
EBF	St. Paul-Baldwin Plains	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	
EBF	St. Paul-Baldwin Plains	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	St. Paul-Baldwin Plains	MA	Spilogale putorius	Eastern Spotted Skunk	19	
EBF	St. Paul-Baldwin Plains	MA	Taxidea taxus	American Badger	24	
EBF	St. Paul-Baldwin Plains	BI	Ammodramus henslowii	Henslow's Sparrow	7	1
EBF	St. Paul-Baldwin Plains	BI	Ammodramus savannarum	Grasshopper Sparrow	14	3
EBF	St. Paul-Baldwin Plains	BI	Anas acuta	Northern Pintail	9	
EBF	St. Paul-Baldwin Plains	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	St. Paul-Baldwin Plains	BI	Bartramia longicauda	Upland Sandpiper	19	1
EBF	St. Paul-Baldwin Plains	BI	Botaurus lentiginosus	American Bittern	21	
EBF	St. Paul-Baldwin Plains	BI	Buteo lineatus	Red-shouldered Hawk	12	15
EBF	St. Paul-Baldwin Plains	BI	Calidris alpina	Dunlin	24	
EBF	St. Paul-Baldwin Plains	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	St. Paul-Baldwin Plains	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	St. Paul-Baldwin Plains	BI	Caprimulgus vociferus	Whip-poor-will	21	
EBF	St. Paul-Baldwin Plains	BI	Catharus fuscescens	Veery	22	6
EBF	St. Paul-Baldwin Plains	BI	Chlidonias niger	Black Tern	18	2
EBF	St. Paul-Baldwin Plains	BI	Chordeiles minor	Common Nighthawk	25	
EBF	St. Paul-Baldwin Plains	BI	Circus cyaneus	Northern Harrier	25	
EBF	St. Paul-Baldwin Plains	BI	Cistothorus palustris	Marsh Wren	20	9
EBF	St. Paul-Baldwin Plains	BI	Cistothorus platensis	Sedge Wren	25	9
EBF	St. Paul-Baldwin Plains	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	5
EBF	St. Paul-Baldwin Plains	BI	Contopus virens	Eastern Wood-pewee	25	44
EBF	St. Paul-Baldwin Plains	BI	Cygnus buccinator	Trumpeter Swan	14	
EBF	St. Paul-Baldwin Plains	BI	Dendroica cerulea	Cerulean Warbler	10	11
EBF	St. Paul-Baldwin Plains	BI	Dolichonyx oryzivorus	Bobolink	25	3
EBF	St. Paul-Baldwin Plains	BI	Empidonax minimus	Least Flycatcher	25	6
EBF	St. Paul-Baldwin Plains	BI	Empidonax traillii	Willow Flycatcher	13	14
EBF	St. Paul-Baldwin Plains	BI	Empidonax virescens	Acadian Flycatcher	6	9
EBF	St. Paul-Baldwin Plains	BI	Falco peregrinus	Peregrine Falcon	6	10
EBF	St. Paul-Baldwin Plains	BI	Gallinula chloropus	Common Moorhen	7	1
EBF	St. Paul-Baldwin Plains	BI	Gavia immer	Common Loon	18	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	St. Paul-Baldwin Plains	BI	Haliaeetus leucocephalus	Bald Eagle	21	35
EBF	St. Paul-Baldwin Plains	BI	Hylocichla mustelina	Wood Thrush	20	11
EBF	St. Paul-Baldwin Plains	BI	Ixobrychus exilis	Least Bittern	16	1
EBF	St. Paul-Baldwin Plains	BI	Lanius ludovicianus	Loggerhead Shrike	10	1
EBF	St. Paul-Baldwin Plains	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	St. Paul-Baldwin Plains	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	St. Paul-Baldwin Plains	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	1
EBF	St. Paul-Baldwin Plains	BI	Melospiza georgiana	Swamp Sparrow	25	16
EBF	St. Paul-Baldwin Plains	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	4
EBF	St. Paul-Baldwin Plains	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	29
EBF	St. Paul-Baldwin Plains	BI	Pluvialis dominica	American Golden-plover	24	
EBF	St. Paul-Baldwin Plains	BI	Podiceps grisegena	Red-necked Grebe	17	
EBF	St. Paul-Baldwin Plains	BI	Protonotaria citrea	Prothonotary Warbler	6	5
EBF	St. Paul-Baldwin Plains	BI	Rallus limicola	Virginia Rail	23	
EBF	St. Paul-Baldwin Plains	BI	Recurvirostra americana	American Avocet	16	
EBF	St. Paul-Baldwin Plains	BI	Scolopax minor	American Woodcock	22	
EBF	St. Paul-Baldwin Plains	BI	Seiurus aurocapillus	Ovenbird	22	24
EBF	St. Paul-Baldwin Plains	BI	Seiurus motacilla	Louisiana Waterthrush	5	8
EBF	St. Paul-Baldwin Plains	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	1
EBF	St. Paul-Baldwin Plains	BI	Spiza americana	Dickcissel	11	
EBF	St. Paul-Baldwin Plains	BI	Spizella pusilla	Field Sparrow	13	10
EBF	St. Paul-Baldwin Plains	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	6
EBF	St. Paul-Baldwin Plains	BI	Sterna forsteri	Forster's Tern	11	3
EBF	St. Paul-Baldwin Plains	BI	Sturnella magna	Eastern Meadowlark	20	2
EBF	St. Paul-Baldwin Plains	BI	Toxostoma rufum	Brown Thrasher	25	6
EBF	St. Paul-Baldwin Plains	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	St. Paul-Baldwin Plains	BI	Troglodytes troglodytes	Winter Wren	18	3
EBF	St. Paul-Baldwin Plains	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	St. Paul-Baldwin Plains	BI	Vermivora pinus	Blue-winged Warbler	6	2
EBF	St. Paul-Baldwin Plains	BI	Vireo bellii	Bell's Vireo	6	2
EBF	St. Paul-Baldwin Plains	BI	Wilsonia citrina	Hooded Warbler	2	9
EBF	St. Paul-Baldwin Plains	RE	Apalone mutica	Smooth Softshell	3	2
EBF	St. Paul-Baldwin Plains	RE	Chelydra serpentina	Common Snapping Turtle	25	14
EBF	St. Paul-Baldwin Plains	RE	Clemmys insculpta	Wood Turtle	11	4
EBF	St. Paul-Baldwin Plains	RE	Cnemidophorus sexlineatus	Six-lined Racerunner	3	
EBF	St. Paul-Baldwin Plains	RE	Coluber constrictor	Eastern Racer	5	1
EBF	St. Paul-Baldwin Plains	RE	Crotalus horridus	Timber Rattlesnake	3	
EBF	St. Paul-Baldwin Plains	RE	Elaphe vulpina	Eastern Fox Snake	9	7
EBF	St. Paul-Baldwin Plains	RE	Elaphe vulpina	Eastern Fox Snake	9	1
EBF	St. Paul-Baldwin Plains	RE	Emydoidea blandingii	Blanding's Turtle	13	83
EBF	St. Paul-Baldwin Plains	RE	Eumeces fasciatus	Five-lined Skink	3	
EBF	St. Paul-Baldwin Plains	RE	Heterodon nasicus	Western Hognose Snake	9	
EBF	St. Paul-Baldwin Plains	RE	Heterodon platirhinos	Eastern Hognose Snake	6	2
EBF	St. Paul-Baldwin Plains	RE	Lampropeltis triangulum	Milk Snake	6	
EBF	St. Paul-Baldwin Plains	RE	Liochlorophis vernalis	Smooth Green Snake	15	
EBF	St. Paul-Baldwin Plains	RE	Pituophis catenifer	Gopher Snake	7	1
EBF	St. Paul-Baldwin Plains	AM	Acris crepitans	Northern Cricket Frog	6	1
EBF	St. Paul-Baldwin Plains	AM	Hemidactylium scutatum	Four-toed Salamander	4	
EBF	St. Paul-Baldwin Plains	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	St. Paul-Baldwin Plains	FI	Acipenser fulvescens	Lake Sturgeon	14	15
EBF	St. Paul-Baldwin Plains	FI	Alosa chrysochloris	Skipjack Herring	4	
EBF	St. Paul-Baldwin Plains	FI	Ammocrypta asprella	Crystal Darter	3	
EBF	St. Paul-Baldwin Plains	FI	Ammocrypta clara	Western Sand Darter	3	18
EBF	St. Paul-Baldwin Plains	FI	Anguilla Rostrata	American Eel	3	9
EBF	St. Paul-Baldwin Plains	FI	Aphredoderus sayanus	Pirate Perch	2	
EBF	St. Paul-Baldwin Plains	FI	Campostoma oligolepis	Largescale Stoneroller	5	
EBF	St. Paul-Baldwin Plains	FI	Cycleptus elongatus	Blue Sucker	3	28
EBF	St. Paul-Baldwin Plains	FI	Etheostoma asprigene	Mud Darter	3	2
EBF	St. Paul-Baldwin Plains	FI	Etheostoma chlorosoma	Bluntnose Darter	2	
EBF	St. Paul-Baldwin Plains	FI	Hybognathus nuchalis	Mississippi Silvery Minnow	2	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	St. Paul-Baldwin Plains	FI	Ichthyomyzon gagei	Southern Brook Lamprey	2	4
EBF	St. Paul-Baldwin Plains	FI	Ictiobus niger	Black Buffalo	3	2
EBF	St. Paul-Baldwin Plains	FI	Lampetra appendix	American Brook Lamprey	7	13
EBF	St. Paul-Baldwin Plains	FI	Lepomis gulosus	Warmouth	2	
EBF	St. Paul-Baldwin Plains	FI	Lepomis megalotis	Longear Sunfish	6	
EBF	St. Paul-Baldwin Plains	FI	Macrhybopsis aestivalis	speckled chub	5	
EBF	St. Paul-Baldwin Plains	FI	Moxostoma carinatum	River Redhorse	3	26
EBF	St. Paul-Baldwin Plains	FI	Moxostoma valenciennesi	Greater Redhorse	11	1
EBF	St. Paul-Baldwin Plains	FI	Notropis amnis	Pallid Shiner	2	
EBF	St. Paul-Baldwin Plains	FI	Notropis anogenus	Pugnose Shiner	9	
EBF	St. Paul-Baldwin Plains	FI	Opsopoeodus emiliae	Pugnose Minnow	2	5
EBF	St. Paul-Baldwin Plains	FI	Percina evides	Gilt Darter	2	11
EBF	St. Paul-Baldwin Plains	FI	Polyodon spathula	Paddlefish	3	11
EBF	St. Paul-Baldwin Plains	FI	Scaphirhynchus platorynchus	Shovelnose Sturgeon	4	6
EBF	St. Paul-Baldwin Plains	SP	Marpissa grata	A Jumping Spider	6	1
EBF	St. Paul-Baldwin Plains	SP	Metaphidippus arizonensis	A Jumping Spider	4	1
EBF	St. Paul-Baldwin Plains	SP	Paradamoetas fontana	A Jumping Spider	5	
EBF	St. Paul-Baldwin Plains	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	1
EBF	St. Paul-Baldwin Plains	IN	Asynarchus rossi	A Caddisfly	1	2
EBF	St. Paul-Baldwin Plains	IN	Atrytone arogos	Arogos Skipper	9	
EBF	St. Paul-Baldwin Plains	IN	Cicindela patruela patruela	A Tiger Beetle	5	
EBF	St. Paul-Baldwin Plains	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
EBF	St. Paul-Baldwin Plains	IN	Erynnis persius	Persius Duskywing	5	
EBF	St. Paul-Baldwin Plains	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
EBF	St. Paul-Baldwin Plains	IN	Gomphus viridifrons	Green-faced Clubtail	2	
EBF	St. Paul-Baldwin Plains	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	
EBF	St. Paul-Baldwin Plains	IN	Ophiogomphus susbehcha	St. Croix Snaketail	2	1
EBF	St. Paul-Baldwin Plains	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
EBF	St. Paul-Baldwin Plains	IN	Speyeria idalia	Regal Fritillary	11	
EBF	St. Paul-Baldwin Plains	MO	Actinonaias ligamentina	Mucket mussel	11	22
EBF	St. Paul-Baldwin Plains	MO	Actinonaias ligamentina	Mucket mussel	11	10
EBF	St. Paul-Baldwin Plains	MO	Alasmidonta marginata	Elktoe	7	14
EBF	St. Paul-Baldwin Plains	MO	Arcidens confragosus	Rock Pocketbook	3	24
EBF	St. Paul-Baldwin Plains	MO	Cumberlandia monodonta	Spectaclecase	3	8
EBF	St. Paul-Baldwin Plains	MO	Cyclonaias tuberculata	Purple Wartyback	5	16
EBF	St. Paul-Baldwin Plains	MO	Ellipsaria lineolata	Butterfly	4	20
EBF	St. Paul-Baldwin Plains	MO	Elliptio crassidens	Elephant-ear	3	13
EBF	St. Paul-Baldwin Plains	MO	Elliptio dilatata	Spike	10	45
EBF	St. Paul-Baldwin Plains	MO	Epioblasma triquetra	Snuffbox	3	12
EBF	St. Paul-Baldwin Plains	MO	Fusconaia ebena	Ebonyshell	4	26
EBF	St. Paul-Baldwin Plains	MO	Lampsilis higginsi	Higgins Eye	4	22
EBF	St. Paul-Baldwin Plains	MO	Lampsilis teres	Yellow Sandshell	3	2
EBF	St. Paul-Baldwin Plains	MO	Lasmigona costata	Fluted-shell	12	11
EBF	St. Paul-Baldwin Plains	MO	Ligumia recta	Black Sandshell	25	44
EBF	St. Paul-Baldwin Plains	MO	Megalonaias nervosa	Washboard	3	3
EBF	St. Paul-Baldwin Plains	MO	Obovaria olivaria	Hickorynut	5	31
EBF	St. Paul-Baldwin Plains	MO	Plethobasus cyphyus	Sheepnose	4	9
EBF	St. Paul-Baldwin Plains	MO	Pleurobema coccineum	Round Pigtoe	6	50
EBF	St. Paul-Baldwin Plains	MO	Quadrula fragosa	Winged Mapleleaf	4	4
EBF	St. Paul-Baldwin Plains	MO	Quadrula metanevra	Monkeyface	10	42
EBF	St. Paul-Baldwin Plains	MO	Quadrula nodulata	Wartyback	5	102
EBF	St. Paul-Baldwin Plains	MO	Simpsonaias ambigua	Salamander Mussel	4	3
EBF	St. Paul-Baldwin Plains	MO	Tritogonia verrucosa	Pistolgrip	5	27
EBF	St. Paul-Baldwin Plains	MO	Truncilla donaciformis	Fawnsfoot	5	8
EBF	St. Paul-Baldwin Plains	MO	Venustaconcha ellipsiformis	Ellipse	8	1
EBF	The Blufflands	MA	Cryptotis parva	Least Shrew	2	
EBF	The Blufflands	MA	Microtus ochrogaster	Prairie Vole	12	
EBF	The Blufflands	MA	Microtus pinetorum	Woodland Vole	1	2
EBF	The Blufflands	MA	Myotis septentrionalis	Northern Myotis	5	10
EBF	The Blufflands	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	13

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	The Blufflands	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	2
EBF	The Blufflands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
EBF	The Blufflands	MA	Spilogale putorius	Eastern Spotted Skunk	19	
EBF	The Blufflands	MA	Taxidea taxus	American Badger	24	
EBF	The Blufflands	BI	Ammodramus henslowii	Henslow's Sparrow	7	4
EBF	The Blufflands	BI	Ammodramus savannarum	Grasshopper Sparrow	14	6
EBF	The Blufflands	BI	Arenaria interpres	Ruddy Turnstone	20	
EBF	The Blufflands	BI	Bartramia longicauda	Upland Sandpiper	19	
EBF	The Blufflands	BI	Buteo lineatus	Red-shouldered Hawk	12	36
EBF	The Blufflands	BI	Calidris alpina	Dunlin	24	
EBF	The Blufflands	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
EBF	The Blufflands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
EBF	The Blufflands	BI	Caprimulgus vociferus	Whip-poor-will	21	1
EBF	The Blufflands	BI	Catharus fuscescens	Veery	22	25
EBF	The Blufflands	BI	Chlidonias niger	Black Tern	18	5
EBF	The Blufflands	BI	Chordeiles minor	Common Nighthawk	25	
EBF	The Blufflands	BI	Circus cyaneus	Northern Harrier	25	1
EBF	The Blufflands	BI	Cistothorus palustris	Marsh Wren	20	17
EBF	The Blufflands	BI	Cistothorus platensis	Sedge Wren	25	15
EBF	The Blufflands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	20
EBF	The Blufflands	BI	Contopus virens	Eastern Wood-pewee	25	278
EBF	The Blufflands	BI	Dendroica cerulea	Cerulean Warbler	10	81
EBF	The Blufflands	BI	Dolichonyx oryzivorus	Bobolink	25	7
EBF	The Blufflands	BI	Empidonax minimus	Least Flycatcher	25	24
EBF	The Blufflands	BI	Empidonax traillii	Willow Flycatcher	13	27
EBF	The Blufflands	BI	Empidonax virescens	Acadian Flycatcher	6	55
EBF	The Blufflands	BI	Falco peregrinus	Peregrine Falcon	6	6
EBF	The Blufflands	BI	Gallinula chloropus	Common Moorhen	7	12
EBF	The Blufflands	BI	Haliaeetus leucocephalus	Bald Eagle	21	129
EBF	The Blufflands	BI	Hylocichla mustelina	Wood Thrush	20	70
EBF	The Blufflands	BI	Ixobrychus exilis	Least Bittern	16	3
EBF	The Blufflands	BI	Lanius ludovicianus	Loggerhead Shrike	10	5
EBF	The Blufflands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
EBF	The Blufflands	BI	Limosa haemastica	Hudsonian Godwit	18	
EBF	The Blufflands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	19
EBF	The Blufflands	BI	Melospiza georgiana	Swamp Sparrow	25	18
EBF	The Blufflands	BI	Numenius phaeopus	Whimbrel	13	
EBF	The Blufflands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	154
EBF	The Blufflands	BI	Pluvialis dominica	American Golden-plover	24	
EBF	The Blufflands	BI	Protonotaria citrea	Prothonotary Warbler	6	18
EBF	The Blufflands	BI	Rallus elegans	King Rail	2	
EBF	The Blufflands	BI	Rallus limicola	Virginia Rail	23	4
EBF	The Blufflands	BI	Recurvirostra americana	American Avocet	16	
EBF	The Blufflands	BI	Scolopax minor	American Woodcock	22	1
EBF	The Blufflands	BI	Seiurus aurocapillus	Ovenbird	22	157
EBF	The Blufflands	BI	Seiurus motacilla	Louisiana Waterthrush	5	61
EBF	The Blufflands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	66
EBF	The Blufflands	BI	Spiza americana	Dickcissel	11	1
EBF	The Blufflands	BI	Spizella pusilla	Field Sparrow	13	104
EBF	The Blufflands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	42
EBF	The Blufflands	BI	Sturnella magna	Eastern Meadowlark	20	22
EBF	The Blufflands	BI	Toxostoma rufum	Brown Thrasher	25	14
EBF	The Blufflands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
EBF	The Blufflands	BI	Troglodytes troglodytes	Winter Wren	18	8
EBF	The Blufflands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
EBF	The Blufflands	BI	Vermivora pinus	Blue-winged Warbler	6	64
EBF	The Blufflands	BI	Vireo bellii	Bell's Vireo	6	9
EBF	The Blufflands	RE	Apalone mutica	Smooth Softshell	3	37
EBF	The Blufflands	RE	Chelydra serpentina	Common Snapping Turtle	25	
EBF	The Blufflands	RE	Clemmys insculpta	Wood Turtle	11	15

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	The Blufflands	RE	Cnemidophorus sexlineatus	Six-lined Racerunner	3	
EBF	The Blufflands	RE	Coluber constrictor	Eastern Racer	5	19
EBF	The Blufflands	RE	Crotalus horridus	Timber Rattlesnake	3	134
EBF	The Blufflands	RE	Elaphe obsoleta	Eastern Rat Snake	1	2
EBF	The Blufflands	RE	Elaphe vulpina	Eastern Fox Snake	9	44
EBF	The Blufflands	RE	Emydoidea blandingii	Blanding's Turtle	13	26
EBF	The Blufflands	RE	Eumeces fasciatus	Five-lined Skink	3	6
EBF	The Blufflands	RE	Heterodon nasicus	Western Hognose Snake	9	
EBF	The Blufflands	RE	Heterodon platirhinos	Eastern Hognose Snake	6	12
EBF	The Blufflands	RE	Lampropeltis triangulum	Milk Snake	6	61
EBF	The Blufflands	RE	Liochlorophis vernalis	Smooth Green Snake	15	
EBF	The Blufflands	RE	Pituophis catenifer	Gopher Snake	7	28
EBF	The Blufflands	RE	Sistrurus catenatus	Eastern Massasauga	1	
EBF	The Blufflands	AM	Acris crepitans	Northern Cricket Frog	6	1
EBF	The Blufflands	AM	Necturus maculosus	Common Mudpuppy	14	
EBF	The Blufflands	AM	Rana palustris	Pickerel Frog	2	57
EBF	The Blufflands	FI	Acipenser fulvescens	Lake Sturgeon	14	45
EBF	The Blufflands	FI	Alosa chrysochloris	Skipjack Herring	4	18
EBF	The Blufflands	FI	Ammocrypta asprella	Crystal Darter	3	53
EBF	The Blufflands	FI	Ammocrypta clara	Western Sand Darter	3	250
EBF	The Blufflands	FI	Anguilla Rostrata	American Eel	3	35
EBF	The Blufflands	FI	Aphredoderus sayanus	Pirate Perch	2	43
EBF	The Blufflands	FI	Clinostomus elongatus	Redside Dace	3	10
EBF	The Blufflands	FI	Cycleptus elongatus	Blue Sucker	3	136
EBF	The Blufflands	FI	Erimystax x-punctata	Gravel Chub	3	4
EBF	The Blufflands	FI	Etheostoma asprigene	Mud Darter	3	375
EBF	The Blufflands	FI	Etheostoma chlorosoma	Bluntnose Darter	2	2
EBF	The Blufflands	FI	Hybognathus nuchalis	Mississippi Silvery Minnow	2	65
EBF	The Blufflands	FI	Ictiobus niger	Black Buffalo	3	13
EBF	The Blufflands	FI	Lampetra appendix	American Brook Lamprey	7	91
EBF	The Blufflands	FI	Lepomis gulosus	Warmouth	2	88
EBF	The Blufflands	FI	Lythrurus umbratilis	Redfin Shiner	3	
EBF	The Blufflands	FI	Macrhybopsis aestivalis	speckled chub	5	73
EBF	The Blufflands	FI	Morone mississippiensis	Yellow Bass	1	35
EBF	The Blufflands	FI	Moxostoma carinatum	River Redhorse	3	468
EBF	The Blufflands	FI	Moxostoma duquesnei	Black Redhorse	3	7
EBF	The Blufflands	FI	Notropis amnis	Pallid Shiner	2	19
EBF	The Blufflands	FI	Notropis nubilus	Ozark Minnow	3	
EBF	The Blufflands	FI	Opsopoeodus emiliae	Pugnose Minnow	2	825
EBF	The Blufflands	FI	Phenacobius mirabilis	Suckermouth Minnow	4	7
EBF	The Blufflands	FI	Polyodon spathula	Paddlefish	3	91
EBF	The Blufflands	FI	Scaphirhynchus platorynchus	Shovelnose Sturgeon	4	90
EBF	The Blufflands	SP	Metaphidippus arizonensis	A Jumping Spider	4	3
EBF	The Blufflands	SP	Phidippus apacheanus	A Jumping Spider	1	
EBF	The Blufflands	SP	Sassacus papenhoei	A Jumping Spider	1	1
EBF	The Blufflands	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	
EBF	The Blufflands	IN	Atrytone arogos	Arogos Skipper	9	
EBF	The Blufflands	IN	Cicindela patruela patruela	A Tiger Beetle	5	3
EBF	The Blufflands	IN	Cicindela splendida cyanocephalata	A Tiger Beetle	1	1
EBF	The Blufflands	IN	Erynnis persius	Persius Duskywing	5	1
EBF	The Blufflands	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
EBF	The Blufflands	IN	Gomphus crassus	Handsome Clubtail	1	
EBF	The Blufflands	IN	Gomphus ventricosus	Skillet Clubtail	2	
EBF	The Blufflands	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	2
EBF	The Blufflands	IN	Hesperia ottoe	Ottoe Skipper	6	3
EBF	The Blufflands	IN	Lycaeides melissa samuelis	Karner Blue	3	1
EBF	The Blufflands	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
EBF	The Blufflands	IN	Schinia indiana	Phlox Moth	5	
EBF	The Blufflands	IN	Speyeria idalia	Regal Fritillary	11	
EBF	The Blufflands	MO	Actinonaias ligamentina	Mucket mussel	11	9

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
EBF	The Blufflands	MO	Actinonaias ligamentina	Mucket mussel	11	13
EBF	The Blufflands	MO	Alasmidonta marginata	Elktoe	7	17
EBF	The Blufflands	MO	Arcidens confragosus	Rock Pocketbook	3	17
EBF	The Blufflands	MO	Cumberlandia monodonta	Spectaclecase	3	
EBF	The Blufflands	MO	Cyclonaias tuberculata	Purple Wartyback	5	4
EBF	The Blufflands	MO	Ellipsaria lineolata	Butterfly	4	22
EBF	The Blufflands	MO	Elliptio crassidens	Elephant-ear	3	9
EBF	The Blufflands	MO	Elliptio dilatata	Spike	10	30
EBF	The Blufflands	MO	Epioblasma triquetra	Snuffbox	3	
EBF	The Blufflands	MO	Fusconaia ebena	Ebonyshell	4	27
EBF	The Blufflands	MO	Lampsilis higginsi	Higgins Eye	4	21
EBF	The Blufflands	MO	Lampsilis teres	Yellow Sandshell	3	14
EBF	The Blufflands	MO	Lasmigona compressa	Creek Heelsplitter	24	6
EBF	The Blufflands	MO	Lasmigona costata	Fluted-shell	12	20
EBF	The Blufflands	MO	Ligumia recta	Black Sandshell	25	54
EBF	The Blufflands	MO	Megalonaias nervosa	Washboard	3	22
EBF	The Blufflands	MO	Novasuccinea n. sp. minnesota a	Minnesota Pleistocene Ambersnail	1	
EBF	The Blufflands	MO	Novasuccinea n. sp. minnesota b	Iowa Pleistocene Ambersnail	1	
EBF	The Blufflands	MO	Obovaria olivaria	Hickorynut	5	74
EBF	The Blufflands	MO	Plethobasus cyphyus	Sheepnose	4	3
EBF	The Blufflands	MO	Pleurobema coccineum	Round Pigtoe	6	44
EBF	The Blufflands	MO	Quadrula fragosa	Winged Mapleleaf	4	1
EBF	The Blufflands	MO	Quadrula metanevra	Monkeyface	10	33
EBF	The Blufflands	MO	Quadrula nodulata	Wartyback	5	18
EBF	The Blufflands	MO	Simpsonaias ambigua	Salamander Mussel	4	
EBF	The Blufflands	MO	Tritogonia verrucosa	Pistolgrip	5	12
EBF	The Blufflands	MO	Truncilla donaciformis	Fawnsfoot	5	21
EBF	The Blufflands	MO	Venustaconcha ellipsiformis	Ellipse	8	18
EBF	The Blufflands	MO	Vertigo hubrichti	Hubricht's Vertigo	1	5
EBF	The Blufflands	MO	Vertigo hubrichti hubrichti	Midwest Pleistocene Vertigo	1	
EBF	The Blufflands	MO	Vertigo hubrichti variabilis n. subsp.	Variable Pleistocene Vertigo	1	
EBF	The Blufflands	MO	Vertigo meramecensis	Bluff Vertigo	1	3
LMF	Agassiz Lowlands	MA	Canis lupus	Gray Wolf	14	
LMF	Agassiz Lowlands	MA	Cervus elaphus	Elk	2	
LMF	Agassiz Lowlands	MA	Lynx canadensis	Canada lynx	10	
LMF	Agassiz Lowlands	MA	Mustela nivalis	Least Weasel	12	
LMF	Agassiz Lowlands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Agassiz Lowlands	MA	Synaptomys borealis	Northern Bog Lemming	3	
LMF	Agassiz Lowlands	MA	Taxidea taxus	American Badger	24	
LMF	Agassiz Lowlands	BI	Accipiter gentilis	Northern Goshawk	13	1
LMF	Agassiz Lowlands	BI	Aegolius funereus	Boreal Owl	4	
LMF	Agassiz Lowlands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	34
LMF	Agassiz Lowlands	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	6
LMF	Agassiz Lowlands	BI	Anas rubripes	American Black Duck	10	
LMF	Agassiz Lowlands	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	Agassiz Lowlands	BI	Asio flammeus	Short-eared Owl	11	7
LMF	Agassiz Lowlands	BI	Bartramia longicauda	Upland Sandpiper	19	5
LMF	Agassiz Lowlands	BI	Botaurus lentiginosus	American Bittern	21	23
LMF	Agassiz Lowlands	BI	Calidris alpina	Dunlin	24	
LMF	Agassiz Lowlands	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	Agassiz Lowlands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Agassiz Lowlands	BI	Caprimulgus vociferus	Whip-poor-will	21	1
LMF	Agassiz Lowlands	BI	Catharus fuscescens	Veery	22	48
LMF	Agassiz Lowlands	BI	Charadrius melodus	Piping Plover	1	3
LMF	Agassiz Lowlands	BI	Chlidonias niger	Black Tern	18	4
LMF	Agassiz Lowlands	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Agassiz Lowlands	BI	Circus cyaneus	Northern Harrier	25	8
LMF	Agassiz Lowlands	BI	Cistothorus palustris	Marsh Wren	20	6
LMF	Agassiz Lowlands	BI	Cistothorus platensis	Sedge Wren	25	71
LMF	Agassiz Lowlands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	29

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Agassiz Lowlands	BI	Contopus cooperi	Olive-sided Flycatcher	14	7
LMF	Agassiz Lowlands	BI	Contopus virens	Eastern Wood-pewee	25	14
LMF	Agassiz Lowlands	BI	Coturnicops noveboracensis	Yellow Rail	10	28
LMF	Agassiz Lowlands	BI	Cygnus buccinator	Trumpeter Swan	14	
LMF	Agassiz Lowlands	BI	Dendroica castanea	Bay-breasted Warbler	4	1
LMF	Agassiz Lowlands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Agassiz Lowlands	BI	Dolichonyx oryzivorus	Bobolink	25	39
LMF	Agassiz Lowlands	BI	Empidonax minimus	Least Flycatcher	25	16
LMF	Agassiz Lowlands	BI	Falcipennis canadensis	Spruce Grouse	6	1
LMF	Agassiz Lowlands	BI	Gavia immer	Common Loon	18	5
LMF	Agassiz Lowlands	BI	Haliaeetus leucocephalus	Bald Eagle	21	26
LMF	Agassiz Lowlands	BI	Ixobrychus exilis	Least Bittern	16	
LMF	Agassiz Lowlands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Agassiz Lowlands	BI	Limosa fedoa	Marbled Godwit	4	2
LMF	Agassiz Lowlands	BI	Limosa haemastica	Hudsonian Godwit	18	
LMF	Agassiz Lowlands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	Agassiz Lowlands	BI	Melospiza georgiana	Swamp Sparrow	25	69
LMF	Agassiz Lowlands	BI	Numenius phaeopus	Whimbrel	13	
LMF	Agassiz Lowlands	BI	Oporornis agilis	Connecticut Warbler	14	26
LMF	Agassiz Lowlands	BI	Pelecanus erythrorhynchos	American White Pelican	4	15
LMF	Agassiz Lowlands	BI	Phalaropus tricolor	Wilson's Phalarope	9	2
LMF	Agassiz Lowlands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	21
LMF	Agassiz Lowlands	BI	Picoides arcticus	Black-backed Woodpecker	10	1
LMF	Agassiz Lowlands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Agassiz Lowlands	BI	Podiceps grisegena	Red-necked Grebe	17	1
LMF	Agassiz Lowlands	BI	Poecile hudsonica	Boreal Chickadee	10	
LMF	Agassiz Lowlands	BI	Rallus limicola	Virginia Rail	23	5
LMF	Agassiz Lowlands	BI	Recurvirostra americana	American Avocet	16	
LMF	Agassiz Lowlands	BI	Scolopax minor	American Woodcock	22	2
LMF	Agassiz Lowlands	BI	Seiurus aurocapillus	Ovenbird	22	33
LMF	Agassiz Lowlands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	3
LMF	Agassiz Lowlands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Agassiz Lowlands	BI	Sterna forsteri	Forster's Tern	11	1
LMF	Agassiz Lowlands	BI	Sterna hirundo	Common Tern	4	5
LMF	Agassiz Lowlands	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Agassiz Lowlands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Agassiz Lowlands	BI	Troglodytes troglodytes	Winter Wren	18	7
LMF	Agassiz Lowlands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Agassiz Lowlands	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	5
LMF	Agassiz Lowlands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	3
LMF	Agassiz Lowlands	BI	Wilsonia canadensis	Canada Warbler	13	
LMF	Agassiz Lowlands	BI	Zonotrichia albicollis	White-throated Sparrow	15	63
LMF	Agassiz Lowlands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Agassiz Lowlands	AM	Necturus maculosus	Common Mudpuppy	14	
LMF	Agassiz Lowlands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Agassiz Lowlands	FI	Acipenser fulvescens	Lake Sturgeon	14	14
LMF	Agassiz Lowlands	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	8
LMF	Agassiz Lowlands	FI	Moxostoma valenciennesi	Greater Redhorse	11	
LMF	Agassiz Lowlands	IN	Cicindela denikei	A Tiger Beetle	4	1
LMF	Agassiz Lowlands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	4
LMF	Agassiz Lowlands	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Agassiz Lowlands	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	1
LMF	Agassiz Lowlands	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	
LMF	Agassiz Lowlands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Agassiz Lowlands	IN	Oxyethira itascae	A Caddisfly	6	10
LMF	Agassiz Lowlands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Agassiz Lowlands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Agassiz Lowlands	MO	Lasmigona compressa	Creek Heelsplitter	24	2
LMF	Agassiz Lowlands	MO	Lasmigona costata	Fluted-shell	12	
LMF	Agassiz Lowlands	MO	Ligumia recta	Black Sandshell	25	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Border Lakes	MA	Canis lupus	Gray Wolf	14	
LMF	Border Lakes	MA	Lynx canadensis	Canada lynx	10	
LMF	Border Lakes	MA	Microtus chrotorrhinus	Rock Vole	3	42
LMF	Border Lakes	MA	Phenacomys intermedius	Heather Vole	3	
LMF	Border Lakes	MA	Sorex fumeus	Smoky Shrew	3	14
LMF	Border Lakes	BI	Accipiter gentilis	Northern Goshawk	13	3
LMF	Border Lakes	BI	Aegolius funereus	Boreal Owl	4	1
LMF	Border Lakes	BI	Ammodramus leconteii	Le Conte's Sparrow	17	
LMF	Border Lakes	BI	Anas rubripes	American Black Duck	10	
LMF	Border Lakes	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	Border Lakes	BI	Botaurus lentiginosus	American Bittern	21	16
LMF	Border Lakes	BI	Calidris alpina	Dunlin	24	
LMF	Border Lakes	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	Border Lakes	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Border Lakes	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Border Lakes	BI	Catharus fuscescens	Veery	22	6
LMF	Border Lakes	BI	Chlidonias niger	Black Tern	18	
LMF	Border Lakes	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Border Lakes	BI	Circus cyaneus	Northern Harrier	25	
LMF	Border Lakes	BI	Cistothorus platensis	Sedge Wren	25	2
LMF	Border Lakes	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
LMF	Border Lakes	BI	Contopus cooperi	Olive-sided Flycatcher	14	
LMF	Border Lakes	BI	Contopus virens	Eastern Wood-pewee	25	1
LMF	Border Lakes	BI	Dendroica caerulescens	Black-throated Blue Warbler	3	15
LMF	Border Lakes	BI	Dendroica castanea	Bay-breasted Warbler	4	
LMF	Border Lakes	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Border Lakes	BI	Dolichonyx oryzivorus	Bobolink	25	
LMF	Border Lakes	BI	Empidonax minimus	Least Flycatcher	25	3
LMF	Border Lakes	BI	Euphagus carolinus	Rusty Blackbird	1	
LMF	Border Lakes	BI	Falcipennis canadensis	Spruce Grouse	6	
LMF	Border Lakes	BI	Gavia immer	Common Loon	18	1
LMF	Border Lakes	BI	Haliaeetus leucocephalus	Bald Eagle	21	215
LMF	Border Lakes	BI	Hylocichla mustelina	Wood Thrush	20	
LMF	Border Lakes	BI	Melospiza georgiana	Swamp Sparrow	25	10
LMF	Border Lakes	BI	Oporornis agilis	Connecticut Warbler	14	
LMF	Border Lakes	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	3
LMF	Border Lakes	BI	Picoides arcticus	Black-backed Woodpecker	10	
LMF	Border Lakes	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Border Lakes	BI	Podiceps grisegena	Red-necked Grebe	17	
LMF	Border Lakes	BI	Poecile hudsonica	Boreal Chickadee	10	
LMF	Border Lakes	BI	Scolopax minor	American Woodcock	22	
LMF	Border Lakes	BI	Seiurus aurocapillus	Ovenbird	22	6
LMF	Border Lakes	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	6
LMF	Border Lakes	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Border Lakes	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Border Lakes	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Border Lakes	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Border Lakes	BI	Troglodytes troglodytes	Winter Wren	18	3
LMF	Border Lakes	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Border Lakes	BI	Vermivora chrysoptera	Golden-winged Warbler	14	
LMF	Border Lakes	BI	Wilsonia canadensis	Canada Warbler	13	3
LMF	Border Lakes	BI	Zonotrichia albicollis	White-throated Sparrow	15	9
LMF	Border Lakes	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Border Lakes	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Border Lakes	FI	Acipenser fulvescens	Lake Sturgeon	14	16
LMF	Border Lakes	FI	Coregonus nipigon	Nipigon cisco	1	22
LMF	Border Lakes	FI	Coregonus zenithicus	Shortjaw Cisco	2	21
LMF	Border Lakes	FI	Cottus ricei	Spoonhead sculpin	2	2
LMF	Border Lakes	FI	Couesius plumbeus	Lake Chub	4	27
LMF	Border Lakes	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	9

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Border Lakes	FI	Lepomis megalotis	Longear Sunfish	6	17
LMF	Border Lakes	IN	Cicindela denikei	A Tiger Beetle	4	60
LMF	Border Lakes	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Border Lakes	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	5
LMF	Border Lakes	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Border Lakes	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Border Lakes	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Border Lakes	MO	Lasmigona compressa	Creek Heelsplitter	24	2
LMF	Border Lakes	MO	Ligumia recta	Black Sandshell	25	
LMF	Chippewa Plains	MA	Canis lupus	Gray Wolf	14	
LMF	Chippewa Plains	MA	Lynx canadensis	Canada lynx	10	
LMF	Chippewa Plains	MA	Myotis septentrionalis	Northern Myotis	5	
LMF	Chippewa Plains	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Chippewa Plains	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	Chippewa Plains	MA	Taxidea taxus	American Badger	24	
LMF	Chippewa Plains	BI	Accipiter gentilis	Northern Goshawk	13	40
LMF	Chippewa Plains	BI	Ammodramus leconteii	Le Conte's Sparrow	17	18
LMF	Chippewa Plains	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	14
LMF	Chippewa Plains	BI	Anas rubripes	American Black Duck	10	1
LMF	Chippewa Plains	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	Chippewa Plains	BI	Asio flammeus	Short-eared Owl	11	
LMF	Chippewa Plains	BI	Bartramia longicauda	Upland Sandpiper	19	1
LMF	Chippewa Plains	BI	Botaurus lentiginosus	American Bittern	21	27
LMF	Chippewa Plains	BI	Buteo lineatus	Red-shouldered Hawk	12	30
LMF	Chippewa Plains	BI	Calidris alpina	Dunlin	24	
LMF	Chippewa Plains	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	Chippewa Plains	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Chippewa Plains	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Chippewa Plains	BI	Catharus fuscescens	Veery	22	22
LMF	Chippewa Plains	BI	Chlidonias niger	Black Tern	18	8
LMF	Chippewa Plains	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Chippewa Plains	BI	Circus cyaneus	Northern Harrier	25	
LMF	Chippewa Plains	BI	Cistothorus palustris	Marsh Wren	20	9
LMF	Chippewa Plains	BI	Cistothorus platensis	Sedge Wren	25	34
LMF	Chippewa Plains	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	1
LMF	Chippewa Plains	BI	Contopus cooperi	Olive-sided Flycatcher	14	
LMF	Chippewa Plains	BI	Contopus virens	Eastern Wood-pewee	25	2
LMF	Chippewa Plains	BI	Coturnicops noveboracensis	Yellow Rail	10	25
LMF	Chippewa Plains	BI	Cygnus buccinator	Trumpeter Swan	14	4
LMF	Chippewa Plains	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Chippewa Plains	BI	Dolichonyx oryzivorus	Bobolink	25	10
LMF	Chippewa Plains	BI	Empidonax minimus	Least Flycatcher	25	5
LMF	Chippewa Plains	BI	Falcipennis canadensis	Spruce Grouse	6	
LMF	Chippewa Plains	BI	Gavia immer	Common Loon	18	16
LMF	Chippewa Plains	BI	Haliaeetus leucocephalus	Bald Eagle	21	285
LMF	Chippewa Plains	BI	Hylocichla mustelina	Wood Thrush	20	
LMF	Chippewa Plains	BI	Ixobrychus exilis	Least Bittern	16	2
LMF	Chippewa Plains	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Chippewa Plains	BI	Limosa haemastica	Hudsonian Godwit	18	
LMF	Chippewa Plains	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	Chippewa Plains	BI	Melospiza georgiana	Swamp Sparrow	25	29
LMF	Chippewa Plains	BI	Numenius phaeopus	Whimbrel	13	
LMF	Chippewa Plains	BI	Oporornis agilis	Connecticut Warbler	14	8
LMF	Chippewa Plains	BI	Phalaropus tricolor	Wilson's Phalarope	9	4
LMF	Chippewa Plains	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	10
LMF	Chippewa Plains	BI	Picoides arcticus	Black-backed Woodpecker	10	
LMF	Chippewa Plains	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Chippewa Plains	BI	Podiceps grisegena	Red-necked Grebe	17	1
LMF	Chippewa Plains	BI	Poecile hudsonica	Boreal Chickadee	10	1
LMF	Chippewa Plains	BI	Rallus limicola	Virginia Rail	23	1

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Chippewa Plains	BI	Recurvirostra americana	American Avocet	16	
LMF	Chippewa Plains	BI	Scolopax minor	American Woodcock	22	
LMF	Chippewa Plains	BI	Seiurus aurocapillus	Ovenbird	22	13
LMF	Chippewa Plains	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	4
LMF	Chippewa Plains	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Chippewa Plains	BI	Sterna forsteri	Forster's Tern	11	1
LMF	Chippewa Plains	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Chippewa Plains	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Chippewa Plains	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Chippewa Plains	BI	Troglodytes troglodytes	Winter Wren	18	5
LMF	Chippewa Plains	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Chippewa Plains	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	Chippewa Plains	BI	Vermivora chrysoptera	Golden-winged Warbler	14	4
LMF	Chippewa Plains	BI	Wilsonia canadensis	Canada Warbler	13	1
LMF	Chippewa Plains	BI	Zonotrichia albicollis	White-throated Sparrow	15	23
LMF	Chippewa Plains	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Chippewa Plains	RE	Liochlorophis vernalis	Smooth Green Snake	15	
LMF	Chippewa Plains	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Chippewa Plains	FI	Etheostoma microperca	Least Darter	9	6
LMF	Chippewa Plains	FI	Lepomis megalotis	Longear Sunfish	6	
LMF	Chippewa Plains	FI	Moxostoma valenciennesi	Greater Redhorse	11	3
LMF	Chippewa Plains	FI	Notropis anogenus	Pugnose Shiner	9	9
LMF	Chippewa Plains	IN	Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	3	1
LMF	Chippewa Plains	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Chippewa Plains	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	
LMF	Chippewa Plains	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Chippewa Plains	IN	Oxyethira ecornuta	A Caddisfly	3	
LMF	Chippewa Plains	IN	Oxyethira itascae	A Caddisfly	6	1
LMF	Chippewa Plains	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Chippewa Plains	IN	Setodes guttatus	A Caddisfly	1	
LMF	Chippewa Plains	MO	Lasmigona compressa	Creek Heelsplitter	24	31
LMF	Chippewa Plains	MO	Ligumia recta	Black Sandshell	25	32
LMF	Glacial Lake Superior Plain	MA	Canis lupus	Gray Wolf	14	
LMF	Glacial Lake Superior Plain	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Glacial Lake Superior Plain	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	Glacial Lake Superior Plain	MA	Taxidea taxus	American Badger	24	
LMF	Glacial Lake Superior Plain	BI	Accipiter gentilis	Northern Goshawk	13	1
LMF	Glacial Lake Superior Plain	BI	Ammodramus leconteii	Le Conte's Sparrow	17	
LMF	Glacial Lake Superior Plain	BI	Bartramia longicauda	Upland Sandpiper	19	1
LMF	Glacial Lake Superior Plain	BI	Botaurus lentiginosus	American Bittern	21	
LMF	Glacial Lake Superior Plain	BI	Buteo lineatus	Red-shouldered Hawk	12	
LMF	Glacial Lake Superior Plain	BI	Calidris alpina	Dunlin	24	
LMF	Glacial Lake Superior Plain	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	Glacial Lake Superior Plain	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Glacial Lake Superior Plain	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Glacial Lake Superior Plain	BI	Catharus fuscescens	Veery	22	12
LMF	Glacial Lake Superior Plain	BI	Chlidonias niger	Black Tern	18	
LMF	Glacial Lake Superior Plain	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Glacial Lake Superior Plain	BI	Circus cyaneus	Northern Harrier	25	1
LMF	Glacial Lake Superior Plain	BI	Cistothorus palustris	Marsh Wren	20	
LMF	Glacial Lake Superior Plain	BI	Cistothorus platensis	Sedge Wren	25	
LMF	Glacial Lake Superior Plain	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	1
LMF	Glacial Lake Superior Plain	BI	Contopus cooperi	Olive-sided Flycatcher	14	
LMF	Glacial Lake Superior Plain	BI	Contopus virens	Eastern Wood-pewee	25	11
LMF	Glacial Lake Superior Plain	BI	Dolichonyx oryzivorus	Bobolink	25	
LMF	Glacial Lake Superior Plain	BI	Empidonax minimus	Least Flycatcher	25	7
LMF	Glacial Lake Superior Plain	BI	Falco peregrinus	Peregrine Falcon	6	
LMF	Glacial Lake Superior Plain	BI	Haliaeetus leucocephalus	Bald Eagle	21	1
LMF	Glacial Lake Superior Plain	BI	Hylocichla mustelina	Wood Thrush	20	4
LMF	Glacial Lake Superior Plain	BI	Ixobrychus exilis	Least Bittern	16	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Glacial Lake Superior Plain	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Glacial Lake Superior Plain	BI	Limosa haemastica	Hudsonian Godwit	18	
LMF	Glacial Lake Superior Plain	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	Glacial Lake Superior Plain	BI	Melospiza georgiana	Swamp Sparrow	25	1
LMF	Glacial Lake Superior Plain	BI	Oporornis agilis	Connecticut Warbler	14	
LMF	Glacial Lake Superior Plain	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	5
LMF	Glacial Lake Superior Plain	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Glacial Lake Superior Plain	BI	Rallus limicola	Virginia Rail	23	
LMF	Glacial Lake Superior Plain	BI	Scolopax minor	American Woodcock	22	
LMF	Glacial Lake Superior Plain	BI	Seiurus aurocapillus	Ovenbird	22	19
LMF	Glacial Lake Superior Plain	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	3
LMF	Glacial Lake Superior Plain	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Glacial Lake Superior Plain	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Glacial Lake Superior Plain	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Glacial Lake Superior Plain	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Glacial Lake Superior Plain	BI	Troglodytes troglodytes	Winter Wren	18	
LMF	Glacial Lake Superior Plain	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Glacial Lake Superior Plain	BI	Vermivora chrysoptera	Golden-winged Warbler	14	1
LMF	Glacial Lake Superior Plain	BI	Wilsonia canadensis	Canada Warbler	13	5
LMF	Glacial Lake Superior Plain	BI	Zonotrichia albicollis	White-throated Sparrow	15	3
LMF	Glacial Lake Superior Plain	RE	Chelydra serpentina	Common Snapping Turtle	25	5
LMF	Glacial Lake Superior Plain	RE	Clemmys insculpta	Wood Turtle	11	71
LMF	Glacial Lake Superior Plain	AM	Ambystoma maculatum	Spotted Salamander	2	
LMF	Glacial Lake Superior Plain	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Glacial Lake Superior Plain	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	14
LMF	Glacial Lake Superior Plain	MO	Lasmigona compressa	Creek Heelsplitter	24	3
LMF	Glacial Lake Superior Plain	MO	Ligumia recta	Black Sandshell	25	2
LMF	Laurentian Uplands	MA	Canis lupus	Gray Wolf	14	
LMF	Laurentian Uplands	MA	Lynx canadensis	Canada lynx	10	
LMF	Laurentian Uplands	MA	Microtus chrotorrhinus	Rock Vole	3	32
LMF	Laurentian Uplands	MA	Phenacomys intermedius	Heather Vole	3	3
LMF	Laurentian Uplands	MA	Sorex fumeus	Smoky Shrew	3	9
LMF	Laurentian Uplands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Laurentian Uplands	MA	Taxidea taxus	American Badger	24	
LMF	Laurentian Uplands	BI	Accipiter gentilis	Northern Goshawk	13	1
LMF	Laurentian Uplands	BI	Aegolius funereus	Boreal Owl	4	2
LMF	Laurentian Uplands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	2
LMF	Laurentian Uplands	BI	Anas rubripes	American Black Duck	10	
LMF	Laurentian Uplands	BI	Botaurus lentiginosus	American Bittern	21	1
LMF	Laurentian Uplands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Laurentian Uplands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Laurentian Uplands	BI	Catharus fuscescens	Veery	22	6
LMF	Laurentian Uplands	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Laurentian Uplands	BI	Circus cyaneus	Northern Harrier	25	1
LMF	Laurentian Uplands	BI	Cistothorus platensis	Sedge Wren	25	3
LMF	Laurentian Uplands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	1
LMF	Laurentian Uplands	BI	Contopus cooperi	Olive-sided Flycatcher	14	4
LMF	Laurentian Uplands	BI	Contopus virens	Eastern Wood-pewee	25	1
LMF	Laurentian Uplands	BI	Dendroica caerulescens	Black-throated Blue Warbler	3	12
LMF	Laurentian Uplands	BI	Dendroica castanea	Bay-breasted Warbler	4	
LMF	Laurentian Uplands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Laurentian Uplands	BI	Dolichonyx oryzivorus	Bobolink	25	1
LMF	Laurentian Uplands	BI	Empidonax minimus	Least Flycatcher	25	3
LMF	Laurentian Uplands	BI	Falcipennis canadensis	Spruce Grouse	6	
LMF	Laurentian Uplands	BI	Gavia immer	Common Loon	18	6
LMF	Laurentian Uplands	BI	Haliaeetus leucocephalus	Bald Eagle	21	10
LMF	Laurentian Uplands	BI	Hylocichla mustelina	Wood Thrush	20	1
LMF	Laurentian Uplands	BI	Melospiza georgiana	Swamp Sparrow	25	9
LMF	Laurentian Uplands	BI	Oporornis agilis	Connecticut Warbler	14	7
LMF	Laurentian Uplands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	3

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Laurentian Uplands	BI	Picoides arcticus	Black-backed Woodpecker	10	7
LMF	Laurentian Uplands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Laurentian Uplands	BI	Poecile hudsonica	Boreal Chickadee	10	1
LMF	Laurentian Uplands	BI	Scolopax minor	American Woodcock	22	
LMF	Laurentian Uplands	BI	Seiurus aurocapillus	Ovenbird	22	23
LMF	Laurentian Uplands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	7
LMF	Laurentian Uplands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Laurentian Uplands	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Laurentian Uplands	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Laurentian Uplands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Laurentian Uplands	BI	Troglodytes troglodytes	Winter Wren	18	9
LMF	Laurentian Uplands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	
LMF	Laurentian Uplands	BI	Wilsonia canadensis	Canada Warbler	13	7
LMF	Laurentian Uplands	BI	Zonotrichia albicollis	White-throated Sparrow	15	24
LMF	Laurentian Uplands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Laurentian Uplands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Laurentian Uplands	IN	Cicindela denikei	A Tiger Beetle	4	2
LMF	Laurentian Uplands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Laurentian Uplands	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Laurentian Uplands	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	1
LMF	Laurentian Uplands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Laurentian Uplands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Laurentian Uplands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Laurentian Uplands	MO	Lasmigona compressa	Creek Heelsplitter	24	5
LMF	Laurentian Uplands	MO	Ligumia recta	Black Sandshell	25	1
LMF	Littlefork-Vermillion Uplands	MA	Canis lupus	Gray Wolf	14	
LMF	Littlefork-Vermillion Uplands	MA	Lynx canadensis	Canada lynx	10	
LMF	Littlefork-Vermillion Uplands	MA	Synaptomys borealis	Northern Bog Lemming	3	
LMF	Littlefork-Vermillion Uplands	MA	Taxidea taxus	American Badger	24	
LMF	Littlefork-Vermillion Uplands	BI	Accipiter gentilis	Northern Goshawk	13	1
LMF	Littlefork-Vermillion Uplands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	
LMF	Littlefork-Vermillion Uplands	BI	Anas rubripes	American Black Duck	10	
LMF	Littlefork-Vermillion Uplands	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	Littlefork-Vermillion Uplands	BI	Botaurus lentiginosus	American Bittern	21	21
LMF	Littlefork-Vermillion Uplands	BI	Calidris alpina	Dunlin	24	
LMF	Littlefork-Vermillion Uplands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Littlefork-Vermillion Uplands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Littlefork-Vermillion Uplands	BI	Catharus fuscescens	Veery	22	
LMF	Littlefork-Vermillion Uplands	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Littlefork-Vermillion Uplands	BI	Circus cyaneus	Northern Harrier	25	
LMF	Littlefork-Vermillion Uplands	BI	Cistothorus platensis	Sedge Wren	25	
LMF	Littlefork-Vermillion Uplands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
LMF	Littlefork-Vermillion Uplands	BI	Contopus cooperi	Olive-sided Flycatcher	14	
LMF	Littlefork-Vermillion Uplands	BI	Contopus virens	Eastern Wood-pewee	25	
LMF	Littlefork-Vermillion Uplands	BI	Coturnicops noveboracensis	Yellow Rail	10	
LMF	Littlefork-Vermillion Uplands	BI	Cygnus buccinator	Trumpeter Swan	14	
LMF	Littlefork-Vermillion Uplands	BI	Dendroica castanea	Bay-breasted Warbler	4	
LMF	Littlefork-Vermillion Uplands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Littlefork-Vermillion Uplands	BI	Dolichonyx oryzivorus	Bobolink	25	
LMF	Littlefork-Vermillion Uplands	BI	Empidonax minimus	Least Flycatcher	25	
LMF	Littlefork-Vermillion Uplands	BI	Falcipennis canadensis	Spruce Grouse	6	
LMF	Littlefork-Vermillion Uplands	BI	Gavia immer	Common Loon	18	
LMF	Littlefork-Vermillion Uplands	BI	Haliaeetus leucocephalus	Bald Eagle	21	16
LMF	Littlefork-Vermillion Uplands	BI	Hylocichla mustelina	Wood Thrush	20	
LMF	Littlefork-Vermillion Uplands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Littlefork-Vermillion Uplands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	Littlefork-Vermillion Uplands	BI	Melospiza georgiana	Swamp Sparrow	25	
LMF	Littlefork-Vermillion Uplands	BI	Oporornis agilis	Connecticut Warbler	14	
LMF	Littlefork-Vermillion Uplands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	
LMF	Littlefork-Vermillion Uplands	BI	Picoides arcticus	Black-backed Woodpecker	10	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Littlefork-Vermillion Uplands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Littlefork-Vermillion Uplands	BI	Podiceps grisegena	Red-necked Grebe	17	
LMF	Littlefork-Vermillion Uplands	BI	Poecile hudsonica	Boreal Chickadee	10	
LMF	Littlefork-Vermillion Uplands	BI	Rallus limicola	Virginia Rail	23	
LMF	Littlefork-Vermillion Uplands	BI	Scolopax minor	American Woodcock	22	
LMF	Littlefork-Vermillion Uplands	BI	Seiurus aurocapillus	Ovenbird	22	
LMF	Littlefork-Vermillion Uplands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	
LMF	Littlefork-Vermillion Uplands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Littlefork-Vermillion Uplands	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Littlefork-Vermillion Uplands	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Littlefork-Vermillion Uplands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Littlefork-Vermillion Uplands	BI	Troglodytes troglodytes	Winter Wren	18	
LMF	Littlefork-Vermillion Uplands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Littlefork-Vermillion Uplands	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	Littlefork-Vermillion Uplands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	
LMF	Littlefork-Vermillion Uplands	BI	Wilsonia canadensis	Canada Warbler	13	
LMF	Littlefork-Vermillion Uplands	BI	Zonotrichia albicollis	White-throated Sparrow	15	
LMF	Littlefork-Vermillion Uplands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Littlefork-Vermillion Uplands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Littlefork-Vermillion Uplands	FI	Acipenser fulvescens	Lake Sturgeon	14	43
LMF	Littlefork-Vermillion Uplands	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	43
LMF	Littlefork-Vermillion Uplands	FI	Moxostoma valenciennesi	Greater Redhorse	11	
LMF	Littlefork-Vermillion Uplands	IN	Cicindela denikei	A Tiger Beetle	4	4
LMF	Littlefork-Vermillion Uplands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Littlefork-Vermillion Uplands	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Littlefork-Vermillion Uplands	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	
LMF	Littlefork-Vermillion Uplands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Littlefork-Vermillion Uplands	IN	Oxyethira itascae	A Caddisfly	6	1
LMF	Littlefork-Vermillion Uplands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Littlefork-Vermillion Uplands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Littlefork-Vermillion Uplands	MO	Lasmigona compressa	Creek Heelsplitter	24	10
LMF	Littlefork-Vermillion Uplands	MO	Ligumia recta	Black Sandshell	25	23
LMF	Mille Lacs Uplands	MA	Canis lupus	Gray Wolf	14	
LMF	Mille Lacs Uplands	MA	Lynx canadensis	Canada lynx	10	
LMF	Mille Lacs Uplands	MA	Mustela nivalis	Least Weasel	12	
LMF	Mille Lacs Uplands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Mille Lacs Uplands	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	Mille Lacs Uplands	MA	Taxidea taxus	American Badger	24	
LMF	Mille Lacs Uplands	BI	Accipiter gentilis	Northern Goshawk	13	3
LMF	Mille Lacs Uplands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	9
LMF	Mille Lacs Uplands	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	10
LMF	Mille Lacs Uplands	BI	Ammodramus savannarum	Grasshopper Sparrow	14	8
LMF	Mille Lacs Uplands	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	Mille Lacs Uplands	BI	Bartramia longicauda	Upland Sandpiper	19	1
LMF	Mille Lacs Uplands	BI	Botaurus lentiginosus	American Bittern	21	12
LMF	Mille Lacs Uplands	BI	Buteo lineatus	Red-shouldered Hawk	12	122
LMF	Mille Lacs Uplands	BI	Calidris alpina	Dunlin	24	
LMF	Mille Lacs Uplands	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	Mille Lacs Uplands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Mille Lacs Uplands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Mille Lacs Uplands	BI	Catharus fuscescens	Veery	22	205
LMF	Mille Lacs Uplands	BI	Chlidonias niger	Black Tern	18	5
LMF	Mille Lacs Uplands	BI	Chordeiles minor	Common Nighthawk	25	1
LMF	Mille Lacs Uplands	BI	Circus cyaneus	Northern Harrier	25	20
LMF	Mille Lacs Uplands	BI	Cistothorus palustris	Marsh Wren	20	12
LMF	Mille Lacs Uplands	BI	Cistothorus platensis	Sedge Wren	25	93
LMF	Mille Lacs Uplands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	33
LMF	Mille Lacs Uplands	BI	Contopus cooperi	Olive-sided Flycatcher	14	1
LMF	Mille Lacs Uplands	BI	Contopus virens	Eastern Wood-pewee	25	135
LMF	Mille Lacs Uplands	BI	Coturnicops noveboracensis	Yellow Rail	10	6

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Mille Lacs Uplands	BI	Cygnus buccinator	Trumpeter Swan	14	1
LMF	Mille Lacs Uplands	BI	Dendroica cerulea	Cerulean Warbler	10	10
LMF	Mille Lacs Uplands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Mille Lacs Uplands	BI	Dolichonyx oryzivorus	Bobolink	25	43
LMF	Mille Lacs Uplands	BI	Empidonax minimus	Least Flycatcher	25	119
LMF	Mille Lacs Uplands	BI	Empidonax traillii	Willow Flycatcher	13	1
LMF	Mille Lacs Uplands	BI	Gavia immer	Common Loon	18	22
LMF	Mille Lacs Uplands	BI	Haliaeetus leucocephalus	Bald Eagle	21	77
LMF	Mille Lacs Uplands	BI	Hylocichla mustelina	Wood Thrush	20	66
LMF	Mille Lacs Uplands	BI	Ixobrychus exilis	Least Bittern	16	
LMF	Mille Lacs Uplands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Mille Lacs Uplands	BI	Limosa haemastica	Hudsonian Godwit	18	
LMF	Mille Lacs Uplands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	9
LMF	Mille Lacs Uplands	BI	Melospiza georgiana	Swamp Sparrow	25	88
LMF	Mille Lacs Uplands	BI	Numenius phaeopus	Whimbrel	13	
LMF	Mille Lacs Uplands	BI	Oporornis agilis	Connecticut Warbler	14	10
LMF	Mille Lacs Uplands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	77
LMF	Mille Lacs Uplands	BI	Picoides arcticus	Black-backed Woodpecker	10	1
LMF	Mille Lacs Uplands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Mille Lacs Uplands	BI	Podiceps grisegena	Red-necked Grebe	17	1
LMF	Mille Lacs Uplands	BI	Rallus limicola	Virginia Rail	23	1
LMF	Mille Lacs Uplands	BI	Recurvirostra americana	American Avocet	16	
LMF	Mille Lacs Uplands	BI	Scolopax minor	American Woodcock	22	3
LMF	Mille Lacs Uplands	BI	Seiurus aurocapillus	Ovenbird	22	195
LMF	Mille Lacs Uplands	BI	Seiurus motacilla	Louisiana Waterthrush	5	53
LMF	Mille Lacs Uplands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	44
LMF	Mille Lacs Uplands	BI	Spizella pusilla	Field Sparrow	13	12
LMF	Mille Lacs Uplands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	4
LMF	Mille Lacs Uplands	BI	Sterna forsteri	Forster's Tern	11	
LMF	Mille Lacs Uplands	BI	Sterna hirundo	Common Tern	4	3
LMF	Mille Lacs Uplands	BI	Sturnella magna	Eastern Meadowlark	20	22
LMF	Mille Lacs Uplands	BI	Toxostoma rufum	Brown Thrasher	25	3
LMF	Mille Lacs Uplands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Mille Lacs Uplands	BI	Troglodytes troglodytes	Winter Wren	18	14
LMF	Mille Lacs Uplands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Mille Lacs Uplands	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	Mille Lacs Uplands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	65
LMF	Mille Lacs Uplands	BI	Wilsonia canadensis	Canada Warbler	13	8
LMF	Mille Lacs Uplands	BI	Zonotrichia albicollis	White-throated Sparrow	15	28
LMF	Mille Lacs Uplands	RE	Chelydra serpentina	Common Snapping Turtle	25	5
LMF	Mille Lacs Uplands	RE	Clemmys insculpta	Wood Turtle	11	25
LMF	Mille Lacs Uplands	RE	Emydoidea blandingii	Blanding's Turtle	13	86
LMF	Mille Lacs Uplands	RE	Heterodon nasicus	Western Hognose Snake	9	2
LMF	Mille Lacs Uplands	RE	Heterodon platirhinos	Eastern Hognose Snake	6	11
LMF	Mille Lacs Uplands	RE	Heterodon platirhinos	Eastern Hognose Snake	6	9
LMF	Mille Lacs Uplands	RE	Lampropeltis triangulum	Milk Snake	6	1
LMF	Mille Lacs Uplands	RE	Liochlorophis vernalis	Smooth Green Snake	15	
LMF	Mille Lacs Uplands	AM	Acris crepitans	Northern Cricket Frog	6	
LMF	Mille Lacs Uplands	AM	Ambystoma maculatum	Spotted Salamander	2	9
LMF	Mille Lacs Uplands	AM	Hemidactylium scutatum	Four-toed Salamander	4	73
LMF	Mille Lacs Uplands	AM	Necturus maculosus	Common Mudpuppy	14	1
LMF	Mille Lacs Uplands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	27
LMF	Mille Lacs Uplands	FI	Acipenser fulvescens	Lake Sturgeon	14	51
LMF	Mille Lacs Uplands	FI	Campostoma oligolepis	Largescale Stoneroller	5	29
LMF	Mille Lacs Uplands	FI	Etheostoma microperca	Least Darter	9	9
LMF	Mille Lacs Uplands	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	18
LMF	Mille Lacs Uplands	FI	Ichthyomyzon gagei	Southern Brook Lamprey	2	94
LMF	Mille Lacs Uplands	FI	Lampetra appendix	American Brook Lamprey	7	
LMF	Mille Lacs Uplands	FI	Lepomis megalotis	Longear Sunfish	6	4
LMF	Mille Lacs Uplands	FI	Moxostoma valenciennesi	Greater Redhorse	11	94

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Mille Lacs Uplands	FI	Notropis anogenus	Pugnose Shiner	9	4
LMF	Mille Lacs Uplands	FI	Percina evides	Gilt Darter	2	143
LMF	Mille Lacs Uplands	SP	Marpissa grata	A Jumping Spider	6	
LMF	Mille Lacs Uplands	SP	Paradamoetas fontana	A Jumping Spider	5	
LMF	Mille Lacs Uplands	IN	Agapetus tomus	A Caddisfly	2	5
LMF	Mille Lacs Uplands	IN	Ceraclea brevis	A Caddisfly	1	
LMF	Mille Lacs Uplands	IN	Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	3	
LMF	Mille Lacs Uplands	IN	Cicindela patruela patruela	A Tiger Beetle	5	2
LMF	Mille Lacs Uplands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Mille Lacs Uplands	IN	Erynnis persius	Persius Duskywing	5	
LMF	Mille Lacs Uplands	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
LMF	Mille Lacs Uplands	IN	Gomphus ventricosus	Skillet Clubtail	2	
LMF	Mille Lacs Uplands	IN	Gomphus viridifrons	Green-faced Clubtail	2	
LMF	Mille Lacs Uplands	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	
LMF	Mille Lacs Uplands	IN	Hydroptila metoeca	A Caddisfly	1	
LMF	Mille Lacs Uplands	IN	Hydroptila novicola	A Caddisfly	1	
LMF	Mille Lacs Uplands	IN	Hydroptila tortosa	A Caddisfly	1	
LMF	Mille Lacs Uplands	IN	Lycaeides melissa samuelis	Karner Blue	3	
LMF	Mille Lacs Uplands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Mille Lacs Uplands	IN	Ophiogomphus howei	Pygmy Snaketail	1	
LMF	Mille Lacs Uplands	IN	Ophiogomphus susbehcha	St. Croix Snaketail	2	7
LMF	Mille Lacs Uplands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Mille Lacs Uplands	IN	Protoptila talola	A Caddisfly	1	
LMF	Mille Lacs Uplands	MO	Actinonaias ligamentina	Mucket mussel	11	38
LMF	Mille Lacs Uplands	MO	Actinonaias ligamentina	Mucket mussel	11	60
LMF	Mille Lacs Uplands	MO	Alasmidonta marginata	Elktoe	7	45
LMF	Mille Lacs Uplands	MO	Cumberlandia monodonta	Spectaclecase	3	5
LMF	Mille Lacs Uplands	MO	Cyclonaias tuberculata	Purple Wartyback	5	26
LMF	Mille Lacs Uplands	MO	Ellipsaria lineolata	Butterfly	4	6
LMF	Mille Lacs Uplands	MO	Elliptio dilatata	Spike	10	59
LMF	Mille Lacs Uplands	MO	Epioblasma triquetra	Snuffbox	3	5
LMF	Mille Lacs Uplands	MO	Fusconaia ebena	Ebonyshell	4	1
LMF	Mille Lacs Uplands	MO	Lampsilis higginsi	Higgins Eye	4	1
LMF	Mille Lacs Uplands	MO	Lasmigona compressa	Creek Heelsplitter	24	55
LMF	Mille Lacs Uplands	MO	Ligumia recta	Black Sandshell	25	76
LMF	Mille Lacs Uplands	MO	Obovaria olivaria	Hickorynut	5	26
LMF	Mille Lacs Uplands	MO	Pleurobema coccineum	Round Pigtoe	6	53
LMF	Mille Lacs Uplands	MO	Quadrula fragosa	Winged Mapleleaf	4	2
LMF	Mille Lacs Uplands	MO	Quadrula metanevra	Monkeyface	10	5
LMF	Mille Lacs Uplands	MO	Quadrula nodulata	Wartyback	5	4
LMF	Mille Lacs Uplands	MO	Simpsonaias ambigua	Salamander Mussel	4	1
LMF	Mille Lacs Uplands	MO	Tritogonia verrucosa	Pistolgrip	5	5
LMF	Nashwauk Uplands	MA	Canis lupus	Gray Wolf	14	
LMF	Nashwauk Uplands	MA	Lynx canadensis	Canada lynx	10	
LMF	Nashwauk Uplands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Nashwauk Uplands	MA	Taxidea taxus	American Badger	24	
LMF	Nashwauk Uplands	BI	Accipiter gentilis	Northern Goshawk	13	3
LMF	Nashwauk Uplands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	
LMF	Nashwauk Uplands	BI	Anas rubripes	American Black Duck	10	
LMF	Nashwauk Uplands	BI	Botaurus lentiginosus	American Bittern	21	3
LMF	Nashwauk Uplands	BI	Calidris alpina	Dunlin	24	
LMF	Nashwauk Uplands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Nashwauk Uplands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Nashwauk Uplands	BI	Catharus fuscescens	Veery	22	
LMF	Nashwauk Uplands	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Nashwauk Uplands	BI	Circus cyaneus	Northern Harrier	25	
LMF	Nashwauk Uplands	BI	Cistothorus platensis	Sedge Wren	25	
LMF	Nashwauk Uplands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
LMF	Nashwauk Uplands	BI	Contopus cooperi	Olive-sided Flycatcher	14	
LMF	Nashwauk Uplands	BI	Contopus virens	Eastern Wood-pewee	25	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Nashwauk Uplands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Nashwauk Uplands	BI	Dolichonyx oryzivorus	Bobolink	25	
LMF	Nashwauk Uplands	BI	Empidonax minimus	Least Flycatcher	25	
LMF	Nashwauk Uplands	BI	Falcipennis canadensis	Spruce Grouse	6	
LMF	Nashwauk Uplands	BI	Falco peregrinus	Peregrine Falcon	6	1
LMF	Nashwauk Uplands	BI	Gavia immer	Common Loon	18	
LMF	Nashwauk Uplands	BI	Haliaeetus leucocephalus	Bald Eagle	21	13
LMF	Nashwauk Uplands	BI	Hylocichla mustelina	Wood Thrush	20	
LMF	Nashwauk Uplands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Nashwauk Uplands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	Nashwauk Uplands	BI	Melospiza georgiana	Swamp Sparrow	25	
LMF	Nashwauk Uplands	BI	Oporornis agilis	Connecticut Warbler	14	
LMF	Nashwauk Uplands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	
LMF	Nashwauk Uplands	BI	Picoides arcticus	Black-backed Woodpecker	10	
LMF	Nashwauk Uplands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Nashwauk Uplands	BI	Podiceps grisegena	Red-necked Grebe	17	
LMF	Nashwauk Uplands	BI	Poecile hudsonica	Boreal Chickadee	10	
LMF	Nashwauk Uplands	BI	Rallus limicola	Virginia Rail	23	
LMF	Nashwauk Uplands	BI	Scolopax minor	American Woodcock	22	
LMF	Nashwauk Uplands	BI	Seiurus aurocapillus	Ovenbird	22	
LMF	Nashwauk Uplands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	
LMF	Nashwauk Uplands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Nashwauk Uplands	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Nashwauk Uplands	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Nashwauk Uplands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Nashwauk Uplands	BI	Troglodytes troglodytes	Winter Wren	18	
LMF	Nashwauk Uplands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Nashwauk Uplands	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	Nashwauk Uplands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	
LMF	Nashwauk Uplands	BI	Wilsonia canadensis	Canada Warbler	13	
LMF	Nashwauk Uplands	BI	Zonotrichia albicollis	White-throated Sparrow	15	
LMF	Nashwauk Uplands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Nashwauk Uplands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Nashwauk Uplands	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	6
LMF	Nashwauk Uplands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Nashwauk Uplands	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Nashwauk Uplands	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	
LMF	Nashwauk Uplands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Nashwauk Uplands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Nashwauk Uplands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Nashwauk Uplands	MO	Lasmigona compressa	Creek Heelsplitter	24	2
LMF	Nashwauk Uplands	MO	Ligumia recta	Black Sandshell	25	2
LMF	North Shore Highlands	MA	Canis lupus	Gray Wolf	14	3
LMF	North Shore Highlands	MA	Lynx canadensis	Canada lynx	10	
LMF	North Shore Highlands	MA	Microtus chrotorrhinus	Rock Vole	3	13
LMF	North Shore Highlands	MA	Myotis septentrionalis	Northern Myotis	5	1
LMF	North Shore Highlands	MA	Myotis septentrionalis	Northern Myotis	5	9
LMF	North Shore Highlands	MA	Phenacomys intermedius	Heather Vole	3	
LMF	North Shore Highlands	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	3
LMF	North Shore Highlands	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	1
LMF	North Shore Highlands	MA	Sorex fumeus	Smoky Shrew	3	6
LMF	North Shore Highlands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	1
LMF	North Shore Highlands	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	North Shore Highlands	MA	Taxidea taxus	American Badger	24	
LMF	North Shore Highlands	BI	Accipiter gentilis	Northern Goshawk	13	5
LMF	North Shore Highlands	BI	Aegolius funereus	Boreal Owl	4	2
LMF	North Shore Highlands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	1
LMF	North Shore Highlands	BI	Anas rubripes	American Black Duck	10	
LMF	North Shore Highlands	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	North Shore Highlands	BI	Botaurus lentiginosus	American Bittern	21	3

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	North Shore Highlands	BI	Calidris alpina	Dunlin	24	
LMF	North Shore Highlands	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	North Shore Highlands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	North Shore Highlands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	North Shore Highlands	BI	Catharus fuscescens	Veery	22	64
LMF	North Shore Highlands	BI	Chordeiles minor	Common Nighthawk	25	1
LMF	North Shore Highlands	BI	Circus cyaneus	Northern Harrier	25	1
LMF	North Shore Highlands	BI	Cistothorus palustris	Marsh Wren	20	1
LMF	North Shore Highlands	BI	Cistothorus platensis	Sedge Wren	25	1
LMF	North Shore Highlands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	3
LMF	North Shore Highlands	BI	Contopus cooperi	Olive-sided Flycatcher	14	1
LMF	North Shore Highlands	BI	Contopus virens	Eastern Wood-pewee	25	57
LMF	North Shore Highlands	BI	Dendroica caerulescens	Black-throated Blue Warbler	3	88
LMF	North Shore Highlands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	North Shore Highlands	BI	Dolichonyx oryzivorus	Bobolink	25	1
LMF	North Shore Highlands	BI	Empidonax minimus	Least Flycatcher	25	83
LMF	North Shore Highlands	BI	Falco peregrinus	Peregrine Falcon	6	17
LMF	North Shore Highlands	BI	Gavia immer	Common Loon	18	15
LMF	North Shore Highlands	BI	Haliaeetus leucocephalus	Bald Eagle	21	18
LMF	North Shore Highlands	BI	Hylocichla mustelina	Wood Thrush	20	6
LMF	North Shore Highlands	BI	Ixobrychus exilis	Least Bittern	16	
LMF	North Shore Highlands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	North Shore Highlands	BI	Limosa haemastica	Hudsonian Godwit	18	
LMF	North Shore Highlands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	North Shore Highlands	BI	Melospiza georgiana	Swamp Sparrow	25	11
LMF	North Shore Highlands	BI	Numenius phaeopus	Whimbrel	13	
LMF	North Shore Highlands	BI	Oporornis agilis	Connecticut Warbler	14	11
LMF	North Shore Highlands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	22
LMF	North Shore Highlands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	North Shore Highlands	BI	Poecile hudsonica	Boreal Chickadee	10	2
LMF	North Shore Highlands	BI	Rallus limicola	Virginia Rail	23	
LMF	North Shore Highlands	BI	Scolopax minor	American Woodcock	22	
LMF	North Shore Highlands	BI	Seiurus aurocapillus	Ovenbird	22	237
LMF	North Shore Highlands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	22
LMF	North Shore Highlands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	North Shore Highlands	BI	Sterna hirundo	Common Tern	4	2
LMF	North Shore Highlands	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	North Shore Highlands	BI	Toxostoma rufum	Brown Thrasher	25	1
LMF	North Shore Highlands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	North Shore Highlands	BI	Troglodytes troglodytes	Winter Wren	18	34
LMF	North Shore Highlands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	North Shore Highlands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	3
LMF	North Shore Highlands	BI	Wilsonia canadensis	Canada Warbler	13	46
LMF	North Shore Highlands	BI	Zonotrichia albicollis	White-throated Sparrow	15	80
LMF	North Shore Highlands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	North Shore Highlands	RE	Clemmys insculpta	Wood Turtle	11	44
LMF	North Shore Highlands	RE	Emydoidea blandingii	Blanding's Turtle	13	5
LMF	North Shore Highlands	AM	Hemidactylium scutatum	Four-toed Salamander	4	14
LMF	North Shore Highlands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	31
LMF	North Shore Highlands	FI	Coregonus hoyi	Bloater	1	1190
LMF	North Shore Highlands	FI	Coregonus kiyi	Kiyi	1	357
LMF	North Shore Highlands	FI	Coregonus zenithicus	Shortjaw Cisco	2	3
LMF	North Shore Highlands	FI	Cottus ricei	Spoonhead sculpin	2	2
LMF	North Shore Highlands	FI	Couesius plumbeus	Lake Chub	4	14
LMF	North Shore Highlands	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	
LMF	North Shore Highlands	FI	Myoxocephalus thompsoni	Deepwater Sculpin	1	1
LMF	North Shore Highlands	FI	Prosopium coulteri	pygmy whitefish	1	
LMF	North Shore Highlands	IN	Cicindela hirticollis rhodensis	A Tiger Beetle	1	
LMF	North Shore Highlands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	North Shore Highlands	IN	Erebia disa mancinus	Disa Alpine	8	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	North Shore Highlands	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	2
LMF	North Shore Highlands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	North Shore Highlands	IN	Ophiogomphus anomalis	Extra-striped Snaketail	1	2
LMF	North Shore Highlands	IN	Oxyethira itascae	A Caddisfly	6	2
LMF	North Shore Highlands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	North Shore Highlands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	North Shore Highlands	MO	Lasmigona compressa	Creek Heelsplitter	24	19
LMF	North Shore Highlands	MO	Ligumia recta	Black Sandshell	25	16
LMF	Pine Moraines & Outwash Plains	MA	Canis lupus	Gray Wolf	14	
LMF	Pine Moraines & Outwash Plains	MA	Microtus ochrogaster	Prairie Vole	12	11
LMF	Pine Moraines & Outwash Plains	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Pine Moraines & Outwash Plains	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	Pine Moraines & Outwash Plains	MA	Taxidea taxus	American Badger	24	
LMF	Pine Moraines & Outwash Plains	BI	Accipiter gentilis	Northern Goshawk	13	7
LMF	Pine Moraines & Outwash Plains	BI	Ammodramus leconteii	Le Conte's Sparrow	17	9
LMF	Pine Moraines & Outwash Plains	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	3
LMF	Pine Moraines & Outwash Plains	BI	Ammodramus savannarum	Grasshopper Sparrow	14	2
LMF	Pine Moraines & Outwash Plains	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	Pine Moraines & Outwash Plains	BI	Asio flammeus	Short-eared Owl	11	
LMF	Pine Moraines & Outwash Plains	BI	Bartramia longicauda	Upland Sandpiper	19	2
LMF	Pine Moraines & Outwash Plains	BI	Botaurus lentiginosus	American Bittern	21	12
LMF	Pine Moraines & Outwash Plains	BI	Buteo lineatus	Red-shouldered Hawk	12	117
LMF	Pine Moraines & Outwash Plains	BI	Calidris alpina	Dunlin	24	
LMF	Pine Moraines & Outwash Plains	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	Pine Moraines & Outwash Plains	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Pine Moraines & Outwash Plains	BI	Caprimulgus vociferus	Whip-poor-will	21	1
LMF	Pine Moraines & Outwash Plains	BI	Catharus fuscescens	Veery	22	86
LMF	Pine Moraines & Outwash Plains	BI	Chlidonias niger	Black Tern	18	
LMF	Pine Moraines & Outwash Plains	BI	Chordeiles minor	Common Nighthawk	25	6
LMF	Pine Moraines & Outwash Plains	BI	Circus cyaneus	Northern Harrier	25	2
LMF	Pine Moraines & Outwash Plains	BI	Cistothorus palustris	Marsh Wren	20	8
LMF	Pine Moraines & Outwash Plains	BI	Cistothorus platensis	Sedge Wren	25	30
LMF	Pine Moraines & Outwash Plains	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	10
LMF	Pine Moraines & Outwash Plains	BI	Contopus cooperi	Olive-sided Flycatcher	14	2
LMF	Pine Moraines & Outwash Plains	BI	Contopus virens	Eastern Wood-pewee	25	71
LMF	Pine Moraines & Outwash Plains	BI	Coturnicops noveboracensis	Yellow Rail	10	16
LMF	Pine Moraines & Outwash Plains	BI	Cygnus buccinator	Trumpeter Swan	14	16
LMF	Pine Moraines & Outwash Plains	BI	Dendroica cerulea	Cerulean Warbler	10	4
LMF	Pine Moraines & Outwash Plains	BI	Dolichonyx oryzivorus	Bobolink	25	4
LMF	Pine Moraines & Outwash Plains	BI	Empidonax minimus	Least Flycatcher	25	67
LMF	Pine Moraines & Outwash Plains	BI	Gavia immer	Common Loon	18	38
LMF	Pine Moraines & Outwash Plains	BI	Haliaeetus leucocephalus	Bald Eagle	21	171
LMF	Pine Moraines & Outwash Plains	BI	Hylocichla mustelina	Wood Thrush	20	7
LMF	Pine Moraines & Outwash Plains	BI	Ixobrychus exilis	Least Bittern	16	
LMF	Pine Moraines & Outwash Plains	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Pine Moraines & Outwash Plains	BI	Limosa haemastica	Hudsonian Godwit	18	
LMF	Pine Moraines & Outwash Plains	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	2
LMF	Pine Moraines & Outwash Plains	BI	Melospiza georgiana	Swamp Sparrow	25	28
LMF	Pine Moraines & Outwash Plains	BI	Numenius phaeopus	Whimbrel	13	
LMF	Pine Moraines & Outwash Plains	BI	Oporornis agilis	Connecticut Warbler	14	4
LMF	Pine Moraines & Outwash Plains	BI	Pelecanus erythrorhynchos	American White Pelican	4	4
LMF	Pine Moraines & Outwash Plains	BI	Phalaropus tricolor	Wilson's Phalarope	9	2
LMF	Pine Moraines & Outwash Plains	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	36
LMF	Pine Moraines & Outwash Plains	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Pine Moraines & Outwash Plains	BI	Podiceps grisegena	Red-necked Grebe	17	
LMF	Pine Moraines & Outwash Plains	BI	Rallus limicola	Virginia Rail	23	
LMF	Pine Moraines & Outwash Plains	BI	Recurvirostra americana	American Avocet	16	
LMF	Pine Moraines & Outwash Plains	BI	Scolopax minor	American Woodcock	22	2
LMF	Pine Moraines & Outwash Plains	BI	Seiurus aurocapillus	Ovenbird	22	95
LMF	Pine Moraines & Outwash Plains	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	27

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Pine Moraines & Outwash Plains	BI	Spizella pusilla	Field Sparrow	13	17
LMF	Pine Moraines & Outwash Plains	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	2
LMF	Pine Moraines & Outwash Plains	BI	Sterna hirundo	Common Tern	4	5
LMF	Pine Moraines & Outwash Plains	BI	Sturnella magna	Eastern Meadowlark	20	1
LMF	Pine Moraines & Outwash Plains	BI	Toxostoma rufum	Brown Thrasher	25	4
LMF	Pine Moraines & Outwash Plains	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Pine Moraines & Outwash Plains	BI	Troglodytes troglodytes	Winter Wren	18	8
LMF	Pine Moraines & Outwash Plains	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Pine Moraines & Outwash Plains	BI	Tympanuchus cupido	Greater Prairie-chicken	4	55
LMF	Pine Moraines & Outwash Plains	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	Pine Moraines & Outwash Plains	BI	Vermivora chrysoptera	Golden-winged Warbler	14	28
LMF	Pine Moraines & Outwash Plains	BI	Wilsonia canadensis	Canada Warbler	13	2
LMF	Pine Moraines & Outwash Plains	BI	Wilsonia citrina	Hooded Warbler	2	1
LMF	Pine Moraines & Outwash Plains	BI	Zonotrichia albicollis	White-throated Sparrow	15	9
LMF	Pine Moraines & Outwash Plains	RE	Chelydra serpentina	Common Snapping Turtle	25	3
LMF	Pine Moraines & Outwash Plains	RE	Emydoidea blandingii	Blanding's Turtle	13	155
LMF	Pine Moraines & Outwash Plains	RE	Heterodon platirhinos	Eastern Hognose Snake	6	16
LMF	Pine Moraines & Outwash Plains	RE	Heterodon platirhinos	Eastern Hognose Snake	6	1
LMF	Pine Moraines & Outwash Plains	RE	Liochlorophis vernalis	Smooth Green Snake	15	
LMF	Pine Moraines & Outwash Plains	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Pine Moraines & Outwash Plains	FI	Etheostoma microperca	Least Darter	9	116
LMF	Pine Moraines & Outwash Plains	FI	Lepomis megalotis	Longear Sunfish	6	26
LMF	Pine Moraines & Outwash Plains	FI	Moxostoma valenciennesi	Greater Redhorse	11	32
LMF	Pine Moraines & Outwash Plains	FI	Notropis anogenus	Pugnose Shiner	9	26
LMF	Pine Moraines & Outwash Plains	IN	Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	3	
LMF	Pine Moraines & Outwash Plains	IN	Chilostigma itascae	Headwater Chilostigman Caddisfly	1	
LMF	Pine Moraines & Outwash Plains	IN	Cicindela patruela patruela	A Tiger Beetle	5	4
LMF	Pine Moraines & Outwash Plains	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Pine Moraines & Outwash Plains	IN	Erynnis persius	Persius Duskywing	5	
LMF	Pine Moraines & Outwash Plains	IN	Euphyes bimacula illinois	Two-spotted Skipper	7	
LMF	Pine Moraines & Outwash Plains	IN	Hesperia leonardus leonardus	Leonard's Skipper	7	3
LMF	Pine Moraines & Outwash Plains	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Pine Moraines & Outwash Plains	IN	Oxyethira ecornuta	A Caddisfly	3	1
LMF	Pine Moraines & Outwash Plains	IN	Oxyethira itascae	A Caddisfly	6	
LMF	Pine Moraines & Outwash Plains	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Pine Moraines & Outwash Plains	IN	Polycentropus milaca	A Caddisfly	2	1
LMF	Pine Moraines & Outwash Plains	MO	Lasmigona compressa	Creek Heelsplitter	24	52
LMF	Pine Moraines & Outwash Plains	MO	Ligumia recta	Black Sandshell	25	35
LMF	St. Louis Moraines	MA	Canis lupus	Gray Wolf	14	
LMF	St. Louis Moraines	MA	Lynx canadensis	Canada lynx	10	
LMF	St. Louis Moraines	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	1
LMF	St. Louis Moraines	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	St. Louis Moraines	MA	Synaptomys borealis	Northern Bog Lemming	3	1
LMF	St. Louis Moraines	MA	Taxidea taxus	American Badger	24	
LMF	St. Louis Moraines	BI	Accipiter gentilis	Northern Goshawk	13	5
LMF	St. Louis Moraines	BI	Ammodramus leconteii	Le Conte's Sparrow	17	2
LMF	St. Louis Moraines	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	
LMF	St. Louis Moraines	BI	Anas rubripes	American Black Duck	10	
LMF	St. Louis Moraines	BI	Arenaria interpres	Ruddy Turnstone	20	
LMF	St. Louis Moraines	BI	Bartramia longicauda	Upland Sandpiper	19	
LMF	St. Louis Moraines	BI	Botaurus lentiginosus	American Bittern	21	10
LMF	St. Louis Moraines	BI	Buteo lineatus	Red-shouldered Hawk	12	18
LMF	St. Louis Moraines	BI	Calidris alpina	Dunlin	24	
LMF	St. Louis Moraines	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
LMF	St. Louis Moraines	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	St. Louis Moraines	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	St. Louis Moraines	BI	Catharus fuscescens	Veery	22	14
LMF	St. Louis Moraines	BI	Chlidonias niger	Black Tern	18	3
LMF	St. Louis Moraines	BI	Chordeiles minor	Common Nighthawk	25	
LMF	St. Louis Moraines	BI	Circus cyaneus	Northern Harrier	25	1

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	St. Louis Moraines	BI	Cistothorus palustris	Marsh Wren	20	2
LMF	St. Louis Moraines	BI	Cistothorus platensis	Sedge Wren	25	9
LMF	St. Louis Moraines	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
LMF	St. Louis Moraines	BI	Contopus cooperi	Olive-sided Flycatcher	14	3
LMF	St. Louis Moraines	BI	Contopus virens	Eastern Wood-pewee	25	23
LMF	St. Louis Moraines	BI	Coturnicops noveboracensis	Yellow Rail	10	
LMF	St. Louis Moraines	BI	Cygnus buccinator	Trumpeter Swan	14	
LMF	St. Louis Moraines	BI	Dolichonyx oryzivorus	Bobolink	25	4
LMF	St. Louis Moraines	BI	Empidonax minimus	Least Flycatcher	25	34
LMF	St. Louis Moraines	BI	Gavia immer	Common Loon	18	5
LMF	St. Louis Moraines	BI	Haliaeetus leucocephalus	Bald Eagle	21	91
LMF	St. Louis Moraines	BI	Hylocichla mustelina	Wood Thrush	20	16
LMF	St. Louis Moraines	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	St. Louis Moraines	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	St. Louis Moraines	BI	Melospiza georgiana	Swamp Sparrow	25	12
LMF	St. Louis Moraines	BI	Oporornis agilis	Connecticut Warbler	14	3
LMF	St. Louis Moraines	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	21
LMF	St. Louis Moraines	BI	Picoides arcticus	Black-backed Woodpecker	10	
LMF	St. Louis Moraines	BI	Pluvialis dominica	American Golden-plover	24	
LMF	St. Louis Moraines	BI	Podiceps grisegena	Red-necked Grebe	17	
LMF	St. Louis Moraines	BI	Poecile hudsonica	Boreal Chickadee	10	
LMF	St. Louis Moraines	BI	Rallus limicola	Virginia Rail	23	
LMF	St. Louis Moraines	BI	Scolopax minor	American Woodcock	22	2
LMF	St. Louis Moraines	BI	Seiurus aurocapillus	Ovenbird	22	59
LMF	St. Louis Moraines	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	28
LMF	St. Louis Moraines	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	St. Louis Moraines	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	St. Louis Moraines	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	St. Louis Moraines	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	St. Louis Moraines	BI	Troglodytes troglodytes	Winter Wren	18	7
LMF	St. Louis Moraines	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	St. Louis Moraines	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	St. Louis Moraines	BI	Vermivora chrysoptera	Golden-winged Warbler	14	4
LMF	St. Louis Moraines	BI	Wilsonia canadensis	Canada Warbler	13	3
LMF	St. Louis Moraines	BI	Zonotrichia albicollis	White-throated Sparrow	15	7
LMF	St. Louis Moraines	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	St. Louis Moraines	AM	Hemidactylium scutatum	Four-toed Salamander	4	29
LMF	St. Louis Moraines	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	St. Louis Moraines	FI	Acipenser fulvescens	Lake Sturgeon	14	
LMF	St. Louis Moraines	FI	Etheostoma microperca	Least Darter	9	30
LMF	St. Louis Moraines	FI	Ichthyomyzon fossor	Northern Brook Lamprey	8	
LMF	St. Louis Moraines	FI	Lepomis megalotis	Longear Sunfish	6	7
LMF	St. Louis Moraines	FI	Moxostoma valenciennesi	Greater Redhorse	11	1
LMF	St. Louis Moraines	FI	Notropis anogenus	Pugnose Shiner	9	2
LMF	St. Louis Moraines	SP	Marpissa grata	A Jumping Spider	6	
LMF	St. Louis Moraines	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	St. Louis Moraines	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	St. Louis Moraines	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	St. Louis Moraines	IN	Polycentropus milaca	A Caddisfly	2	1
LMF	St. Louis Moraines	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	St. Louis Moraines	MO	Lasmigona compressa	Creek Heelsplitter	24	16
LMF	St. Louis Moraines	MO	Ligumia recta	Black Sandshell	25	21
LMF	Tamarack Lowlands	MA	Canis lupus	Gray Wolf	14	
LMF	Tamarack Lowlands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Tamarack Lowlands	MA	Spilogale putorius	Eastern Spotted Skunk	19	
LMF	Tamarack Lowlands	MA	Taxidea taxus	American Badger	24	
LMF	Tamarack Lowlands	BI	Accipiter gentilis	Northern Goshawk	13	4
LMF	Tamarack Lowlands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	10
LMF	Tamarack Lowlands	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	7
LMF	Tamarack Lowlands	BI	Anas rubripes	American Black Duck	10	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Tamarack Lowlands	BI	Asio flammeus	Short-eared Owl	11	3
LMF	Tamarack Lowlands	BI	Bartramia longicauda	Upland Sandpiper	19	3
LMF	Tamarack Lowlands	BI	Botaurus lentiginosus	American Bittern	21	12
LMF	Tamarack Lowlands	BI	Calidris alpina	Dunlin	24	
LMF	Tamarack Lowlands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Tamarack Lowlands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Tamarack Lowlands	BI	Catharus fuscescens	Veery	22	20
LMF	Tamarack Lowlands	BI	Chlidonias niger	Black Tern	18	5
LMF	Tamarack Lowlands	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Tamarack Lowlands	BI	Circus cyaneus	Northern Harrier	25	4
LMF	Tamarack Lowlands	BI	Cistothorus palustris	Marsh Wren	20	5
LMF	Tamarack Lowlands	BI	Cistothorus platensis	Sedge Wren	25	30
LMF	Tamarack Lowlands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	3
LMF	Tamarack Lowlands	BI	Contopus cooperi	Olive-sided Flycatcher	14	2
LMF	Tamarack Lowlands	BI	Contopus virens	Eastern Wood-pewee	25	3
LMF	Tamarack Lowlands	BI	Coturnicops noveboracensis	Yellow Rail	10	16
LMF	Tamarack Lowlands	BI	Cygnus buccinator	Trumpeter Swan	14	3
LMF	Tamarack Lowlands	BI	Dendroica tigrina	Cape May Warbler	10	1
LMF	Tamarack Lowlands	BI	Dolichonyx oryzivorus	Bobolink	25	8
LMF	Tamarack Lowlands	BI	Empidonax minimus	Least Flycatcher	25	6
LMF	Tamarack Lowlands	BI	Gavia immer	Common Loon	18	1
LMF	Tamarack Lowlands	BI	Haliaeetus leucocephalus	Bald Eagle	21	23
LMF	Tamarack Lowlands	BI	Hylocichla mustelina	Wood Thrush	20	3
LMF	Tamarack Lowlands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
LMF	Tamarack Lowlands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
LMF	Tamarack Lowlands	BI	Melospiza georgiana	Swamp Sparrow	25	21
LMF	Tamarack Lowlands	BI	Oporornis agilis	Connecticut Warbler	14	7
LMF	Tamarack Lowlands	BI	Phalaropus tricolor	Wilson's Phalarope	9	1
LMF	Tamarack Lowlands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	12
LMF	Tamarack Lowlands	BI	Picoides arcticus	Black-backed Woodpecker	10	1
LMF	Tamarack Lowlands	BI	Pluvialis dominica	American Golden-plover	24	
LMF	Tamarack Lowlands	BI	Podiceps grisegena	Red-necked Grebe	17	
LMF	Tamarack Lowlands	BI	Poecile hudsonica	Boreal Chickadee	10	1
LMF	Tamarack Lowlands	BI	Rallus limicola	Virginia Rail	23	
LMF	Tamarack Lowlands	BI	Scolopax minor	American Woodcock	22	2
LMF	Tamarack Lowlands	BI	Seiurus aurocapillus	Ovenbird	22	10
LMF	Tamarack Lowlands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	5
LMF	Tamarack Lowlands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Tamarack Lowlands	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Tamarack Lowlands	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Tamarack Lowlands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Tamarack Lowlands	BI	Troglodytes troglodytes	Winter Wren	18	4
LMF	Tamarack Lowlands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
LMF	Tamarack Lowlands	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	
LMF	Tamarack Lowlands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	13
LMF	Tamarack Lowlands	BI	Wilsonia canadensis	Canada Warbler	13	3
LMF	Tamarack Lowlands	BI	Zonotrichia albicollis	White-throated Sparrow	15	7
LMF	Tamarack Lowlands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Tamarack Lowlands	RE	Clemmys insculpta	Wood Turtle	11	38
LMF	Tamarack Lowlands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Tamarack Lowlands	FI	Acipenser fulvescens	Lake Sturgeon	14	2
LMF	Tamarack Lowlands	FI	Couesius plumbeus	Lake Chub	4	3
LMF	Tamarack Lowlands	FI	Moxostoma valenciennesi	Greater Redhorse	11	1
LMF	Tamarack Lowlands	SP	Marpissa grata	A Jumping Spider	6	
LMF	Tamarack Lowlands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Tamarack Lowlands	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Tamarack Lowlands	IN	Oeneis macounii	Macoun's Arctic	11	
LMF	Tamarack Lowlands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Tamarack Lowlands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Tamarack Lowlands	MO	Lasmigona compressa	Creek Heelsplitter	24	7

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
LMF	Tamarack Lowlands	MO	Ligumia recta	Black Sandshell	25	45
LMF	Toimi Uplands	MA	Canis lupus	Gray Wolf	14	
LMF	Toimi Uplands	MA	Lynx canadensis	Canada lynx	10	
LMF	Toimi Uplands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
LMF	Toimi Uplands	MA	Taxidea taxus	American Badger	24	
LMF	Toimi Uplands	BI	Accipiter gentilis	Northern Goshawk	13	3
LMF	Toimi Uplands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	
LMF	Toimi Uplands	BI	Anas rubripes	American Black Duck	10	
LMF	Toimi Uplands	BI	Botaurus lentiginosus	American Bittern	21	
LMF	Toimi Uplands	BI	Calidris alpina	Dunlin	24	
LMF	Toimi Uplands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
LMF	Toimi Uplands	BI	Caprimulgus vociferus	Whip-poor-will	21	
LMF	Toimi Uplands	BI	Catharus fuscescens	Veery	22	
LMF	Toimi Uplands	BI	Chordeiles minor	Common Nighthawk	25	
LMF	Toimi Uplands	BI	Circus cyaneus	Northern Harrier	25	
LMF	Toimi Uplands	BI	Cistothorus platensis	Sedge Wren	25	
LMF	Toimi Uplands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
LMF	Toimi Uplands	BI	Contopus cooperi	Olive-sided Flycatcher	14	
LMF	Toimi Uplands	BI	Contopus virens	Eastern Wood-pewee	25	
LMF	Toimi Uplands	BI	Dendroica tigrina	Cape May Warbler	10	
LMF	Toimi Uplands	BI	Dolichonyx oryzivorus	Bobolink	25	
LMF	Toimi Uplands	BI	Empidonax minimus	Least Flycatcher	25	
LMF	Toimi Uplands	BI	Gavia immer	Common Loon	18	
LMF	Toimi Uplands	BI	Haliaeetus leucocephalus	Bald Eagle	21	3
LMF	Toimi Uplands	BI	Hylocichla mustelina	Wood Thrush	20	
LMF	Toimi Uplands	BI	Melospiza georgiana	Swamp Sparrow	25	
LMF	Toimi Uplands	BI	Oporornis agilis	Connecticut Warbler	14	
LMF	Toimi Uplands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	
LMF	Toimi Uplands	BI	Picoides arcticus	Black-backed Woodpecker	10	
LMF	Toimi Uplands	BI	Poecile hudsonica	Boreal Chickadee	10	
LMF	Toimi Uplands	BI	Rallus limicola	Virginia Rail	23	
LMF	Toimi Uplands	BI	Scolopax minor	American Woodcock	22	
LMF	Toimi Uplands	BI	Seiurus aurocapillus	Ovenbird	22	
LMF	Toimi Uplands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	
LMF	Toimi Uplands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
LMF	Toimi Uplands	BI	Sturnella magna	Eastern Meadowlark	20	
LMF	Toimi Uplands	BI	Toxostoma rufum	Brown Thrasher	25	
LMF	Toimi Uplands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
LMF	Toimi Uplands	BI	Troglodytes troglodytes	Winter Wren	18	
LMF	Toimi Uplands	BI	Vermivora chrysoptera	Golden-winged Warbler	14	
LMF	Toimi Uplands	BI	Wilsonia canadensis	Canada Warbler	13	
LMF	Toimi Uplands	BI	Zonotrichia albicollis	White-throated Sparrow	15	
LMF	Toimi Uplands	RE	Chelydra serpentina	Common Snapping Turtle	25	
LMF	Toimi Uplands	RE	Clemmys insculpta	Wood Turtle	11	11
LMF	Toimi Uplands	AM	Plethodon cinereus	Eastern Red-backed Salamander	13	
LMF	Toimi Uplands	FI	Couesius plumbeus	Lake Chub	4	
LMF	Toimi Uplands	IN	Epidemia epixanthe michiganensis	Bog Copper	13	
LMF	Toimi Uplands	IN	Erebia disa mancinus	Disa Alpine	8	
LMF	Toimi Uplands	IN	Lycaeides idas nabokovi	Nabokov's Blue	7	
LMF	Toimi Uplands	IN	Phyciodes batesii	Tawny Crescent	12	
LMF	Toimi Uplands	IN	Pyrgus centaureae freija	Grizzled Skipper	9	
LMF	Toimi Uplands	MO	Lasmigona compressa	Creek Heelsplitter	24	4
LMF	Toimi Uplands	MO	Ligumia recta	Black Sandshell	25	6
PPK	Coteau Moraines	MA	Microtus ochrogaster	Prairie Vole	12	13
PPK	Coteau Moraines	MA	Mustela nivalis	Least Weasel	12	
PPK	Coteau Moraines	MA	Onychomys leucogaster	Northern Grasshopper Mouse	4	
PPK	Coteau Moraines	MA	Perognathus flavescens	Plains Pocket Mouse	5	
PPK	Coteau Moraines	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	
PPK	Coteau Moraines	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
PPK	Coteau Moraines	MA	Spermophilus richardsonii	Richardson's Ground Squirrel	4	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
PPK	Coteau Moraines	MA	Spilogale putorius	Eastern Spotted Skunk	19	
PPK	Coteau Moraines	MA	Taxidea taxus	American Badger	24	
PPK	Coteau Moraines	BI	Aechmophorus occidentalis	Western Grebe	5	
PPK	Coteau Moraines	BI	Ammodramus savannarum	Grasshopper Sparrow	14	5
PPK	Coteau Moraines	BI	Anas acuta	Northern Pintail	9	
PPK	Coteau Moraines	BI	Arenaria interpres	Ruddy Turnstone	20	
PPK	Coteau Moraines	BI	Asio flammeus	Short-eared Owl	11	1
PPK	Coteau Moraines	BI	Bartramia longicauda	Upland Sandpiper	19	18
PPK	Coteau Moraines	BI	Botaurus lentiginosus	American Bittern	21	3
PPK	Coteau Moraines	BI	Buteo swainsoni	Swainson's Hawk	6	
PPK	Coteau Moraines	BI	Calidris alpina	Dunlin	24	
PPK	Coteau Moraines	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
PPK	Coteau Moraines	BI	Calidris pusilla	Semipalmated Sandpiper	25	
PPK	Coteau Moraines	BI	Chlidonias niger	Black Tern	18	
PPK	Coteau Moraines	BI	Chordeiles minor	Common Nighthawk	25	
PPK	Coteau Moraines	BI	Circus cyaneus	Northern Harrier	25	
PPK	Coteau Moraines	BI	Cistothorus palustris	Marsh Wren	20	1
PPK	Coteau Moraines	BI	Cistothorus platensis	Sedge Wren	25	3
PPK	Coteau Moraines	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	1
PPK	Coteau Moraines	BI	Contopus virens	Eastern Wood-pewee	25	1
PPK	Coteau Moraines	BI	Dolichonyx oryzivorus	Bobolink	25	5
PPK	Coteau Moraines	BI	Empidonax minimus	Least Flycatcher	25	2
PPK	Coteau Moraines	BI	Empidonax traillii	Willow Flycatcher	13	4
PPK	Coteau Moraines	BI	Ixobrychus exilis	Least Bittern	16	
PPK	Coteau Moraines	BI	Lanius ludovicianus	Loggerhead Shrike	10	1
PPK	Coteau Moraines	BI	Larus pipixcan	Franklin's Gull	3	
PPK	Coteau Moraines	BI	Limnodromus griseus	Short-billed Dowitcher	22	
PPK	Coteau Moraines	BI	Limosa haemastica	Hudsonian Godwit	18	
PPK	Coteau Moraines	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
PPK	Coteau Moraines	BI	Melospiza georgiana	Swamp Sparrow	25	1
PPK	Coteau Moraines	BI	Numenius phaeopus	Whimbrel	13	
PPK	Coteau Moraines	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	
PPK	Coteau Moraines	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	1
PPK	Coteau Moraines	BI	Pluvialis dominica	American Golden-plover	24	
PPK	Coteau Moraines	BI	Podiceps nigricollis	Eared Grebe	9	
PPK	Coteau Moraines	BI	Rallus elegans	King Rail	2	
PPK	Coteau Moraines	BI	Rallus limicola	Virginia Rail	23	
PPK	Coteau Moraines	BI	Recurvirostra americana	American Avocet	16	
PPK	Coteau Moraines	BI	Speotyto cunicularia	Burrowing Owl	4	1
PPK	Coteau Moraines	BI	Spiza americana	Dickcissel	11	2
PPK	Coteau Moraines	BI	Spizella pusilla	Field Sparrow	13	1
PPK	Coteau Moraines	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	1
PPK	Coteau Moraines	BI	Sterna forsteri	Forster's Tern	11	1
PPK	Coteau Moraines	BI	Toxostoma rufum	Brown Thrasher	25	1
PPK	Coteau Moraines	BI	Tringa melanoleuca	Greater Yellowlegs	25	
PPK	Coteau Moraines	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
PPK	Coteau Moraines	RE	Chelydra serpentina	Common Snapping Turtle	25	
PPK	Coteau Moraines	RE	Elaphe vulpina	Eastern Fox Snake	9	
PPK	Coteau Moraines	RE	Emydoidea blandingii	Blanding's Turtle	13	
PPK	Coteau Moraines	RE	Liochlorophis vernalis	Smooth Green Snake	15	
PPK	Coteau Moraines	AM	Necturus maculosus	Common Mudpuppy	14	
PPK	Coteau Moraines	FI	Cyprinella lutrensis	Red Shiner	2	2
PPK	Coteau Moraines	FI	Fundulus sciadicus	Plains Topminnow	2	
PPK	Coteau Moraines	FI	Notropis topeka	Topeka Shiner	2	9
PPK	Coteau Moraines	SP	Phidippus pius	A Jumping Spider	4	
PPK	Coteau Moraines	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	1
PPK	Coteau Moraines	IN	Atrytone arogos	Arogos Skipper	9	4
PPK	Coteau Moraines	IN	Hesperia dacotae	Dakota Skipper	5	1
PPK	Coteau Moraines	IN	Hesperia leonardus pawnee	Pawnee Skipper	4	2
PPK	Coteau Moraines	IN	Hesperia ottoe	Ottoe Skipper	6	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
PPK	Coteau Moraines	IN	Oarisma powesheik	Powesheik Skipper	6	17
PPK	Coteau Moraines	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
PPK	Coteau Moraines	IN	Schinia indiana	Phlox Moth	5	
PPK	Coteau Moraines	IN	Speyeria idalia	Regal Fritillary	11	11
PPK	Coteau Moraines	MO	Actinonaias ligamentina	Mucket mussel	11	7
PPK	Coteau Moraines	MO	Elliptio dilatata	Spike	10	11
PPK	Coteau Moraines	MO	Lasmigona compressa	Creek Heelsplitter	24	4
PPK	Coteau Moraines	MO	Lasmigona costata	Fluted-shell	12	
PPK	Coteau Moraines	MO	Ligumia recta	Black Sandshell	25	2
PPK	Coteau Moraines	MO	Quadrula metanevra	Monkeyface	10	1
PPK	Coteau Moraines	MO	Venustaconcha ellipsiformis	Ellipse	8	
PPK	Inner Coteau	MA	Cryptotis parva	Least Shrew	2	
PPK	Inner Coteau	MA	Microtus ochrogaster	Prairie Vole	12	1
PPK	Inner Coteau	MA	Mustela nivalis	Least Weasel	12	
PPK	Inner Coteau	MA	Onychomys leucogaster	Northern Grasshopper Mouse	4	
PPK	Inner Coteau	MA	Perognathus flavescens	Plains Pocket Mouse	5	
PPK	Inner Coteau	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	1
PPK	Inner Coteau	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
PPK	Inner Coteau	MA	Spermophilus richardsonii	Richardson's Ground Squirrel	4	
PPK	Inner Coteau	MA	Spilogale putorius	Eastern Spotted Skunk	19	
PPK	Inner Coteau	MA	Taxidea taxus	American Badger	24	
PPK	Inner Coteau	BI	Ammodramus savannarum	Grasshopper Sparrow	14	
PPK	Inner Coteau	BI	Anas acuta	Northern Pintail	9	
PPK	Inner Coteau	BI	Arenaria interpres	Ruddy Turnstone	20	
PPK	Inner Coteau	BI	Asio flammeus	Short-eared Owl	11	
PPK	Inner Coteau	BI	Bartramia longicauda	Upland Sandpiper	19	7
PPK	Inner Coteau	BI	Buteo swainsoni	Swainson's Hawk	6	
PPK	Inner Coteau	BI	Calidris alpina	Dunlin	24	
PPK	Inner Coteau	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
PPK	Inner Coteau	BI	Calidris pusilla	Semipalmated Sandpiper	25	
PPK	Inner Coteau	BI	Chlidonias niger	Black Tern	18	
PPK	Inner Coteau	BI	Chordeiles minor	Common Nighthawk	25	
PPK	Inner Coteau	BI	Circus cyaneus	Northern Harrier	25	
PPK	Inner Coteau	BI	Cistothorus palustris	Marsh Wren	20	
PPK	Inner Coteau	BI	Cistothorus platensis	Sedge Wren	25	
PPK	Inner Coteau	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	
PPK	Inner Coteau	BI	Contopus virens	Eastern Wood-pewee	25	
PPK	Inner Coteau	BI	Dolichonyx oryzivorus	Bobolink	25	
PPK	Inner Coteau	BI	Empidonax minimus	Least Flycatcher	25	
PPK	Inner Coteau	BI	Empidonax traillii	Willow Flycatcher	13	
PPK	Inner Coteau	BI	Ixobrychus exilis	Least Bittern	16	
PPK	Inner Coteau	BI	Lanius ludovicianus	Loggerhead Shrike	10	2
PPK	Inner Coteau	BI	Limnodromus griseus	Short-billed Dowitcher	22	
PPK	Inner Coteau	BI	Limosa haemastica	Hudsonian Godwit	18	
PPK	Inner Coteau	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
PPK	Inner Coteau	BI	Melospiza georgiana	Swamp Sparrow	25	
PPK	Inner Coteau	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	
PPK	Inner Coteau	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	
PPK	Inner Coteau	BI	Pluvialis dominica	American Golden-plover	24	
PPK	Inner Coteau	BI	Podiceps nigricollis	Eared Grebe	9	
PPK	Inner Coteau	BI	Rallus limicola	Virginia Rail	23	
PPK	Inner Coteau	BI	Recurvirostra americana	American Avocet	16	
PPK	Inner Coteau	BI	Speotyto cunicularia	Burrowing Owl	4	3
PPK	Inner Coteau	BI	Spiza americana	Dickcissel	11	
PPK	Inner Coteau	BI	Spizella pusilla	Field Sparrow	13	
PPK	Inner Coteau	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	
PPK	Inner Coteau	BI	Sterna forsteri	Forster's Tern	11	
PPK	Inner Coteau	BI	Toxostoma rufum	Brown Thrasher	25	
PPK	Inner Coteau	BI	Tringa melanoleuca	Greater Yellowlegs	25	
PPK	Inner Coteau	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
PPK	Inner Coteau	RE	Chelydra serpentina	Common Snapping Turtle	25	
PPK	Inner Coteau	RE	Elaphe vulpina	Eastern Fox Snake	9	
PPK	Inner Coteau	RE	Emydoidea blandingii	Blanding's Turtle	13	6
PPK	Inner Coteau	RE	Liochlorophis vernalis	Smooth Green Snake	15	
PPK	Inner Coteau	RE	Tropidoclonion lineatum	Lined Snake	1	1
PPK	Inner Coteau	AM	Acris crepitans	Northern Cricket Frog	6	
PPK	Inner Coteau	AM	Necturus maculosus	Common Mudpuppy	14	
PPK	Inner Coteau	FI	Cyprinella lutrensis	Red Shiner	2	24
PPK	Inner Coteau	FI	Fundulus sciadicus	Plains Topminnow	2	32
PPK	Inner Coteau	FI	Notropis topeka	Topeka Shiner	2	294
PPK	Inner Coteau	SP	Habronattus texanus	A Jumping Spider	2	
PPK	Inner Coteau	SP	Phidippus pius	A Jumping Spider	4	
PPK	Inner Coteau	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	
PPK	Inner Coteau	IN	Atrytone arogos	Arogos Skipper	9	3
PPK	Inner Coteau	IN	Hesperia dacotae	Dakota Skipper	5	3
PPK	Inner Coteau	IN	Hesperia leonardus pawnee	Pawnee Skipper	4	3
PPK	Inner Coteau	IN	Hesperia ottoe	Ottoe Skipper	6	3
PPK	Inner Coteau	IN	Hesperia uncas	Uncas Skipper	2	
PPK	Inner Coteau	IN	Oarisma powesheik	Powesheik Skipper	6	11
PPK	Inner Coteau	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
PPK	Inner Coteau	IN	Schinia indiana	Phlox Moth	5	
PPK	Inner Coteau	IN	Speyeria idalia	Regal Fritillary	11	22
PPK	Inner Coteau	MO	Actinonaias ligamentina	Mucket mussel	11	
PPK	Inner Coteau	MO	Elliptio dilatata	Spike	10	
PPK	Inner Coteau	MO	Lasmigona compressa	Creek Heelsplitter	24	3
PPK	Inner Coteau	MO	Lasmigona costata	Fluted-shell	12	
PPK	Inner Coteau	MO	Ligumia recta	Black Sandshell	25	
PPK	Inner Coteau	MO	Quadrula metanevra	Monkeyface	10	
PPK	Inner Coteau	MO	Venustaconcha ellipsiformis	Ellipse	8	
PPK	Minnesota River Prairie	MA	Microtus ochrogaster	Prairie Vole	12	19
PPK	Minnesota River Prairie	MA	Mustela nivalis	Least Weasel	12	
PPK	Minnesota River Prairie	MA	Onychomys leucogaster	Northern Grasshopper Mouse	4	3
PPK	Minnesota River Prairie	MA	Perognathus flavescens	Plains Pocket Mouse	5	
PPK	Minnesota River Prairie	MA	Pipistrellus subflavus	Eastern Pipistrelle	7	
PPK	Minnesota River Prairie	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	26
PPK	Minnesota River Prairie	MA	Reithrodontomys megalotis	Western Harvest Mouse	10	6
PPK	Minnesota River Prairie	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	1
PPK	Minnesota River Prairie	MA	Spermophilus richardsonii	Richardson's Ground Squirrel	4	4
PPK	Minnesota River Prairie	MA	Spilogale putorius	Eastern Spotted Skunk	19	2
PPK	Minnesota River Prairie	MA	Taxidea taxus	American Badger	24	1
PPK	Minnesota River Prairie	BI	Aechmophorus occidentalis	Western Grebe	5	6
PPK	Minnesota River Prairie	BI	Ammodramus henslowii	Henslow's Sparrow	7	11
PPK	Minnesota River Prairie	BI	Ammodramus savannarum	Grasshopper Sparrow	14	93
PPK	Minnesota River Prairie	BI	Anas acuta	Northern Pintail	9	5
PPK	Minnesota River Prairie	BI	Arenaria interpres	Ruddy Turnstone	20	
PPK	Minnesota River Prairie	BI	Asio flammeus	Short-eared Owl	11	2
PPK	Minnesota River Prairie	BI	Bartramia longicauda	Upland Sandpiper	19	84
PPK	Minnesota River Prairie	BI	Botaurus lentiginosus	American Bittern	21	17
PPK	Minnesota River Prairie	BI	Buteo swainsoni	Swainson's Hawk	6	
PPK	Minnesota River Prairie	BI	Calidris alpina	Dunlin	24	
PPK	Minnesota River Prairie	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
PPK	Minnesota River Prairie	BI	Calidris pusilla	Semipalmated Sandpiper	25	
PPK	Minnesota River Prairie	BI	Caprimulgus vociferus	Whip-poor-will	21	1
PPK	Minnesota River Prairie	BI	Catharus fuscescens	Veery	22	26
PPK	Minnesota River Prairie	BI	Chlidonias niger	Black Tern	18	63
PPK	Minnesota River Prairie	BI	Chordeiles minor	Common Nighthawk	25	5
PPK	Minnesota River Prairie	BI	Circus cyaneus	Northern Harrier	25	17
PPK	Minnesota River Prairie	BI	Cistothorus palustris	Marsh Wren	20	113
PPK	Minnesota River Prairie	BI	Cistothorus platensis	Sedge Wren	25	158
PPK	Minnesota River Prairie	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	19

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
PPK	Minnesota River Prairie	BI	Contopus virens	Eastern Wood-pewee	25	112
PPK	Minnesota River Prairie	BI	Cygnus buccinator	Trumpeter Swan	14	2
PPK	Minnesota River Prairie	BI	Dendroica cerulea	Cerulean Warbler	10	24
PPK	Minnesota River Prairie	BI	Dolichonyx oryzivorus	Bobolink	25	217
PPK	Minnesota River Prairie	BI	Empidonax minimus	Least Flycatcher	25	52
PPK	Minnesota River Prairie	BI	Empidonax traillii	Willow Flycatcher	13	70
PPK	Minnesota River Prairie	BI	Empidonax virescens	Acadian Flycatcher	6	6
PPK	Minnesota River Prairie	BI	Gallinula chloropus	Common Moorhen	7	3
PPK	Minnesota River Prairie	BI	Gavia immer	Common Loon	18	24
PPK	Minnesota River Prairie	BI	Haliaeetus leucocephalus	Bald Eagle	21	54
PPK	Minnesota River Prairie	BI	Hylocichla mustelina	Wood Thrush	20	30
PPK	Minnesota River Prairie	BI	Ixobrychus exilis	Least Bittern	16	3
PPK	Minnesota River Prairie	BI	Lanius ludovicianus	Loggerhead Shrike	10	18
PPK	Minnesota River Prairie	BI	Limnodromus griseus	Short-billed Dowitcher	22	
PPK	Minnesota River Prairie	BI	Limosa fedoa	Marbled Godwit	4	33
PPK	Minnesota River Prairie	BI	Limosa haemastica	Hudsonian Godwit	18	
PPK	Minnesota River Prairie	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	12
PPK	Minnesota River Prairie	BI	Melospiza georgiana	Swamp Sparrow	25	142
PPK	Minnesota River Prairie	BI	Numenius phaeopus	Whimbrel	13	
PPK	Minnesota River Prairie	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	16
PPK	Minnesota River Prairie	BI	Pelecanus erythrorhynchos	American White Pelican	4	52
PPK	Minnesota River Prairie	BI	Phalaropus tricolor	Wilson's Phalarope	9	7
PPK	Minnesota River Prairie	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	87
PPK	Minnesota River Prairie	BI	Pluvialis dominica	American Golden-plover	24	
PPK	Minnesota River Prairie	BI	Podiceps grisegena	Red-necked Grebe	17	12
PPK	Minnesota River Prairie	BI	Podiceps nigricollis	Eared Grebe	9	3
PPK	Minnesota River Prairie	BI	Protonotaria citrea	Prothonotary Warbler	6	3
PPK	Minnesota River Prairie	BI	Rallus limicola	Virginia Rail	23	10
PPK	Minnesota River Prairie	BI	Recurvirostra americana	American Avocet	16	
PPK	Minnesota River Prairie	BI	Scolopax minor	American Woodcock	22	
PPK	Minnesota River Prairie	BI	Seiurus aurocapillus	Ovenbird	22	92
PPK	Minnesota River Prairie	BI	Speotyto cunicularia	Burrowing Owl	4	1
PPK	Minnesota River Prairie	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	41
PPK	Minnesota River Prairie	BI	Spiza americana	Dickcissel	11	37
PPK	Minnesota River Prairie	BI	Spizella pusilla	Field Sparrow	13	86
PPK	Minnesota River Prairie	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	15
PPK	Minnesota River Prairie	BI	Sterna forsteri	Forster's Tern	11	17
PPK	Minnesota River Prairie	BI	Sturnella magna	Eastern Meadowlark	20	5
PPK	Minnesota River Prairie	BI	Toxostoma rufum	Brown Thrasher	25	38
PPK	Minnesota River Prairie	BI	Tringa melanoleuca	Greater Yellowlegs	25	
PPK	Minnesota River Prairie	BI	Troglodytes troglodytes	Winter Wren	18	2
PPK	Minnesota River Prairie	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
PPK	Minnesota River Prairie	BI	Tympanuchus cupido	Greater Prairie-chicken	4	9
PPK	Minnesota River Prairie	BI	Vermivora pinus	Blue-winged Warbler	6	6
PPK	Minnesota River Prairie	BI	Vireo bellii	Bell's Vireo	6	
PPK	Minnesota River Prairie	RE	Chelydra serpentina	Common Snapping Turtle	25	
PPK	Minnesota River Prairie	RE	Elaphe vulpina	Eastern Fox Snake	9	31
PPK	Minnesota River Prairie	RE	Emydoidea blandingii	Blanding's Turtle	13	10
PPK	Minnesota River Prairie	RE	Eumeces fasciatus	Five-lined Skink	3	3
PPK	Minnesota River Prairie	RE	Heterodon nasicus	Western Hognose Snake	9	6
PPK	Minnesota River Prairie	RE	Lampropeltis triangulum	Milk Snake	6	4
PPK	Minnesota River Prairie	RE	Liochlorophis vernalis	Smooth Green Snake	15	
PPK	Minnesota River Prairie	RE	Pituophis catenifer	Gopher Snake	7	2
PPK	Minnesota River Prairie	AM	Necturus maculosus	Common Mudpuppy	14	
PPK	Minnesota River Prairie	FI	Acipenser fulvescens	Lake Sturgeon	14	3
PPK	Minnesota River Prairie	FI	Alosa chrysochloris	Skipjack Herring	4	
PPK	Minnesota River Prairie	FI	Campostoma oligolepis	Largescale Stoneroller	5	9
PPK	Minnesota River Prairie	FI	Etheostoma microperca	Least Darter	9	11
PPK	Minnesota River Prairie	FI	Lampetra appendix	American Brook Lamprey	7	
PPK	Minnesota River Prairie	FI	Notropis anogenus	Pugnose Shiner	9	19

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
PPK	Minnesota River Prairie	SP	Marpissa grata	A Jumping Spider	6	1
PPK	Minnesota River Prairie	SP	Paradamoetas fontana	A Jumping Spider	5	1
PPK	Minnesota River Prairie	SP	Phidippus pius	A Jumping Spider	4	
PPK	Minnesota River Prairie	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	4
PPK	Minnesota River Prairie	IN	Atrytone arogos	Arogos Skipper	9	7
PPK	Minnesota River Prairie	IN	Cicindela fulgida fulgida	A Tiger Beetle	1	
PPK	Minnesota River Prairie	IN	Cicindela lepida	Little White Tiger Beetle	2	
PPK	Minnesota River Prairie	IN	Hesperia dacotae	Dakota Skipper	5	30
PPK	Minnesota River Prairie	IN	Hesperia leonardus pawnee	Pawnee Skipper	4	19
PPK	Minnesota River Prairie	IN	Hesperia ottoe	Ottoe Skipper	6	
PPK	Minnesota River Prairie	IN	Oarisma powesheik	Powesheik Skipper	6	57
PPK	Minnesota River Prairie	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
PPK	Minnesota River Prairie	IN	Schinia indiana	Phlox Moth	5	
PPK	Minnesota River Prairie	IN	Speyeria idalia	Regal Fritillary	11	85
PPK	Minnesota River Prairie	MO	Actinonaias ligamentina	Mucket mussel	11	35
PPK	Minnesota River Prairie	MO	Actinonaias ligamentina	Mucket mussel	11	37
PPK	Minnesota River Prairie	MO	Alasmidonta marginata	Elktoe	7	32
PPK	Minnesota River Prairie	MO	Elliptio dilatata	Spike	10	24
PPK	Minnesota River Prairie	MO	Lasmigona compressa	Creek Heelsplitter	24	66
PPK	Minnesota River Prairie	MO	Lasmigona costata	Fluted-shell	12	26
PPK	Minnesota River Prairie	MO	Ligumia recta	Black Sandshell	25	68
PPK	Minnesota River Prairie	MO	Obovaria olivaria	Hickorynut	5	4
PPK	Minnesota River Prairie	MO	Quadrula metanevra	Monkeyface	10	3
PPK	Minnesota River Prairie	MO	Simpsonaias ambigua	Salamander Mussel	4	3
PPK	Minnesota River Prairie	MO	Tritogonia verrucosa	Pistolgrip	5	3
PPK	Minnesota River Prairie	MO	Truncilla donaciformis	Fawnsfoot	5	1
PPK	Minnesota River Prairie	MO	Venustaconcha ellipsiformis	Ellipse	8	4
PPK	Red River Prairie	MA	Microtus ochrogaster	Prairie Vole	12	5
PPK	Red River Prairie	MA	Mustela nivalis	Least Weasel	12	
PPK	Red River Prairie	MA	Onychomys leucogaster	Northern Grasshopper Mouse	4	5
PPK	Red River Prairie	MA	Perognathus flavescens	Plains Pocket Mouse	5	1
PPK	Red River Prairie	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
PPK	Red River Prairie	MA	Spermophilus richardsonii	Richardson's Ground Squirrel	4	1
PPK	Red River Prairie	MA	Spilogale putorius	Eastern Spotted Skunk	19	
PPK	Red River Prairie	MA	Taxidea taxus	American Badger	24	
PPK	Red River Prairie	MA	Thomomys talpoides	Northern Pocket Gopher	2	4
PPK	Red River Prairie	BI	Ammodramus bairdii	Baird's Sparrow	2	2
PPK	Red River Prairie	BI	Ammodramus henslowii	Henslow's Sparrow	7	3
PPK	Red River Prairie	BI	Ammodramus leconteii	Le Conte's Sparrow	17	30
PPK	Red River Prairie	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	8
PPK	Red River Prairie	BI	Ammodramus savannarum	Grasshopper Sparrow	14	1
PPK	Red River Prairie	BI	Anas acuta	Northern Pintail	9	2
PPK	Red River Prairie	BI	Anthus spragueii	Sprague's Pipit	2	
PPK	Red River Prairie	BI	Arenaria interpres	Ruddy Turnstone	20	
PPK	Red River Prairie	BI	Asio flammeus	Short-eared Owl	11	1
PPK	Red River Prairie	BI	Aythya affinis	Lesser Scaup	3	
PPK	Red River Prairie	BI	Bartramia longicauda	Upland Sandpiper	19	42
PPK	Red River Prairie	BI	Botaurus lentiginosus	American Bittern	21	19
PPK	Red River Prairie	BI	Buteo swainsoni	Swainson's Hawk	6	
PPK	Red River Prairie	BI	Calcarius ornatus	Chestnut-collared Longspur	1	1
PPK	Red River Prairie	BI	Calidris alpina	Dunlin	24	
PPK	Red River Prairie	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
PPK	Red River Prairie	BI	Calidris pusilla	Semipalmated Sandpiper	25	
PPK	Red River Prairie	BI	Chlidonias niger	Black Tern	18	13
PPK	Red River Prairie	BI	Chordeiles minor	Common Nighthawk	25	
PPK	Red River Prairie	BI	Circus cyaneus	Northern Harrier	25	8
PPK	Red River Prairie	BI	Cistothorus palustris	Marsh Wren	20	44
PPK	Red River Prairie	BI	Cistothorus platensis	Sedge Wren	25	48
PPK	Red River Prairie	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	3
PPK	Red River Prairie	BI	Contopus virens	Eastern Wood-pewee	25	3

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
PPK	Red River Prairie	BI	Coturnicops noveboracensis	Yellow Rail	10	9
PPK	Red River Prairie	BI	Cygnus buccinator	Trumpeter Swan	14	5
PPK	Red River Prairie	BI	Dolichonyx oryzivorus	Bobolink	25	60
PPK	Red River Prairie	BI	Empidonax minimus	Least Flycatcher	25	12
PPK	Red River Prairie	BI	Empidonax traillii	Willow Flycatcher	13	13
PPK	Red River Prairie	BI	Haliaeetus leucocephalus	Bald Eagle	21	11
PPK	Red River Prairie	BI	Lanius ludovicianus	Loggerhead Shrike	10	12
PPK	Red River Prairie	BI	Limnodromus griseus	Short-billed Dowitcher	22	
PPK	Red River Prairie	BI	Limosa fedoa	Marbled Godwit	4	35
PPK	Red River Prairie	BI	Limosa haemastica	Hudsonian Godwit	18	
PPK	Red River Prairie	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	
PPK	Red River Prairie	BI	Melospiza georgiana	Swamp Sparrow	25	42
PPK	Red River Prairie	BI	Numenius phaeopus	Whimbrel	13	
PPK	Red River Prairie	BI	Phalaropus tricolor	Wilson's Phalarope	9	9
PPK	Red River Prairie	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	4
PPK	Red River Prairie	BI	Pluvialis dominica	American Golden-plover	24	
PPK	Red River Prairie	BI	Podiceps grisegena	Red-necked Grebe	17	2
PPK	Red River Prairie	BI	Podiceps nigricollis	Eared Grebe	9	1
PPK	Red River Prairie	BI	Rallus limicola	Virginia Rail	23	10
PPK	Red River Prairie	BI	Recurvirostra americana	American Avocet	16	
PPK	Red River Prairie	BI	Speotyto cunicularia	Burrowing Owl	4	
PPK	Red River Prairie	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	1
PPK	Red River Prairie	BI	Spiza americana	Dickcissel	11	
PPK	Red River Prairie	BI	Spizella pusilla	Field Sparrow	13	1
PPK	Red River Prairie	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	2
PPK	Red River Prairie	BI	Sterna forsteri	Forster's Tern	11	
PPK	Red River Prairie	BI	Toxostoma rufum	Brown Thrasher	25	5
PPK	Red River Prairie	BI	Tringa melanoleuca	Greater Yellowlegs	25	
PPK	Red River Prairie	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
PPK	Red River Prairie	BI	Tympanuchus cupido	Greater Prairie-chicken	4	306
PPK	Red River Prairie	RE	Chelydra serpentina	Common Snapping Turtle	25	
PPK	Red River Prairie	RE	Heterodon nasicus	Western Hognose Snake	9	3
PPK	Red River Prairie	RE	Liochlorophis vernalis	Smooth Green Snake	15	
PPK	Red River Prairie	AM	Necturus maculosus	Common Mudpuppy	14	
PPK	Red River Prairie	FI	Acipenser fulvescens	Lake Sturgeon	14	5
PPK	Red River Prairie	FI	Platygobio gracilis	flathead chub	1	
PPK	Red River Prairie	SP	Metaphidippus arizonensis	A Jumping Spider	4	1
PPK	Red River Prairie	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	3
PPK	Red River Prairie	IN	Atrytone arogos	Arogos Skipper	9	
PPK	Red River Prairie	IN	Cicindela fulgida westbournei	A Tiger Beetle	1	
PPK	Red River Prairie	IN	Hesperia comma assiniboia	Assiniboia Skipper	2	
PPK	Red River Prairie	IN	Hesperia dacotae	Dakota Skipper	5	2
PPK	Red River Prairie	IN	Hesperia leonardus pawnee	Pawnee Skipper	4	
PPK	Red River Prairie	IN	Oarisma powesheik	Powesheik Skipper	6	21
PPK	Red River Prairie	IN	Oeneis uhleri varuna	Uhler's Arctic	1	
PPK	Red River Prairie	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
PPK	Red River Prairie	IN	Speyeria idalia	Regal Fritillary	11	8
PPK	Red River Prairie	MO	Lasmigona compressa	Creek Heelsplitter	24	14
PPK	Red River Prairie	MO	Lasmigona costata	Fluted-shell	12	28
PPK	Red River Prairie	MO	Ligumia recta	Black Sandshell	25	53
TAP	Aspen Parklands	MA	Canis lupus	Gray Wolf	14	
TAP	Aspen Parklands	MA	Cervus elaphus	Elk	2	
TAP	Aspen Parklands	MA	Mustela nivalis	Least Weasel	12	
TAP	Aspen Parklands	MA	Spermophilus franklinii	Franklin's Ground Squirrel	23	
TAP	Aspen Parklands	MA	Spilogale putorius	Eastern Spotted Skunk	19	
TAP	Aspen Parklands	MA	Taxidea taxus	American Badger	24	
TAP	Aspen Parklands	MA	Thomomys talpoides	Northern Pocket Gopher	2	
TAP	Aspen Parklands	BI	Aechmophorus occidentalis	Western Grebe	5	1
TAP	Aspen Parklands	BI	Ammodramus bairdii	Baird's Sparrow	2	4
TAP	Aspen Parklands	BI	Ammodramus leconteii	Le Conte's Sparrow	17	167

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
TAP	Aspen Parklands	BI	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	9	72
TAP	Aspen Parklands	BI	Ammodramus savannarum	Grasshopper Sparrow	14	30
TAP	Aspen Parklands	BI	Anas acuta	Northern Pintail	9	11
TAP	Aspen Parklands	BI	Anthus spragueii	Sprague's Pipit	2	3
TAP	Aspen Parklands	BI	Arenaria interpres	Ruddy Turnstone	20	
TAP	Aspen Parklands	BI	Asio flammeus	Short-eared Owl	11	13
TAP	Aspen Parklands	BI	Aythya affinis	Lesser Scaup	3	7
TAP	Aspen Parklands	BI	Bartramia longicauda	Upland Sandpiper	19	183
TAP	Aspen Parklands	BI	Botaurus lentiginosus	American Bittern	21	152
TAP	Aspen Parklands	BI	Buteo swainsoni	Swainson's Hawk	6	
TAP	Aspen Parklands	BI	Calidris alpina	Dunlin	24	
TAP	Aspen Parklands	BI	Calidris fuscicollis	White-rumped Sandpiper	20	
TAP	Aspen Parklands	BI	Calidris pusilla	Semipalmated Sandpiper	25	
TAP	Aspen Parklands	BI	Caprimulgus vociferus	Whip-poor-will	21	6
TAP	Aspen Parklands	BI	Catharus fuscescens	Veery	22	187
TAP	Aspen Parklands	BI	Chlidonias niger	Black Tern	18	62
TAP	Aspen Parklands	BI	Chordeiles minor	Common Nighthawk	25	2
TAP	Aspen Parklands	BI	Circus cyaneus	Northern Harrier	25	76
TAP	Aspen Parklands	BI	Cistothorus palustris	Marsh Wren	20	105
TAP	Aspen Parklands	BI	Cistothorus platensis	Sedge Wren	25	290
TAP	Aspen Parklands	BI	Coccyzus erythropthalmus	Black-billed Cuckoo	25	127
TAP	Aspen Parklands	BI	Contopus cooperi	Olive-sided Flycatcher	14	4
TAP	Aspen Parklands	BI	Contopus virens	Eastern Wood-pewee	25	113
TAP	Aspen Parklands	BI	Coturnicops noveboracensis	Yellow Rail	10	140
TAP	Aspen Parklands	BI	Cygnus buccinator	Trumpeter Swan	14	1
TAP	Aspen Parklands	BI	Dolichonyx oryzivorus	Bobolink	25	228
TAP	Aspen Parklands	BI	Empidonax minimus	Least Flycatcher	25	122
TAP	Aspen Parklands	BI	Empidonax traillii	Willow Flycatcher	13	32
TAP	Aspen Parklands	BI	Gavia immer	Common Loon	18	6
TAP	Aspen Parklands	BI	Haliaeetus leucocephalus	Bald Eagle	21	20
TAP	Aspen Parklands	BI	Ixobrychus exilis	Least Bittern	16	3
TAP	Aspen Parklands	BI	Larus pipixcan	Franklin's Gull	3	72
TAP	Aspen Parklands	BI	Limnodromus griseus	Short-billed Dowitcher	22	
TAP	Aspen Parklands	BI	Limosa fedoa	Marbled Godwit	4	178
TAP	Aspen Parklands	BI	Limosa haemastica	Hudsonian Godwit	18	
TAP	Aspen Parklands	BI	Melanerpes erythrocephalus	Red-headed Woodpecker	22	2
TAP	Aspen Parklands	BI	Melospiza georgiana	Swamp Sparrow	25	187
TAP	Aspen Parklands	BI	Numenius phaeopus	Whimbrel	13	
TAP	Aspen Parklands	BI	Nycticorax nycticorax	Black-crowned Night-heron	8	14
TAP	Aspen Parklands	BI	Oporornis agilis	Connecticut Warbler	14	14
TAP	Aspen Parklands	BI	Phalaropus tricolor	Wilson's Phalarope	9	31
TAP	Aspen Parklands	BI	Pheucticus ludovicianus	Rose-breasted Grosbeak	25	165
TAP	Aspen Parklands	BI	Pluvialis dominica	American Golden-plover	24	
TAP	Aspen Parklands	BI	Podiceps auritus	Horned Grebe	1	3
TAP	Aspen Parklands	BI	Podiceps grisegena	Red-necked Grebe	17	6
TAP	Aspen Parklands	BI	Podiceps nigricollis	Eared Grebe	9	3
TAP	Aspen Parklands	BI	Rallus limicola	Virginia Rail	23	22
TAP	Aspen Parklands	BI	Recurvirostra americana	American Avocet	16	
TAP	Aspen Parklands	BI	Scolopax minor	American Woodcock	22	8
TAP	Aspen Parklands	BI	Seiurus aurocapillus	Ovenbird	22	92
TAP	Aspen Parklands	BI	Sphyrapicus varius	Yellow-bellied Sapsucker	23	25
TAP	Aspen Parklands	BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	25	1
TAP	Aspen Parklands	BI	Sterna forsteri	Forster's Tern	11	11
TAP	Aspen Parklands	BI	Toxostoma rufum	Brown Thrasher	25	43
TAP	Aspen Parklands	BI	Tringa melanoleuca	Greater Yellowlegs	25	
TAP	Aspen Parklands	BI	Troglodytes troglodytes	Winter Wren	18	8
TAP	Aspen Parklands	BI	Tryngites subruficollis	Buff-breasted Sandpiper	23	
TAP	Aspen Parklands	BI	Tympanuchus cupido	Greater Prairie-chicken	4	151
TAP	Aspen Parklands	BI	Tympanuchus phasianellus	Sharp-tailed Grouse	9	13
TAP	Aspen Parklands	BI	Zonotrichia albicollis	White-throated Sparrow	15	68

Province	SubsectionName	Taxa	Scientific Name	Common Name	# subsections	# occurrences since 1990
TAP	Aspen Parklands	RE	Chelydra serpentina	Common Snapping Turtle	25	
TAP	Aspen Parklands	RE	Liochlorophis vernalis	Smooth Green Snake	15	
TAP	Aspen Parklands	AM	Necturus maculosus	Common Mudpuppy	14	
TAP	Aspen Parklands	FI	Acipenser fulvescens	Lake Sturgeon	14	
TAP	Aspen Parklands	SP	Marpissa grata	A Jumping Spider	6	
TAP	Aspen Parklands	IN	Aflexia rubranura	Red Tailed Prairie Leafhopper	10	
TAP	Aspen Parklands	IN	Hesperia comma assiniboia	Assiniboia Skipper	2	4
TAP	Aspen Parklands	IN	Hesperia dacotae	Dakota Skipper	5	6
TAP	Aspen Parklands	IN	Oarisma garita	Garita Skipper	1	9
TAP	Aspen Parklands	IN	Oarisma powesheik	Powesheik Skipper	6	11
TAP	Aspen Parklands	IN	Papaipema beeriana	Blazing Star Stem Borer	9	
TAP	Aspen Parklands	IN	Speyeria idalia	Regal Fritillary	11	
TAP	Aspen Parklands	MO	Lasmigona compressa	Creek Heelsplitter	24	30
TAP	Aspen Parklands	MO	Lasmigona costata	Fluted-shell	12	14
TAP	Aspen Parklands	MO	Ligumia recta	Black Sandshell	25	26

Key:

Prov	EBF	Eastern Broadleaf Forest,
	LMF	Laurentian Mixed Forest
	PPK	Prairie Parkland
	TAP	Tallgrass Aspen Parkland
Taxa	MA	Mammals
	BI	Birds
	RE	Reptiles
	AM	Amphibians
	FI	Fish
	SP	Spiders
	IN	Insects
	MO	Mollusks
# of subsections		The number of subsections the species is known or predicted to occur in.
# occurrences since 1990		Number of records for given species in subsection. Based on MCBS surveys, MN DNR Fish Database, MN DNR Mussel Survey.

Appendix H: Data Sources for Maps Used in the Chapter 5, Subsection Profiles

SGCN Element Occurrences by Township Map

Species Occurrences

Source: MN DNR Division of Ecological Services , Minnesota County Biological Survey– Rare animal surveys
http://www.dnr.state.mn.us/ecological_services/mcbs/index.html

Source: MN DNR Division of Ecological Services, Minnesota Statewide Mussel Survey
http://www.dnr.state.mn.us/ecological_services/nhnrp/mussel_survey/index.html

Source: MN DNR Division of Fish and Wildlife, Lake and Stream Surveys
http://www.dnr.state.mn.us/fisheries/management/gatherinfo.html

Source: MN DNR Division of Ecological Services, Natural Heritage Information System
http://www.dnr.state.mn.us/ecological_services/nhnrp/nhis.html

Township maps

Source: PLS Town-Range Boundaries

http://deli.dnr.state.mn.us/data_catalog.html

Number of SGCN Occurrences by township

Notes: Combined data sources from Species Occurrences, using occurrences since 1990 only, and summed the total number of occurrences by township, using the Township maps baselayer.

Public and private conservancy

Source: GAP Stewardship - All Ownership Types

http://deli.dnr.state.mn.us/data_catalog.html

Notes: Public and private conservancy polygons were selected from the main dataset for presentation in the map.

Counties

Source: Minnesota County Boundaries

http://deli.dnr.state.mn.us/data_catalog.html

Subsections

Source: Ecological Subsections of Minnesota

http://deli.dnr.state.mn.us/data_catalog.html

Distribution of Key Habitats and Species Richness by Township Map

Most terrestrial key habitats

Source: MCBS Native Plant Communities

http://deli.dnr.state.mn.us/data_catalog.html

Source: MCBS Railroad Rights-of-way Prairies

http://deli.dnr.state.mn.us/data_catalog.html

Source: GAP Land Cover – Raster

http://deli.dnr.state.mn.us/data_catalog.html

Notes: Where available, the MCBS Native Plant Communities were used instead of the GAP Land Cover. For both coverages, we selected and displayed only the key habitats for the subsection.

Grasslands

Source: HAPET Grassland Bird Conservation Areas (GBCAs)

http://www.fws.gov/midwest/hapet/GrasslandBirdMaps.htm

Notes: Type 1 and 2 GBCAs are displayed. GBCAs were not available the Oak Savanna and St. Paul-Baldwin Plains subsections. See below for sources used for those subsections.

Source: HAPET Classified Landuse/Landcover

http://www.fws.gov/midwest/hapet/DistLandcovrMap.htm

Notes: Used for grasslands in the Oak Savanna subsection. Only grassland patches greater than 80 acres in size are displayed.

Source: Twin Cities Metro Hybrid Landcover (2000)

http://deli.dnr.state.mn.us/data_catalog.html

Notes: The following categories were used to identify grasslands: 61. Tall grasses – Inventory, 63. Dry tall grasses, 65. Tall grass – Satellite Derived. Boundaries between these three polygons were dissolved. Displayed are grassland patches greater than 80 acres in size, and other grassland patches within 200 feet of the larger 80 acre patches.

Key River Reaches

Notes: All three of the following data sources were used for displaying the key river reaches. See Chapter 7 for a description of how these were selected.

Source: The Nature Conservancy (TNC)

Notes: This is a compilation of river sources used for several different TNC plans and is not currently available publicly.

Source: Major River Centerline Traces in Minnesota

http://deli.dnr.state.mn.us/data_catalog.html

Source: DNR 24 k rivers and streams

http://deli.dnr.state.mn.us/data_catalog.html

Shallow Lakes

Source: Shallow lakes shapefile from the MN DNR Shallow Lakes Program

http://www.dnr.state.mn.us/wildlife/shallowlakes/habitateval.html

Notes: This dataset is not yet publicly available.

Deep lakes

Source: DNR 100k Lakes and Rivers

http://deli.dnr.state.mn.us/data_catalog.html

Notes: Only those lakes with at least one SGCN fish or mussel element occurrence, using the fish and mussel data described above, are displayed.

SGCN Richness

Notes: Using the data described under SGCN occurrences above, we summed the number of species per township.

Counties

Source: Minnesota County Boundaries

http://deli.dnr.state.mn.us/data_catalog.html

Subsections

Source: Ecological Subsections of Minnesota

http://deli.dnr.state.mn.us/data_catalog.html

Appendix I Key Rivers and Streams by Subsection

	TNC ANALYSIS	SGCN OCCURRENCE
AGASSIZ LOWLANDS		
Clearwater River	X	X
Rainy River	X	X
Rapid River	X	
Rapid River, East Branch	X	
Rapid River, North Branch	X	
Red Lake River	X	X
Roseau River	X	X
Roseau River, South Fork	X	
Manomin Creek	X	
Sandy River	X	
Sturgeon River		X
Warroad River	X	
Warroad River, West Branch	X	
Winter Road River	X	
ANOKA SAND PLAIN		
Clearwater River		X
Coon Creek	X	
Crow Wing River		X
Elk River		X
Hardwood Creek	X	
Minnehaha Creek	X	
Mississippi River	X	X
North Fork Crow River	X	X
Platte River		X
Rice Creek	X	
Rum River	X	X
Rum River, West Branch		X
Saint Francis River		X
Sauk River	X	X
Skunk River		X
Spunk Creek		X
Sunrise River	X	X
Sunrise River, North Branch	X	
Sunrise River, South Branch	X	
Sunrise River, West Branch	X	X
Swan River		X
Two River		X
Watab River		X

	TNC ANALYSIS	SGCN OCCURRENCE
ASPEN PARKLANDS		
Clearwater River	X	X
Hill River		X
Lost River		X
Poplar River		X
Red Lake River	X	X
Roseau River	X	X
Roseau River, South Fork	X	
Sand Hill River		X
Two Rivers, North Branch	X	
Two Rivers, South Branch		X
BIG WOODS		
Assumption Creek	X	
Blue Earth River	X	X
Cannon River	X	X
Chub Creek		X
Clearwater River		X
Crow River, North Fork	X	X
Crow River, South Fork	X	
High Island Creek	X	
Le Sueur River	X	X
Minnehaha Creek	X	
Minnesota River	X	X
Rush River	X	
Rush River, South Branch	X	
Straight River	X	X
BLUFFLANDS		
Adams Valley Creek	X	
Bear Creek		X
Beaver Creek		X
Beaver Creek, West Branch		X
Belle Creek		X
Burns Valley Creek	X	
Burns Valley Creek, East Branch		X
Butterfield Creek	X	
Campbell Creek	X	
Canfield Creek		X

	TNC ANALYSIS	SGCN OCCURRENCE
Cannon River		X
Clear Creek	X	
Crooked Creek		X
Crystal Creek		X
Day Creek		X
Deer Creek		X
Diamond Creek	X	
East Indian Creek		X
Ferguson Creek	X	
Gilmore Creek		X
Gorman Creek	X	
Kedran Creek	X	
Little Cannon River		X
Little Kingsley Creek	X	
Lost Creek		X
Lynch Creek		X
Mahoods Creek	X	
Maple Creek	X	
Mississippi River	X	X
Money Creek		X
Pine Creek		X
Prairie Creek		X
Riceford Creek		X
Rollingstone Creek	X	X
Root River	X	X
Root River, Middle Branch	X	X
Root River, South Fork	X	X
Rush Creek	X	X
Snake Creek	X	
Speltz Creek	X	
Spring Branch Creek		X
Spring Valley Creek	X	X
St. Croix River	X	X
Thompson Creek		X
Trout Brook		X
Trout Valley Creek		X
Vermillion River		X
Wells Creek		X
West Indian Creek	X	
Whitewater River, Middle Fork		X
Whitewater River, North Fork		X
Whitewater River, South Fork		X
Wildcat Creek		X

	TNC ANALYSIS	SGCN OCCURRENCE
Winnebago Creek		X
Zumbro River	X	X
Zumbro River, North Fork		X
BORDER LAKES		
Ash River	X	
Blackduck River	X	
Brule River	X	X
Cascade River	X	
Greenwood River		X
Isabella River	X	
Island River	X	
Kawashiwi River	X	
Little Isabella River	X	
Perent River	X	
Pigeon River	X	
Rainy River	X	X
Reservation River	X	
Snake River	X	
South Brule River	X	X
South Kawashiwi River	X	
Swamp River	X	
Vermilion River	X	X
CHIPPEWA PLAINS		
Big Fork River	X	X
Boy River	X	
Clearwater River	X	X
Fishermans Brook	X	
Kabekona River	X	
Leech Lake River		X
Little Boy River		X
Mississippi River	X	X
Necktie River	X	
Pokety Creek (Pickedee)	X	
Sandy River	X	
Schoolcraft River	X	X
Stall Creek	X	
Steamboat River	X	
Third River	X	
Turtle River	X	X

	TNC ANALYSIS	SGCN OCCURRENCE
Wild Rice River	X	X
COTEAU MORAINES		
Beaver Creek	X	
Canby Creek		X
Champepadan Creek		X
Chanarambie Creek		X
Coon Creek	X	
Cottonwood River		X
Des Moines River	X	X
Florida Creek	X	
Kanaranzi River		X
Kanaranzi River, East Branch		X
Lac qui Parle River, West Branch		X
Little Rock Creek		X
Little Rock River		X
Little Sioux River	X	
Little Sioux River, West Fork	X	
Mud Creek	X	
Redwood River	X	X
Threemile Creek	X	
Watonwan River	X	X
Yellow Medicine River, North Branch	X	
GLACIAL LAKE SUPERIOR PLAIN		
Blackhoof River		X
Nemadji River	X	
Nemadji River, South Fork	X	
Net River		X
St. Louis River	X	X
HARDWOOD HILLS		
Buffalo River	X	X
Chippewa River	X	X
Clearwater River	X	X
Elk River	X	X
Getchell Creek	X	
Hill River		X
Leaf River		X
Little Floyd Lake Tributary		X

	TNC ANALYSIS	SGCN OCCURRENCE
Little Swan River	X	
Long Prairie River	X	X
North Fork Crow River	X	X
North Two River		X
Ottertail River	X	X
Partridge River	X	
Pelican River	X	X
Pomme de Terre River	X	X
Poplar River		X
Sand Hill River		X
Sauk River	X	X
Spunk Creek		X
Swan River		X
Watab River		X
Wild Rice River	X	X
Wing River		X

INNER COTEAU

Ash Creek		X
Beaver Creek		X
Champepadan Creek		X
Chanarambie Creek		X
Elk Creek		X
Flandreau Creek		X
Kanaranzi Creek		X
Little Beaver Creek		X
Little Rock Creek		X
Little Rock River		X
Medary Creek		X
Mound Creek		X
Mud Creek		X
Norwegian Creek	X	
Pipestone Creek		X
Pipestone Creek, North Branch		X
Poplar Creek		X
Rock River	X	X
Rock River, East Branch		X
Rock River Tributaries		X
Split Rock Creek		X
Springwater Creek		X
Willow Creek		X

	TNC ANALYSIS	SGCN OCCURRENCE
LAURENTIAN UPLANDS		
Cloquet River	X	X
Little Isabella River	X	
Perent River	X	
Poplar River		X
St. Louis River	X	X
Snake River	X	
Stony River		X
LITTLEFORK VERMILION UPLANDS		
Big Fork River	X	X
Dark River		X
Little Fork River	X	X
Nett Lake River		X
Rainy River	X	X
Sturgeon River		X
MILLE LACS UPLANDS		
Ann River		X
Bear Creek		X
Birch Creek	X	
Blackhoof River		X
Bogus Creek	X	
Chase Brook	X	
Crooked Creek, East Fork		X
Elk River		X
Grindstone River	X	X
Groundhouse River		X
Groundhouse River South Fork	X	
Hay Creek		X
Kettle River	X	X
Knife River	X	X
Little Sand Creek	X	
Lower Tamarack River	X	X
Midway River		X
Mike Drew Brook	X	
Mississippi River	X	X
Moose River	X	X
Mud Creek	X	
Net River		X

	TNC ANALYSIS	SGCN OCCURRENCE
Pine River	X	X
Platte River		X
Rock Creek		X
Rum River	X	X
Rum River, West Branch	X	X
Rush Creek	X	
St. Croix River	X	X
St. Francis River		X
St. Louis River	X	X
Sand River	X	X
Skunk River		X
Snake River	X	X
Sunrise River	X	X
Tibbetts Brook	X	
Upper Tamarack River	X	X
Vondell Brook	X	
Willow River	X	X

MINNESOTA RIVER PRAIRIE

Beaver Creek		X
Blue Earth River	X	X
Butterfield Creek	X	
Chetomba Creek	X	
Chippewa River	X	X
Chippewa River, East Branch		X
Chippewa River Tributary		X
Clear Creek	X	
Cottonwood River	X	X
Crow River, North Fork	X	X
Crow River, South Fork	X	
Dry Weather Creek	X	
Elm Creek		X
Florida Creek	X	
Getchell Creek	X	
Hawk Creek		X
High Island Creek	X	
Hindeman Creek	X	
Lac qui Parle River		X
Lac qui Parle River Tributary	X	
Lazaras Creek		X
Le Sueur River	X	X
Little Cottonwood River		X

	TNC ANALYSIS	SGCN OCCURRENCE
Long Prairie River		X
Maple River		X
Minnesota River	X	X
Mud Creek	X	
Mustinka River	X	
North Fork Crow River Tributary		X
Ottertail River	X	X
Pelican River	X	X
Perch Creek	X	
Pomme de Terre River	X	X
Ramsey Creek	X	
Red River		X
Redwood River	X	X
Rush River	X	
Rush River, Middle Branch	X	
Rush River, South Branch	X	
Sauk River	X	X
Spring Creek	X	
Threemile Creek	X	
Watonwan River	X	X
Watonwan River, North Fork	X	
Watonwan River, South Fork	X	X
Yellow Bank River		X
Yellow Bank River, North Fork	X	X
Yellow Bank River, South Fork	X	X
Yellow Medicine River	X	X
Yellow Medicine River, North Branch	X	
NASHWAUK UPLANDS		
Boriin Creek	X	
Dark River		X
Prairie River	X	
Sturgeon River		X
Swan River	X	
NORTH SHORE HIGHLANDS		
Baptism River		X
Brule River	X	X
Cascade River	X	
Cloquet River	X	X
Kettle River	X	X

	TNC ANALYSIS	SGCN OCCURRENCE
Knife River	X	
Knife River, West Branch	X	
Little Knife River	X	
Manitou River	X	X
Midway River		X
Moose River	X	X
Pigeon River	X	
Poplar River		X
Prairie River	X	X
Reservation River	X	
St. Louis River	X	X
Swamp River	X	

OAK SAVANNA

Bear Creek		X
Beaver Creek	X	X
Cannon River	X	X
Cedar River	X	X
Cedar River, Middle Fork	X	
Cedar River, West Fork	X	
Chub Creek		X
Deer Creek		X
Dobbin Creek	X	X
Dobbin Creek, South Branch	X	
Iowa River, North Branch	X	
Le Sueur River	X	X
Little Cedar River	X	X
Little Iowa River		X
Milliken Creek		X
Orchard Creek		X
Otter Creek	X	X
Prairie Creek		X
Roberts Creek	X	
Root River		X
Root River, North Branch	X	
Root River, South Branch		X
Rose Creek	X	X
Rush Creek	X	
Salem Creek		X
Straight River	X	X
Turtle Creek	X	X
Upper Iowa River	X	X

	TNC ANALYSIS	SGCN OCCURRENCE
Wapsipinicon River	X	
Woodbury Creek	X	X
Zumbro River		X
Zumbro River, Middle Fork		X
Zumbro River, Middle Fork North Branch		X
Zumbro River, Middle Fork South Branch	X	X
Zumbro River, North Fork		X
Zumbro River, South Fork		X

PINE MORAINES AND OUTWASH PLAINS

Blueberry River		X
Crow Wing River		X
Elk River	X	X
Fishhook River		X
Gull River	X	
Kabekona River	X	X
Kettle River		X
Leaf River		X
Little Boy River		X
Little Swan Creek	X	
Long Prairie River	X	X
Mississippi River	X	X
Moose River	X	
Mosquito Creek	X	
Mosquito Creek, East	X	
Ottertail River	X	X
Partridge River	X	
Pine River		X
Redeye River		X
Schoolcraft River	X	X
Shell River		X
Singobee River	X	
Steamboat River	X	
Straight River		X
Swan Creek	X	
Two Inlets Lake Tributary		X
Wing River		X

RED RIVER PRAIRIE

Buffalo River	X	X
Marsh River	X	

	TNC ANALYSIS	SGCN OCCURRENCE
Mustinka River	X	
Ottertail River	X	X
Pelican River	X	X
Pomme de Terre River	X	X
Red Lake River	X	X
Red River	X	X
Sand Hill River		X
Two Rivers, North Branch		X
Two Rivers, South Branch		X
Wild Rice River	X	X
Wild Rice River, South Branch		X

ROCHESTER PLATEAU

Bear Creek		X
Beaver Creek		X
Belle Creek		X
Canfield Creek		X
Cannon River		X
Cannon River Tributary		X
Carey Creek	X	
Coldwater Creek	X	
Deer Creek		X
Kedran Creek	X	
Little Kingsley Creek	X	
Logan Branch		X
Lynch Creek	X	
Milliken Creek		X
Pine Creek	X	
Riceford Creek		X
Rollingstone Creek	X	X
Root River	X	X
Root River, Middle Branch	X	
Root River, South Branch	X	X
Rush Creek	X	X
Salem Creek		X
Shingle Creek		X
Spring Valley Creek	X	X
Upper Iowa River	X	X
Whitewater River, Middle Fork		X
Whitewater River, South Fork		X
Zumbro River		X
Zumbro River, Middle Fork		X

	TNC ANALYSIS	SGCN OCCURRENCE
Zumbro River, Middle Fork North Branch		X
Zumbro River, Middle Fork South Branch	X	X
Zumbro River, North Fork	X	X
Zumbro River, South Fork Tributary		X
ST. LOUIS MORAINES		
Big Fork River		X
Cameron Lake Tributary		X
Hanson Creek	X	
Kettle River	X	X
Mississippi River	X	X
Moose River	X	
Prairie River	X	X
Prairie River Tributary		X
Sandy River	X	
Swan River	X	X
Tamarack River		X
Willow River	X	X
ST. PAUL BALDWIN PLAINS AND MORAINES		
Hardwood Creek	X	
Minnesota River	X	X
Mississippi River	X	X
St. Croix River	X	X
Sunrise River	X	X
Valley Creek		X
TAMARACK LOWLANDS		
Floodwood River		X
Mississippi River	X	X
Moose River	X	
Paleface River		X
Prairie River	X	X
St. Louis River	X	X
Sandy River	X	
Swan River	X	X
Whiteface River		X
Willow River	X	X

	TNC ANALYSIS	SGCN OCCURRENCE
TOIMI UPLANDS		
Cloquet River	**X**	**X**
St. Louis River	**X**	**X**
Whiteface River		**X**

Definitions

TNC Analysis:
Stream/ River is listed as a priority under a TNC ecoregional or aquatic analysis, or is a major branch/fork of the listed stream river and is contained within the TNC priority area.

SGCN Occurrence:
At least two species in greatest conservation need reported occurring along stream/river (at 1:100,000 resolution). It is not required that SCGN occurrences are along the stream/river reach within the subsection, but can be anywhere along the stream/river reach.

Appendix J
Wildlife Recreation and Tourism Considerations

The conservation of Minnesota's wildlife is a long-term comprehensive process of both land and people management that results in enhanced diversity and abundance of the state's wildlife. This can provide ecological, economic, and recreational benefits within the state. In many cases the recreational wildlife benefits are considered primarily in terms of traditional license-holding stakeholders like hunters.

However, the sociological and recreational landscape is changing. Recent trends in outdoor recreation are shifting the dynamics among traditional stakeholders and are creating a significant new public that builds its recreation around the activities of enjoying wildlife through wildlife watching, bird watching, outdoor photography, nature study, bird feeding, and general wildlife observation.

Any conservation strategy of the future will require significant financial investment to preserve Minnesota wildlife and their respective habitats, and the support for that investment must come from a new alliance of stakeholders who represent both traditional license-holders and wildlife watchers who share the commitment to preserve wildlife for its intrinsic ecological benefits and for future generations to enjoy.

A comprehensive wildlife conservation strategy must involve understanding some of the basic facts about current trends in wildlife recreation that are essential if habitat-based conservation initiatives are to succeed financially and successfully compete with all the other potential uses of public dollars.

National Trends

Nationwide, in 2001 there were about 66.1 million people who spent about $38.4 billion per year to enjoy wildlife. This generated over 1,027,000 jobs, $3.3 billion in federal income tax revenue, $712 million in state income tax, and $2.1 billion in state sales tax revenue. There are several significant factors related to this phenomenon. First, healthy, diverse wildlife populations contribute to the creation of wildlife tourism opportunities in small rural communities as well as in metropolitan areas. Wildlife tourism provides memorable and healthy outdoor experiences, diversifies the economic bases of the communities involved, and can help extend the length of the tourism season in favorable destinations by providing business opportunities in the so-called "shoulder seasons" when tourism business is slack. Good wildlife experiences also solidify the support base from the public to endorse and fund additional wildlife conservation and habitat initiatives.

One of the important features of this "wildlife watching" segment of the public is that it is popular among a broad range of age groups who specifically enjoy or pursue birds for viewing or photography. Surveys in 2001 estimated that there were 46 million birders in the US and that 18 million of those birders traveled away from their home to see and enjoy birds. The US average for participation rates in wildlife watching is 22%. These people tend to be affluent and well educated, and there is good participation by both men and women. Among

all wildlife watchers, 46 percent are men and 54 percent are women (2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, USFWS).

Minnesota Trends

In Minnesota, the 2001 data revealed that there were 2,155,000 people who participated in wildlife watching. This included 171,000 residents from other states who came to Minnesota for their wildlife watching experience. The other 1,984,000 participants were from Minnesota.

Expenditures for wildlife-watching experiences in 2001 were $531,100,000. This industry created 12,730 jobs in the state. Those jobs resulted in people earning $296,300,000 in income and that income resulted in the payment of $10,900,000 in state income tax revenue and $32,700,000 in federal income tax revenue. The sales taxes paid for the equipment and products used for enjoying wildlife totaled $21,000,000. Nonresidents who came to Minnesota to enjoy the wildlife spent $57,700,000 in 2001.

If you consider that component of wildlife watching comprised of "birdwatching," the statistics are still impressive. The average participation rate for birding/bird watching nationally is 22 %, but the rate for Minnesota is 5th highest in the nation, at 36%. Wildlife watchers are almost evenly split along gender lines, with 50.7% being men and 49.3% being women (2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, USFWS).

Comparisons with Hunting and Fishing Statistics

There are some interesting comparisons that can be made between hunters/anglers and wildlife watchers. First of all, these activities are not mutually exclusive. Many of the individuals participating in hunting and fishing also are active wildlife watchers.

The number of Minnesota hunters in 2001 was estimated at 597,000. There were an estimated 1,624,000 anglers. The hunters spent a total of $482,614,000, for an average expense of $783 per hunter per year, while the anglers spent $1,284,522,000, for an average expense of $790. The number of wildlife-watching participants was 2,155,000 in 2001. They spent a total of $531,057,000. Wildlife watchers spent about $246 per person, or about one-third the amount for hunters. The total expenditure by wildlife watchers exceeded the expenditures of hunters for the first time in the history of this survey. All three of these activities contribute significantly to the Minnesota economy (2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, USFWS).

Future opportunities for Stakeholder Cooperation and Conservation

Together, these constituencies should be looked upon as a significant group of stakeholders and voters who care about Minnesota's natural resources and who can play a significant role in crafting visionary legislation that will help preserve and manage natural resources into the future and provide a rich diversity of outdoor experiences for all of those stakeholders.

The national legislation that originally started as "Teaming with Wildlife," evolved into the Conservation and Restoration Act (CARA) effort, and then into the State Wildlife Grants program, has the potential to help blend the interests and support for conservation among a broader constituency than ever before possible. It brings in wildlife watchers who do not hunt, wildlife tourism outfitters, chambers of commerce, convention and visitor's bureaus, the hospitality industry, and the optics industry. They all benefit from a diverse landscape with many opportunities for hunting, fishing, as well as wildlife watching and nature tourism.

For that reason, it is worthwhile to maintain a connection between basic wildlife conservation efforts carried out through SWG grants and through the wildlife-tourism-related publics who stand to benefit through the preservation and management of species in greatest conservation need.

One way to maintain these connections is to carry out an assessment of the wildlife tourism potential within a state so that tourism related businesses can enhance wildlife tourism activities by building upon the existing base of public lands and SGCN species which have potential for wildlife tourism experiences.

Reason for Concern: Declining Participation Rates

From 1991 to 2001, all of the U.S. and Minnesota participation rates fell for fishing, hunting, and wildlife watching. Wildlife watching is broken into two types: first is away from home viewing (over one mile from home), and second is total wildlife watching, which includes away from home plus near-home activity.

The U.S. and Minnesota participation declines for fishing and away-from-home wildlife watching are close in size, while the Minnesota hunting decline is smaller than the national average. The Minnesota decline in total wildlife watching participants is smaller than the U.S. decline, and it is not significantly different than zero (Minnesota DNR Report, July 2005). These declining trends are troubling. It will be important to watch these declines closely to better understand why participation rates are falling and what can be done to turn this trend around.

The Grackle Junction Model for Wildlife Tourism Resource Assessments

In 2002, the Minnesota Department of Natural Resources created a curriculum entitled "The Saga of Grackle Junction" to create a process for evaluating tourism potential in an area through a ten-step resource assessment process and to develop a plan that provides for

adequate networking of interested publics and development and enhancement of wildlife tourism opportunities. The first training class for implementation of this process was given at the 2002 national Watchable Wildlife conference in St. Paul, MN.

The ten-step resource assessment process has been applied to all 25 of Minnesota's ecological subsections and scored on a fifty-point scale. The information will be summarized on the DNR CWCS Website for all 25 subsections in the near future. This information can be used by the respective tourism entities within each subsection to promote wildlife tourism—and hopefully create a case for preservation and management of the unique and rare wildlife resources that create the backbone of wildlife recreation industry for each respective subsection.

Minnesota's Million Dollar Owl: The Great Gray Owl
A Grackle Junction Case Study in 2005

Minnesota is home to one of the nation's most sought-after birding treasures: the great gray Owl. This imposing owl made national headlines in the fall and winter of 2004-2005 when thousands of these owls moved from Canada into Minnesota's Northwoods and nearly one million dollars were spent by birders to see the owl. The local communities of Meadowlands, Cotton, Duluth, and Cloquet had perhaps known of the reputation of the local "Sax-Zim Bog" as a nationally publicized birding destination for boreal birds, but there were never enough visitors to capture their imagination from a tourism promotion standpoint.

The owl invasion of 2004-2005 is an excellent example of the potential wildlife watching has for tourism in Minnesota. It was enough to capture the imagination of even casual nature lovers with the prospect of seeing more than 10 or 20 great gray owls, northern hawk-owls, and even boreal owls with a simple trip north along the North Shore of Lake Superior or into the bog country near Cotton and Meadowlands. Literally thousands of people came throughout the winter- from throughout the United States and even other countries.

The great gray owl is good at what it does—it catches and eats voles. It hunts by perching on a tree branch or roadside sign. It listens for the sound of rodents moving in the ground litter or under the snow. The owl will drop from its perch and glide silently towards its prey. Life is good for great gray owls, as long as there are lots of voles. Unfortunately, Mother Nature puts both the owls and the voles on a roller coaster ride of population booms and busts that follow a frequency of about ten years.

In 2004, populations of red-backed Voles in Canadian forests crashed. Great gray owls nesting failed in their nesting efforts and began a nomadic movement (not a true migration) into northern Minnesota. They discovered a mother lode of rodents living in roadside rights-of-way: lots of Meadow Voles. There were perhaps more than 10,000 great gray owls in northeastern Minnesota last winter.

About two years ago, the Department of Natural Resources teamed up with avid birders from Duluth and the Minnesota Ornithologists' Union, county foresters, DNR wildlife managers, and local citizens to form a Sax-Zim working group to help deal with the infrastructure of

accommodating nature tourism in this sparsely settled area. It was the Grackle Junction model in action.

On July 29, 2005, a town meeting was held in the tiny community of Meadowlands and over 70 people showed up to learn about nature tourism and how to provide the goods and services for owl enthusiasts in future years. There were local mayors, county commissioners, county foresters, birds, local citizens, Minnesota Ornithologists' Union members, Duluth Audubon Club members, and biologists from the Department of Natural Resources. The Grackle Junction model for developing wildlife tourism was reaching critical mass and many improvements are anticipated for helping visitors in the future enjoy a lifetime experience as they come to view the area's "million dollar owls."

Appendix K
References by Chapter

Chapter 1

Groves, Craig. 2003. *Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity*. The Nature Conservancy. Washington, DC: Island Press.

Hunter, Malcolm L. 2005. A mesofilter conservation strategy to complement fine and coarse filters. *Conservation Biology*, *19*(4): 1025–1029.

Chapter 2

None

Chapter 3

See listing within chapter.

Chapter 4

None

Chapter 5

References used for the State Overview

Fagan, B. M. 1987. *The great journey: The peopling of ancient America*. New York: Thames and Hudson.

Gibbon, G. E. 1979. *The Mississippian occupation of the Red Wing area.* St. Paul: Minnesota Historical Society.

Hudak, G. Joseph, Elizabeth Hobbs, Allyson Brooks, Carol Ann Sersland, and Crystal Phillips. A predictive model of precontact archaeological site location for the State of Minnesota, final report. MN/DOT Agreement No. 73217, SHPO Reference Number 95-4098. Online at http://www.mnmodel.dot.state.mn.us.

Matsch, C. L. 1983. River Warren, the southern outlet of Glacial Lake Agassiz. In *Glacial Lake Agassiz*, edited by J. T. Teller and L. Clayton, 231–244. St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Department of Geology, Geological Association of Canada.

McMurry, Martha. 2002. Minnesota Department of Administration, State Demographic Center. MN Population Projections, 2000–2030. Online at http://www.demography.state.mn.us.

Minnesota Department of Natural Resources (2003). Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, MNDNR St Paul, MN.

Minnesota Department of Natural Resources (2005). Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, MNDNR St. Paul, MN.

Minnesota Department of Natural Resources (2005). Field Guide to the Native Plant Communities of Minnesota: The Prairie Parkland and Tallgrass Aspen Parklands Provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, MNDNR St Paul, MN.

Teller, J. T., and L. H. Thorleifson. 1983. The Lake Agassiz–Lake Superior connection. In *Glacial Lake Agassiz*, edited by J. T. Teller and L. Clayton, 26–90. St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Department of Geology, Geological Association of Canada.

Tester, John R. 1995. *Minnesota's natural heritage: An ecological perspective*. Minneapolis: University of Minnesota Press.

GIS datasources for Maps in subsection profiles

Grassland Bird Conservation Areas (GBCA). 2002. GIS dataset. Habitat and Population Evaluation Team (HAPET) , U.S. Fish and Wildlife Service, Fergus Falls, MN. http://www.fws.gov/midwest/hapet/GrasslandBirdMaps.htm Accessed June 28, 2005.

HAPET Landcover Classification. 2002. GIS dataset. Habitat and Population Evaluation Team (HAPET) , U.S. Fish and Wildlife Service, Fergus Falls, MN. http://www.fws.gov/midwest/hapet Accessed June 28, 2005.

Major River Centerline Traces in Minnesota. 1984. GIS dataset. Land Management Information Center, Minnesota Planning, St. Paul, MN. GIS Metadata Record for: Major River Centerline Traces in Minnesota, found under "Hydrography" at: http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MCBS Native Plant Communities. 2005. GIS dataset. MN Department of Natural Resources, Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, St. Paul, MN. GIS Metadata Record for: MCBS Native Plant Communities found under "Land Cover" at: http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MCBS Railroad Rights-of-Way Prairies. 1997. GIS dataset. MN Department of Natural Resources, Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, St. Paul, MN. GIS Metadata Record for MCBS Railroad Rights-of-Way Prairies found under "Land Cover" at: http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MN DNR 24K Lakes. 1990. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for DNR 24K Lakes found under "Hydrography" at" http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MN DNR 24K Rivers and Streams. 2005. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for DNR 24K Rivers and Streams found under "Hydrography" at: http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MN GAP Landcover. 1993. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for GAP Land Cover – Tiled Raster found under "Land Cover" at http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MN GAP Stewardship. 1995. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for GAP Stewardship found under "Ownership" at http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005. This dataset is still being developed and may have omissions.

Shallow Lakes in Minnesota. 2005. GIS dataset. Minnesota Department of Natural Resources. Shallow Lake Program. Website: http://www.dnr.state.mn.us/wildlife/shallowlakes/index.html Metadata unavailable.
The Nature Conservancy Rivers and Streams combined dataset. 2005. GIS dataset. The Nature Conservancy, Minnesota Chapter. Minneapolis, MN. Metadata unavailable.
Twin Cities Metro Regionally Significant Ecological Areas (RSEA). 2000. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for Twin Cities Metro Regionally Significant Ecological Areas found under "Land Cover" at: http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

Chapter 6

Annear, T. I., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jöbsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth, and C. Stalnaker. 2004. *Instream flows for riverine resource stewardship*. Cheyenne, WY: Instream Flow Council.
Breining, G. 1989. *Managing Minnesota's fish.* St. Paul: Minnesota Department of Natural Resources.
Conroy, T. 2005. *Shallow lakes: Hope for Minnesota's troubled waters*. St. Paul: Minnesota Department of Natural Resources.
Friedman, S. K., and P. B. Reich. 2005. Regional legacies of logging: departure from presettlement forest conditions in northern Minnesota. *Ecological Applications* 15(2): 726–744.
Marschner, F. J. 1930. Presettlement Vegetation. Minnesota Department of Natural Resources GIS Metadata Record for Presettlement Vegetation found under "Land Cover" at http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.
Minnesota Department of Natural Resources. 2003. Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, MNDNR St Paul, MN.
Minnesota Department of Natural Resources. 2005. Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, MNDNR St Paul, MN.
Minnesota Department of Natural Resources. 2006. Field Guide to the Native Plant Communities of Minnesota: The Prairie Parkland and Tallgrass Aspen Parklands Provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, MNDNR St Paul, MN.
Minnesota Department of Natural Resources, 2003. Minnesota's Native Plant Community Classification (version 2.0). Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, St. Paul, MN.
MN GAP Landcover. 1993. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for GAP Land Cover – Tiled Raster found under "Land Cover" at http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.
Owen, J. G. 1984. Sorex fumeus. *Mammalian Species* 215: 1–8.

Perry, David A., and Michael P. Amaranthus. 1997. Disturbance, recovery, and stability. In Kathryn A. Kohm and Jerry F. Franklin, eds., *Creating a forestry for the 21st century: The science of ecosystem management.* Washington, DC: Island Press.

Sample, David W., and Michael J. Mossman. 1997. Managing habitat for grassland birds - a guide for Wisconsin. Wisconsin Department of Natural Resources, Madison, WI, PUBL-SS-925-97. 154 pp. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/2002/wiscbird/wiscbird.htm (Version 03JUN2002).

Valley, R. D., T. K. Cross, and P. Radomski. 2004. *The role of submersed aquatic vegetation as habitat for fish in Minnesota lakes, including the implications of non-native plant invasions and their management*. Special Publication 160. St. Paul: Minnesota Department of Natural Resources.

Chapter 7

Almendinger, J. 1997. *Minnesota's bearing tree database*. Biological Report No. 56. St. Paul: Minnesota Department of Natural Resources.

Almendinger, J. C., and D. S. Hanson. 2004. *Changes in relative abundance of trees Between public land survey bearing trees circa 1900 and forest inventory and analysis plot trees circa 1990.* Unpublished ARCVIEW shapefiles and databases.

Anderson, J. P., and W. J. Craig, 1984. *Growing energy crops on Minnesota's wetlands: The land use perspective.* Publication CURA 84-3.95. Minneapolis: University of Minnesota, Center for Urban and Regional Affairs.

Dephilip, M. 2001. *Aquatic ecoregional planning in the U.S. portion of the Great Lakes watershed.* Great Lakes Program, The Nature Conservancy.

Friedman, S. K., and P. B. Reich. 2005. Regional legacies of logging: Departure from presettlement forest conditions in northern Minnesota. *Ecological Applications*. 15(2): 726–744.

Gagnon, P., P. Gerla, B. Schreurs, M. Cornett, M. Khoury, and J. Hall. 2004. *The Northern Tallgrass Prairie Ecoregion: A river and stream conservation portfolio.* The Nature Conservancy.

Groves, C. R. 2003. Drafting a conservation blueprint: A practitioner's guide to regional planning for biodiversity. Washington, DC: Island Press.

Hatch, J. T., K. P. Schmidt, D. P. Siems, J. C. Underhill, R. A. Bellig, and R. A. Baker. 2003. A new distributional checklist of Minnesota fishes, with comments on historical occurrence. *Journal of the Minnesota Academy of Science* 67: 1–17.

Higgins, J. V., M. T. Bryer, M. L. Khoury, and T. W. Fitzhugh. 2005. A freshwater classification approach for biodiversity conservation planning. *Conservation Biology* 19(2): 432–445.

Marschner, F. J. 1930. Presettlement Vegetation. Minnesota Department of Natural Resources GIS Metadata Record for Presettlement Vegetation found under "Land Cover" at http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

MN GAP Landcover. 1993. GIS dataset. Minnesota Department of Natural Resources. GIS Metadata Record for GAP Land Cover – Tiled Raster found under "Land Cover" at http://deli.dnr.state.mn.us/data_catalog.html Accessed June 28, 2005.

The Nature Conservancy, Prairie Forest Border Ecoregional Planning Team. 2000. The Prairie-Forest Border Ecoregion: A conservation plan. Madison, WI: The Nature Conservancy, Wisconsin Chapter.

Superior Mixed Forest Ecoregional Planning Team. 2002. The Superior Mixed Forest Ecoregion: A conservation plan. 75 pages + appendixes. Madison, WI: The Nature Conservancy.

USGS GAP Analysis Program. http://www.gap.uidaho.edu/

Valley, R. D., T. K. Cross, and P. Radomski. 2004. *The role of submersed aquatic vegetation as habitat for fish in Minnesota Lakes, including the implications of non-native plant invasions and their management.* Minnesota Department of Natural Resources Special Publication 160.

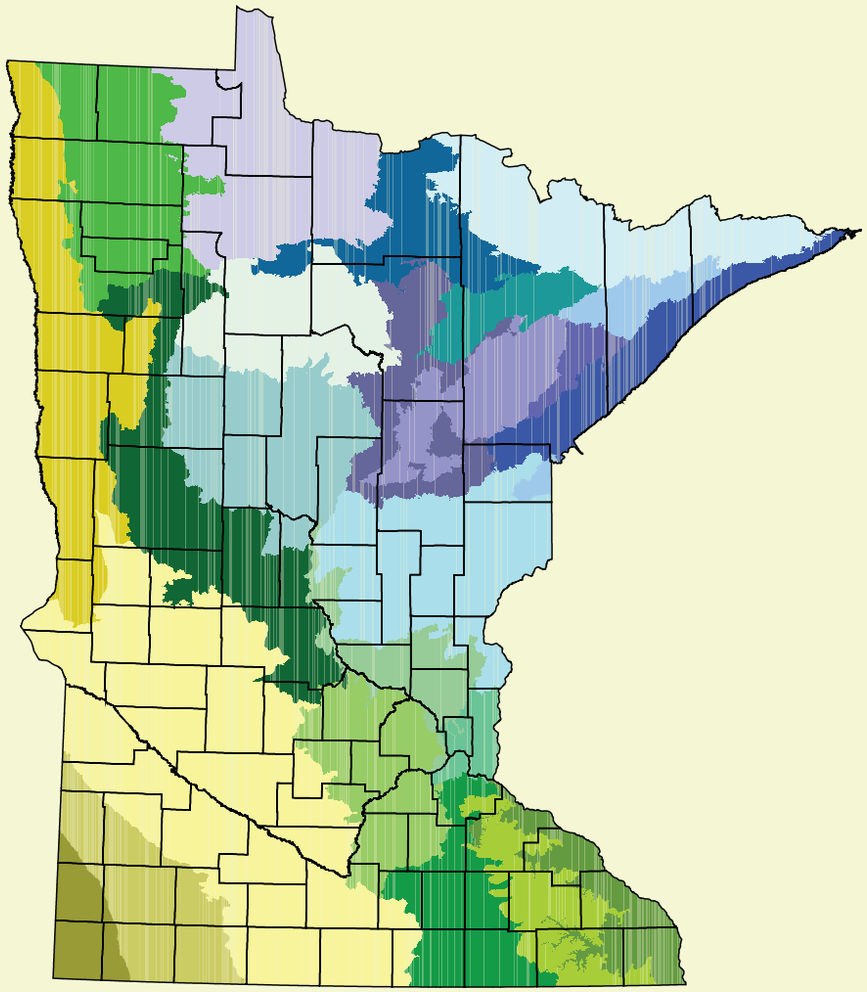
Weitzell, R. E., M. L. Khoury, P. Gagnon, B. Schreurs, D. Grossman, and J. Higgins. 2003. *Conservation priorities for freshwater biodiversity in the Upper Mississippi River Basin.* Arlington, VA: Nature Serve and The Nature Conservancy.

Our encounters with wildlife are as diverse as the neighborhoods and towns in which we live. We may listen in wonder to the mysterious yodel of common loons from a cabin in the north woods or delight in watching a tiger swallowtail as it visits our garden searching for nectar on a steamy August afternoon. Perhaps it's the blue racer we spot moving quietly across a limestone outcrop along the Mississippi River or the bubbly chatter of black-capped chickadees that visit our bird feeder after a January snowstorm. Regardless of where we live, we are surrounded by a rich variety of wildlife species native to Minnesota. These species not only contribute to our enjoyment of the outdoors, they also play a significant role in maintaining the health and long-term sustainability of Minnesota's lakes, rivers, wetlands, forests, and grasslands.

Ensuring that these species remain a prominent component of our natural world for generations to come is an increasingly complex challenge.

Lee Pfannmuller
from the Forward
January 2006

Tomorrow's Habitat for the Wild and Rare



Minnesota's Comprehensive Wildlife Conservation Strategy