Crane Meadows

National Wildlife Refuge

Comprehensive Conservation Plan Approval

Submitted by:

Anne Sittauer 8/25/10

Anne Sittauer
Refuge Manager

Date

Concur:

James T. Leach 9-13-10

James T. Leach
Refuge Supervisor, Area 3

Date

Richard D. Schultz 9/14/10

Richard D. Schultz
Regional Chief, National Wildlife Refuge System

Date

Approve:

Charles M. Wooley
Acting Regional Director

Charles Wooley 9/14/10

for Thomas O. Melius
~~Regional Director~~

Date

Crane Meadows
National Wildlife Refuge
Comprehensive Conservation Plan

Table of Contents

Executive Summary ..... **I**

Chapter 1: Introduction and Background **1**
- Introduction 1
- The U.S. Fish and Wildlife Service 4
  - Mission of the U.S. Fish and Wildlife Service 4
- The National Wildlife Refuge System 4
  - Mission of the National Wildlife Refuge System 4
  - Goals of the National Wildlife Refuge System 4
- Laws and Directives for Refuge Planning 5
- Purpose of a Comprehensive Conservation Plan 5
- Refuge History and Establishment 6
- Refuge Purposes 7
- Refuge Vision 8
  - Crane Meadows NWR Vision Statement 8

Chapter 2: The Planning Process **9**
- The CCP Planning Process 9
  - Preplanning 9
  - Scoping 9
    - Habitat 10
    - Land Acquisition 10
    - Water Resources 11
    - Wildlife 11
    - Visitor Services 11
      - Hunting 11
      - Fishing 11
      - Environmental Education 11
      - Trails 12
      - Facilities 12
    - Archaeological Resources 12
    - Support 12
  - Alternatives Development 12
- Preparation, Review, and Finalization of the CCP 12
- Wilderness Review 13

Chapter 3: Refuge Environment and Current Management **14**
- ***Section 1 – Refuge Environment*** ***14***
- Introduction 14
  - Other Units Administered 14
    - Farm Services Administration Conservation Easements 14

The Local Conservation Landscape 15
Ecological Context 20
Historic Vegetation 23
Current Land Use / Land Cover 25
Migratory Bird Conservation Initiatives 25
North American Waterfowl Management Plan 27
North American Landbird Conservation Plan 29
U.S. Shorebird Conservation Plan (2001) 32
North American Waterbird Conservation Plan (2002) 32
Region 3 Fish and Wildlife Conservation Priorities 32
Minnesota Comprehensive Wildlife Strategy 33
Strategic Habitat Conservation 33
Landscape Conservation Cooperatives 34
Conservation Corridors and Green Infrastructure 34
Socioeconomic Setting 38
Population, Demographics, and Housing 38
Employment and Income 38
Education 40
Economic Value of Crane Meadows to the Regional Economy 40
Potential Refuge Visitation 40
Climate 41
Air Quality 42
Criteria Air Pollutants 42
Hazardous Air Pollutants 42
Geology and Soils 43
Major Soil Constituents 43
Minor Soil Constituents 46
Water and Hydrology 48
Wild Rice 50
Refuge Habitats 54
Wetlands and Open Water 55
Woodlands 57
Oak Savanna 57
Grasslands 61
Agriculture 61
Refuge Wildlife 61
Birds 61
Mammals 62
Amphibians and Reptiles 63
Fish 63
Threatened and Endangered Species 63
Animals 63
Plants 63
Threats to Resources 64
Agricultural Development 64
Animal Barns and Poultry Houses 64
Center Pivot Irrigation 64
Tiling, Channelization, and Draining 64

Invasive Species 64
Urban and Residential Development 65
Contaminants 65
Climate Change 65
Mitigation and Adaptation 67
Climate Trends of the Past Century 67
Climate Projections for the Next Century 68
Midwest Key Issues 69
Water Resources 69
Agriculture 69
Changes in Semi-natural and Natural Ecosystems 69
Outdoor Recreation 70
Administrative Facilities 70
Cultural Resources 70
Section 2 – Current Management 72
Habitat Management 72
Wetlands 72
Open Water 72
River/Streams 72
Emergent Marsh 72
Sedge Meadow 72
Willow-dogwood Shrub Swamp 72
Northern Floodplain Forest 72
Uplands 72
Grasslands (Southern Dry Prairie, Southern Mesic Prairie, and Wet Prairie) 72
Oak Savanna (Southern Dry Savanna) 74
Woodlands (Oak, Oak-Aspen, and Jack Pine) 74
Agriculture (Cropland/Pasture) 74
Fish and Wildlife Management and Monitoring 74
Migratory and Resident Birds 74
Native Resident Wildlife 75
Fish and Other Aquatic Resources 75
Habitat Monitoring and Management 75
Visitor Services 76
Hunting 76
Fishing 76
Wildlife Observation and Photography 76
Interpretation and Programs 76
Habitat Day 76
Platte River Clean-up 78
Bat Program 78
Bird Tour 78
Environmental Education and Outreach 78
Friends Group 78
Volunteer Program 78
Partnerships 78
Cultural Resources 79
Private Lands Program (Partners for Fish and Wildlife) 80
Law Enforcement 81

Staff and Budget 81

Chapter 4: Management Direction 82
Goal 1: Habitat 82
Goal 2: Wildlife 94
Goal 3: People 97

Chapter 5: Plan Implementation 105
Introduction 105
Funding 105
New and Existing Projects 106
Staffing 106
Partnerships 107
Step-Down Management Plans 107
Monitoring and Evaluation 107
Plan Review and Revision 108

Appendix A: Finding of No Significant Impact 109
Appendix B: Glossary 113
Appendix C: Lists of Species Occurring on Crane Meadows NWR 115
Appendix D: Regional Conservation Priority Species 145
Appendix E: Deferred Maintenance and Improvement Projects 155
Appendix F: Compliance Requirements 157
Appendix G: Compatibility Determinations 163
Appendix H: Appropriate Use 183
Appendix I: References Cited 187
Appendix J: List of Preparers and Contributors 193
Appendix K: Crane Meadows NWR CCP Communications List 195
Appendix L: Oak Savanna Definition 197

List of Figures

Figure 1: Location of Crane Meadows NWR 2
Figure 2: Land Ownership, Crane Meadows NWR 3
Figure 3: FSA Easements Administered by Crane Meadows NWR 16
Figure 4: Surrounding Conservation Lands, Crane Meadows NWR (1) 17
Figure 5: Surrounding Conservation Lands, Crane Meadows NWR (2) 18
Figure 6: Ecological Context, Crane Meadows NWR 21
Figure 7: Minnesota's Ecological Subsections and Landtype Associations 22
Figure 8: Presettlement Vegetation Based on the Marschner Map, Crane Meadows NWR 24
Figure 9: Soil Survey Vegetation Data, Crane Meadows NWR 26
Figure 10: Land Cover Within a 10-mile Radius of Crane Meadows NWR 28
Figure 11: Land Cover Within Crane Meadows NWR 30
Figure 12: Ecological Regions Related to Crane Meadows NWR 31
Figure 13: Diagram of the Strategic Habitat Conservation Framework 34
Figure 14: U.S. Fish and Wildlife Service Landscape Conservation Cooperatives 35
Figure 15: Biophysical Suitability Model Results for Green Infrastructure 36
Figure 16: Social Suitabililty Model Results for Green Infrastructure 37
Figure 17: Green Infrastructure Hubs and Links with Conservation Lands 39
Figure 18: Soil Survey Farmland Status, Crane Meadows NWR 44
Figure 19: Soil Survey Drainage Classes, Crane Meadows NWR 45
Figure 20: Soil Types, Crane Meadows NWR 47
Figure 21: Platte-Spunk Watershed 49
Figure 22: Federal Emergency Management Agency Floodplain Map, Crane Meadows NWR 51
Figure 23: Land Cover in the Platte-Spunk Watershed 52
Figure 24: Water Quality Monitoring Sites, Crane Meadows NWR 53
Figure 25: National Wetland Inventory Wetland Vegetation Classes, Crane Meadows NWR 59
Figure 26: Refuge Vegetation Based on 2006 Imagery, Crane Meadows NWR 60
Figure 27: Development Near Crane Meadows NWR 66
Figure 28: Refuge Unit Names, Crane Meadows NWR 73
Figure 29: Existing Visitor Services Facilities, Crane Meadows NWR 77
Figure 30: Desired Future Land Cover, Crane Meadows NWR 85
Figure 31: Existing Upland Habitat Source Areas, Crane Meadows NWR 88
Figure 32: Original Acquisition Priorities (1992), Crane Meadows NWR 93
Figure 33: Future Visitor Services Facilities, Crane Meadows NWR 98

List of Tables

Table 1: Land Acquisition History at Crane Meadows NWR 7
Table 2: Marschner's Pre-settlement Vegetation 25
Table 3: Potential Vegetation Derived from Soil Survey (SSURGO) Information 27
Table 4: Land Cover Types in the Vicinity of Crane Meadows NWR 29
Table 5: Potential Visitation to Crane Meadows NWR in Five Categories 40
Table 6: Outdoor Recreation Activities of Minnesota Adults 41
Table 7: Soils Present at Crane Meadows NWR 46
Table 8: Wild Rice Productivity at Crane Meadows NWR (2008) 54
Table 9: Habitats Found at Crane Meadows NWR 56
Table 10: Vegetation Cover Type Reclassification 58
Table 11: Refuge Contributions to Climate Change Mitigation and Adaptation 68
Table 12: Refuge Visitation – Crane Meadows National Wildlife Refuge 76
Table 13: Volunteerism at Crane Meadows National Wildlife Refuge 78
Table 14: Morrison County Private Lands Program Accomplishments 81
Table 15: Six-year Operations and Maintenance Budget 81
Table 16: Benchmark Conditions for Habitat Types, Crane Meadows NWR 83
Table 17: Habitat: Current and Proposed, Crane Meadows NWR 84
Table 18: Burn Cycles for Crane Meadows NWR Habitat Types 92
Table 19: Wildlife Monitoring at Crane Meadows NWR 95
Table 20: Future Visitor Services Facilities 97
Table 21: Additional Staffing Needs at Crane Meadows NWR 104
Table 22: New Project List, Crane Meadows NWR 106
Table 23: Current and Proposed Staffing as Indicated by the 2008 NWRS Staffing Model 107

Executive Summary

The wetland complex we know today as Crane Meadows National Wildlife Refuge (NWR) has been important to wildlife and people for thousands of years. The Refuge is located in central Minnesota and falls within a transitional zone between tallgrass prairie and deciduous forest (Figure 1). The area of the Refuge is a mosaic of open water, wetlands, floodplain forest, wet prairie, dry prairie, savanna, upland conifer and deciduous forest. The diversity of habitat is matched by a diversity of wildlife.

Established in 1992, Crane Meadows NWR has acquired just over 1,800 acres of the approved 13,540-acre acquisition area. Approximately 900 acres are owned and managed by the state of Minnesota, and the remaining land is privately owned.

A Comprehensive Conservation Plan (CCP) has been prepared for the Refuge that will guide management decisions over the next 15 years. The CCP will ensure that the Refuge plays a role in fulfilling the mission of the U.S. Fish and Wildlife Service (Service) and the mission of the National Wildlife Refuge System (NWRS), as well as fulfill the established purposes of Crane Meadows NWR.

A 30-day public review and comment period for the Draft CCP provided an opportunity for everyone who cares about the Refuge and its future management – neighbors, local and state government, tribal government, non-governmental organizations, and outdoor enthusiasts – to see how the Service proposes to manage Crane Meadows NWR.

During the planning process, all factors of a refuge are discussed and evaluated by Service employees, partners, stakeholders, and the public with regard to species, habitats, visitor services, facilities, operations, and other relevant issues. A range of alternative management options are then defined and presented to partners, stakeholders, and the public during the planning process in order to identify and define the most suitable, or 'preferred' management plan for the Refuge. The CCP describes the results of that process and the details of the preferred alternative. In this document, the broad goals of the preferred alternative are defined and measureable objectives are identified to support each goal. Specific implementation strategies are also identified to meet these goals and objectives within the 15-year timeframe.

Summary Figure 1: Location of Crane Meadows NWR

Three goals were identified for Crane Meadows NWR:

- *Goal 1: Habitat*

  Conserve a diverse mosaic of habitats both on- and off-Refuge, particularly sedge meadow,

Crane Meadows NWR's 2008 Habitat Day. Photo Credit: FWS

shallow lake, oak savanna, prairie, and other declining endemic habitat types, to meet the needs of native plants and wildlife with emphasis on Service Regional Conservation Priority Species. Crane Meadows NWR will remain engaged in efforts to protect and enhance water quality and natural hydrology in the watershed.

- *Goal 2: Wildlife*

  Protect, restore, and maintain native wildlife species to ensure biological diversity and abundance, with special emphasis on Service Regional Conservation Priority Species.

- *Goal 3: People*

  As an active partner in collaborative conservation, the Refuge will provide quality wildlife-dependent recreation, environmental education, and outreach to a diverse audience. These activities will preserve cultural resources and promote understanding, appreciation, and support for Crane Meadows NWR, the National Wildlife Refuge System, and natural resource conservation.

Objectives

The objectives are designed to guide the Refuge toward the accomplishment of each goal. Additional information, including rationales and strategies and all tables and figures, can be found in Chapter 4 of this document.

The goals and objectives of this plan are the management framework that provides direction and continuity in Refuge programs over the next 15 years. Strategies and management activities are suggested in this plan as ways to achieve specific objectives. However, the planning process is an iterative and adaptive cycle, making this CCP a living document. A variety of different management applications may be adopted as technology improves, new information becomes available, and new approaches to natural resource conservation are created.

Habitat Goal

Objective 1.1: Wetlands

Maintain existing wetland habitat, and restore disturbed, altered, or degraded wetland areas where feasible within 5 years of acquisition.

Over the long term (100-plus years) within the full Refuge acquisition boundary, maintain existing and restore drained or degraded wetland habitats in suitable areas to the desired benchmark conditions to achieve a minimum of 8,000 acres (approximately 60 percent of the Refuge) in a mosaic of wetland habitats with the approximate desired acreages targets displayed in Table 1. (see Figure 2 on page IV of this Summary.)

Objective 1.2: Upland Prairie

Over the life of the plan:

Seed all newly acquired disturbed, altered, or degraded upland areas to prairie (as a transition step for southern dry savanna restoration) using local ecotype seed characteristic of savanna within 5 years of acquisition.

Restore 20 percent (approximately 75 acres) of Service-owned upland prairie habitat to southern dry savanna.

Within 3 years of plan approval identify the highest quality Service-owned upland prairie habitat to retain (see Figure 3 on page V for a map of existing upland prairies on the Refuge). Work in these areas to improve vegetation structure and composition to desired benchmark habitat conditions and develop quality prairie seed source areas. Benchmark habitat conditions are described in Table 16 on page 83.

Summary Table 1: Habitat Vegetation: Current and Proposed, Crane Meadows NWR

Habitat Type	Habitat[a]	Service-owned Acres (1,800)		Total Acquisition Boundary Acres (13,540)	
		Current[b]	Approximate 15-Year Objective[c]	Current	Approximate Long-term Objective (100+ years)
Wetland	Open Water	18	18	150	150
Wetland	River/Stream	3 miles	3 miles	32 miles	32 miles
Wetland	Emergent Marsh	100	100	1,600	1,600
Wetland	Sedge Meadow	460	460	2,640	3,350
Wetland	Willow-Dogwood Shrub Swamp	410	410	2,500	2,500
Wetland	Southern Rich Conifer Swamp	0	0	0	100
Wetland	Northern Floodplain Forest	50	50	435	300
Upland	Prairie (Wet, Southern Mesic, and Southern Dry)	380	305	910	500
Upland	Southern Dry Savanna	5	210	185	4,700
Upland	Jack Pine Woodland	10	5	85	0
Upland	Oak Woodland	200	100	1,180	300
Upland	Oak-Aspen Woodland	65	33	670	0
Upland	Agriculture	10	0	2,940	0
Upland	Conifer Plantation	10	0	200	0

a. *Refuge vegetation was identified and quantified during a 2006 aerial imagery project conducted by the Service. Habitat classes were later standardized using plant communities described the Minnesota DNR's Field Guide to the Native Plant Communities; Eastern Broadleaf Forest Province (2005).*

b. *Current habitat acreages for both existing fee-title and acquisition boundary are approximate and based on GIS area calculations.*

c. *These numbers only account for land currently-owned by the Service, and will change with any new land acquisitions made by the Service over the 15-year planning period.*

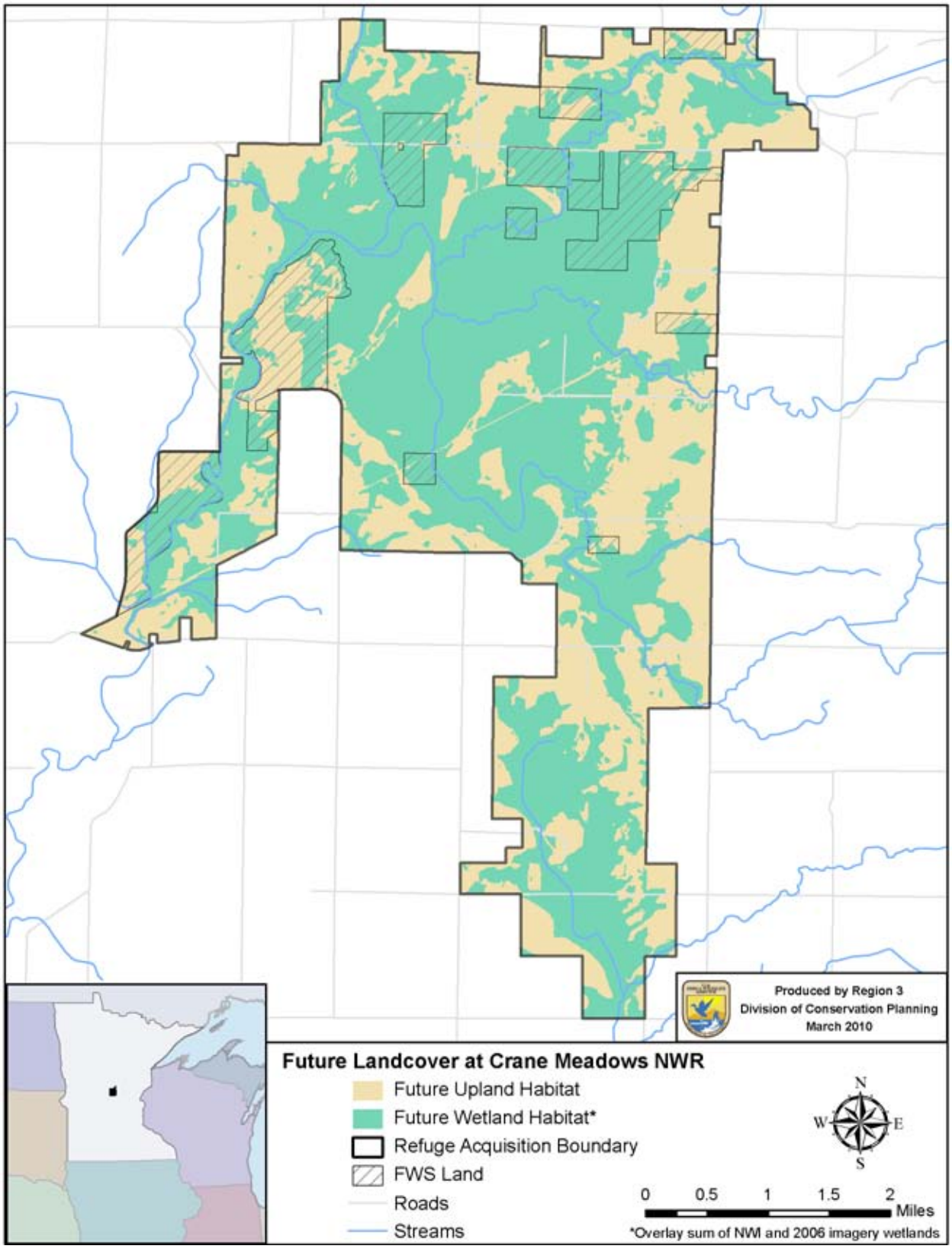
Over the long term (100-plus years) within the full Refuge acquisition boundary, maintain a minimum of 4 percent (approximately 500 acres) upland prairie habitat at desired benchmark habitat conditions, transitioning the remaining 3 percent (approximately 400 acres) to southern dry savanna.

Objective 1.3: Southern Dry Savanna (Oak and Jack Pine)

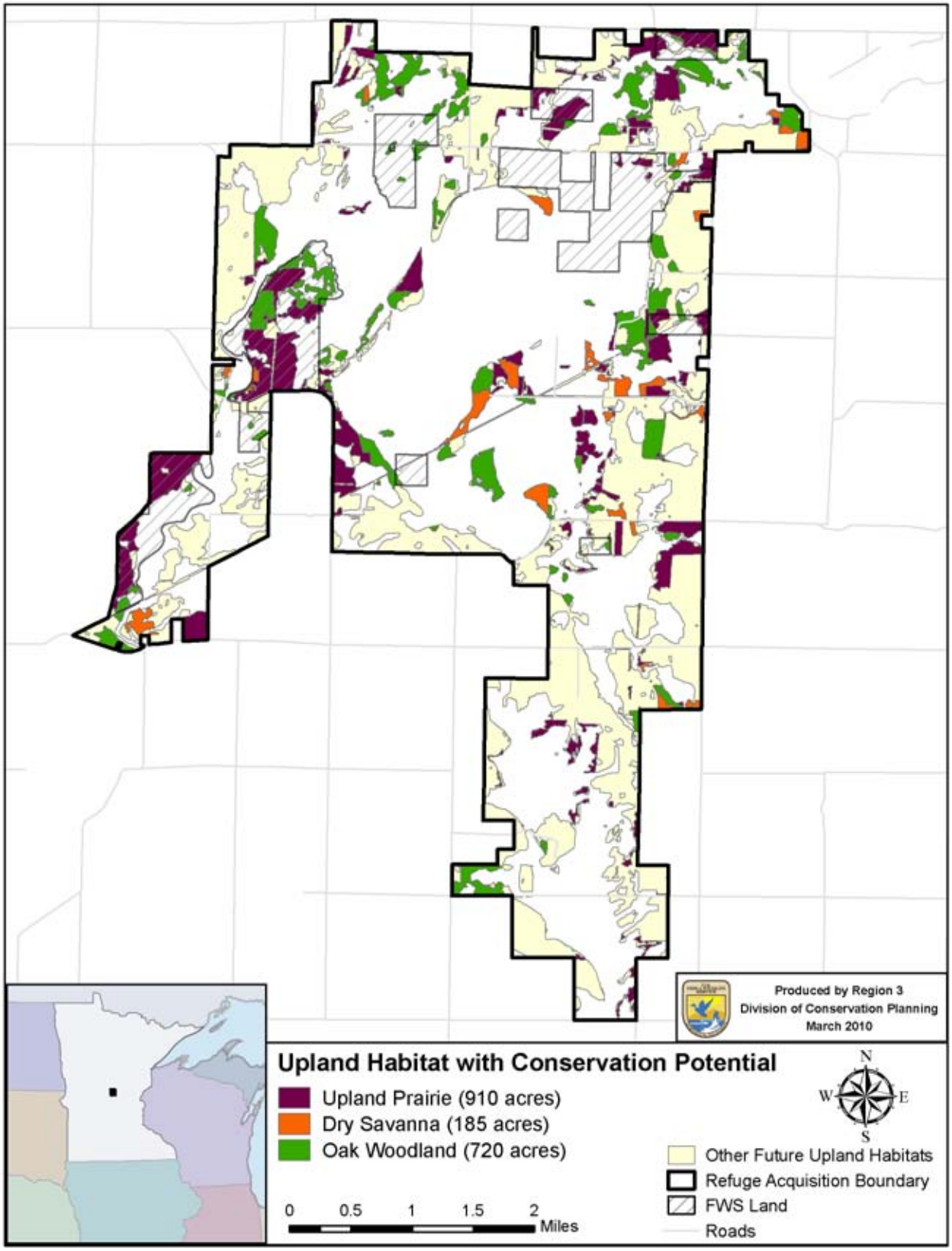
Over the life of the plan, begin restoring southern dry savanna habitat to desired benchmark conditions (see Table 16 on page 83) on 30 percent (approximately 210 acres) of the total Service-owned land. This acreage will come from suitable existing upland prairie (approximately 75 acres) and oak woodland (approximately 135 acres) habitats.

Over the long term (100-plus years) within the full Refuge acquisition boundary, establish and maintain a minimum of 35 percent (approximately 4,700 acres) southern dry savanna habitat (see Figure 3 on page V). Existing oak savanna will be retained (~200 acres), and restoration will occur on existing upland prairies (~400 acres), oak woodlands (~1,550 acres), conifer forests and plantations (~300 acres), and agricultural areas (~2,250 acres).

Summary Figure 2: Desired Future Land Cover, Crane Meadows NWR



Summary Figure 3: Existing Upland Habitat Source Areas, Crane Meadows NWR



Objective 1.4: Oak Woodland

Within 3 years of plan approval identify the highest quality Service-owned oak woodland habitat to retain (see Figure 3 on page V for a map of existing oak woodlands). Begin thinning 50 percent of those stands outside the highest quality oak woodlands selected to be retained to the desired basal area (ranging from 5 to 50 square feet/acre) and species composition for southern dry savanna habitat.

Over the long term (100-plus years) within the full Refuge acquisition boundary, reduce coverage of oak woodland to 2 percent (approximately 300 acres), transitioning approximately 1,550 acres to southern dry savanna. See Appendix L for a complete description of the desired habitat.

Objective 1.5: Water Resource Monitoring, Management, and Watershed Conservation

Within 5 years of plan approval, begin regular monitoring of the five major streams passing through the Refuge acquisition boundary. Work with partners to improve water quality with the long-term goal of removing all Refuge waters from state impaired waters lists.

Objective 1.6: Prescribed Fire

Implement and monitor a rotational prescribed burn program over the life of the plan, according to historic guidelines, that supports fire-dependent vegetation communities on the Refuge and reduces hazardous fuel loads.

Objective 1.7: Land Acquisition

Within 3 years of plan approval, update the land acquisition priority map created for the environmental assessment that established the Refuge. Over the life of the plan, increase efforts to make land acquisitions from willing landowners in high priority areas.

Objective 1.8: Partners Program and FSA Easements

Over the life of the plan, conduct a minimum of 100 habitat improvement projects through the Partners program within Morrison County, specifically targeting areas within, and upwatershed of the Refuge acquisition boundary. Ensure compliance of all properties with FSA easements (annual monitoring) and Partners program volunteer agreements (5-year monitoring cycle).

Wildlife Goal

Objective 2.1: Federal and State Threatened and Endangered Species and/or Regional Species of Conservation Priority

Participate in larger state and federal wildlife population monitoring efforts for species of conservation concern. Within 5 years of plan approval, develop and implement monitoring programs for the Bald Eagle and Blanding's turtle.

Objective 2.2: Migratory Birds

Participate in larger state and federal wildlife population monitoring efforts. Over the life of the plan, conduct periodic monitoring of marsh birds, songbirds, and other migratory bird species.

Objective 2.3: Native Plant Species

Within 5 years of plan approval, collaborate with the Minnesota DNR and other partners to conduct baseline inventories of plant species on the Refuge.

Objective 2.4: Invasive and Exotic Plant Species

Within 5 years of plan approval, conduct a comprehensive survey to assess the extent of invasive plant species on Service-owned Refuge lands. Within 10 years no more than 10 percent of acquired Refuge lands will be affected by invasive plant species.

Objective 2.5: Wild Rice

Keep informed of the wild rice trends in the wetland complex and assist with monitoring and documenting wild rice trends through routine Service aerial imagery vegetation surveys.

People Goal

Objective 3.1: Welcoming and Orienting Visitors

Bring all Refuge literature, web resources, kiosks, and directional signage into compliance with Service standards within 10 years of plan approval, and expand welcoming and orienting facilities at locations described in Table 2 on page VIII and illustrated in Figure 4 on page VII.

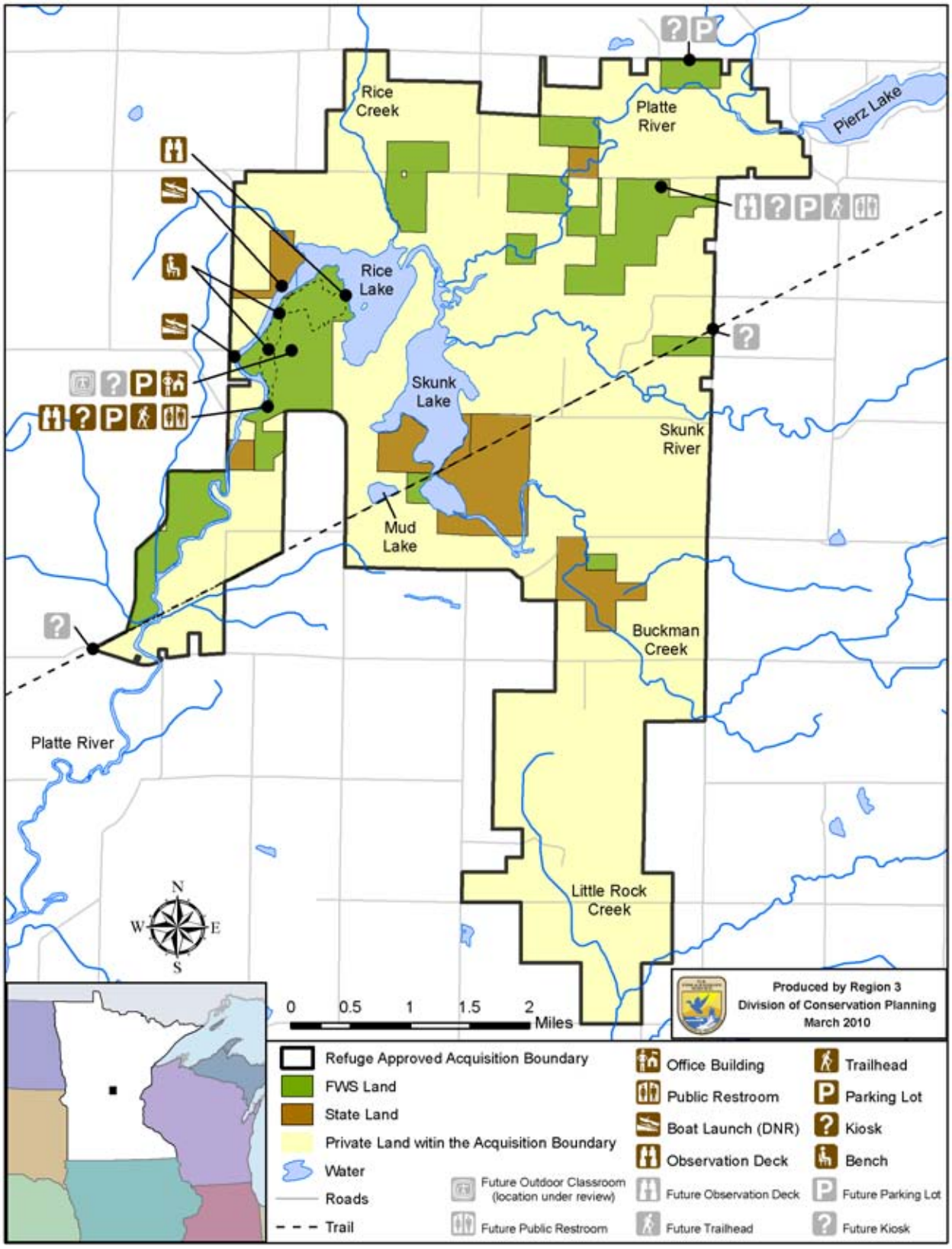
Objective 3.2: Hunting

Within 5 years of plan approval, work with partners to open managed white-tailed deer and turkey hunts on specified Refuge units for hunters with disabilities and for youth hunters.

Objective 3.3: Fishing

Within 3 years, evaluate the potential to establish seasonal bank fishing opportunities on the Platte River West Unit; over the life of the plan

Summary Figure 4: Future Visitor Facilities, Crane Meadows NWR



Summary Table 2: Visitor Services Facilities Needs

Unit	Additional Facilities	Timeframe
Headquarters	Kiosk (near office), outdoor classroom	5 years
Highway 27	Directional signage, kiosk, parking area	10 years
Soo Line East[a]	Kiosk	15 years
Platte River West	Kiosk	15 years
Sedge Meadow	Kiosk, observation platform, trail/boardwalk, parking area, restroom	15 years

a. The facilities at these locations will require partnerships with Morrison County Trail Association, Minnesota DNR, and private landowners.

evaluate the potential for new bank fishing opportunities as additional properties are acquired.

Objective 3.4: Wildlife Observation and Photography

Over the life of the plan, maintain existing wildlife observation and photography infrastructure and opportunities, and expand and promote opportunities along the Soo Line Trail corridor and on the Sedge Meadow Unit to correspond to a 20 percent increase in Refuge visitation from 2009 levels (see Table 2).

Objective 3.5: Environmental Education and Interpretation

Increase Refuge environmental education and interpretation provision from 2009 levels, specifically:

Increasing participation in programs by 20 percent within 15 years.

Establishing new interpretive displays that convey key habitat, wildlife, and other natural resource messages to visitors on the following Refuge units: Highway 27, Sedge Meadow, Platte River West, and Soo Line East (see Table 2).

Habitat Day, Crane Meadows NWR. Photo credit: FWS

Objective 3.6: Outreach and Partnerships

Maintain relationships with current partners and existing outreach activities, and identify and participate in at least 10 new outreach opportunities or community activities over the life of the plan to increase collaboration, improve the public understanding of Crane Meadows NWR and the Refuge System, and reinforce the importance of natural resource conservation.

Objective 3.7: Cultural Resource Management

Over the life of the plan, work to protect all cultural, historic, and archaeological resources on the Refuge.

Objective 3.8: Volunteers and Friends Group

Over the life of the plan, increase Friends group membership by 10 percent, increase the 3-year moving average of annual service hours contributed by volunteers an average of 1 percent per year, and increase volunteer opportunities related to resource monitoring, environmental education, partnership development, land protection, and visitor services.

Objective 3.9: Law Enforcement

Work with local police authorities, state conservation officers, and law enforcement officers from other national wildlife refuges to ensure visitor safety and resource protection. Work to minimize the potential for incidents, violations, and other illegal activities on the Refuge.

Objective 3.10: Staffing

Increase staffing from the existing two positions to the four positions projected by the 2008

Region 3 staffing model to accomplish the work set forth by the CCP.

Environmental Assessment

The comprehensive conservation planning process as guided by the National Environmental Policy Act (NEPA), calls for the consideration of alternative management scenarios. Three management alternatives were developed as a part of the Environmental Assessment included in the Draft CCP (see http://www.fws.gov/midwest/planning/CraneMeadows).

The first alternative for the future management of Crane Meadows NWR, Alternative A, depicts a continuation of current Refuge management, or a 'no action' scenario, as required by NEPA. In the case of Crane Meadows NWR, land acquisition is minimal, conservation work on private lands is extensive, and both occur opportunistically. As land is acquired quality habitats are maintained in their current state, degraded habitats are improved or restored, and all habitats are considered to have relatively equal priority. There is an active prescribed fire program, and little involvement with local water resources which are under the jurisdiction of the state. Wildlife management is minimal, and monitoring efforts follow existing, broader state and federal efforts. Visitor use is concentrated on a single Refuge property, the Headquarters Unit, and consists of wildlife observation, photography, hiking, cross-country skiing, and snowshoeing as seasons and trail conditions allow. No hunting or fishing is permitted. There are half a dozen annual programs, supported by an active Refuge Friends Group and local volunteers. Staff is limited to two positions: refuge wildlife specialist and maintenance.

The second alternative, Alternative B, portrays a long-term vision for habitat restoration to near-historic benchmark conditions and increases recreation opportunities for visitors over the 15-year planning horizon. Historic and other ecological data is used to identify desired quantities of individual habitat types for the entire Refuge acquisition boundary. A diversity of wetland and savanna habitats is favored to reinforce historic conditions, while prairie and woodland are reduced over the long-term. This alternative includes active participation in monitoring and improving the upstream water resources that affect the Refuge, and calls for adherence to a well-developed prescribed fire plan. Land acquisition and work on private lands increases, and targets high priority areas. Biological inventory and monitoring increase for wildlife species of concern, guilds of birds, native plants, and invasive species. Visitor services are offered at a greater number of locations. In addition to increasing facilities on the Headquarters Unit, new opportunities are provided along Highway 27 on the northern boundary of the Refuge, along the county-maintained Soo Line Recreational Trail, and on the Sedge Meadow Unit. Specific, managed hunts are offered, and opportunities for quality fishing experiences will be evaluated as new lands are acquired. It is projected that these changes and new opportunities will result in increased visitation to the Refuge, increased attendance in Refuge programs and events, and increased participation in Friends Group and volunteer roles. This alternative also calls for full staffing at Crane Meadows NWR, including four positions: refuge wildlife specialist, biologist, administrative assistant, and maintenance.

The third alternative, Alternative C, retains many of the concepts and objectives from Alternative B, but increases the emphasis given to water resources both on-Refuge and in the watershed upstream of the wetland complex. This alternative more directly addresses the principal establishing purpose of the Refuge, for '... the conservation of the wetlands of the Nation…', and seeks to maximize efforts to understand, protect, and conserve the water resources that affect the Refuge's rare and unique wetland complex. Using Alternative B as a base, Alternative C restores additional wetland and upland acres up-watershed of the Refuge, expands water resource monitoring and improvement activities throughout the east half of the Platte-Spunk watershed, targets a limited quantity of additional lands with critical water resource value adjacent to the existing Refuge boundary for acquisition, increases and directs private lands work to priority aquatic and riparian areas upstream of the Refuge, emphasizes fishing as a primary recreation opportunity, directs additional education and interpretation efforts to water resource topics, and highlights partnerships, outreach opportunities, and volunteerism that occur within, or directly affect the Refuge's watershed.

Aerial view of the Platte River 40 Unit, Crane Meadows NWR. Photo credit: FWS

Alternative B was selected as the preferred management option, and used to draft this CCP. The CCP based on this alternative presents the most viable combination of goals, objectives, and strategies that we believe will best achieve the Refuge vision, contribute to the NWRS mission, fulfill Refuge purposes and legal mandates, address key issues, incorporate sound principles of natural resource management, and serve the American public now and into the future. The CCP will guide management decisions and actions on the Refuge over the next 15 years and will be used as a tool to help natural resource agencies, conservation partners, local communities, and the public understand our priorities.

Chapter 1: Introduction and Background

Introduction

Established in 1992 to conserve and protect the diminishing number of high quality wetlands that remain on the American landscape, Crane Meadows National Wildlife Refuge (NWR) is not only the location of one of the most intact wetland complexes in the state; it also protects and maintains important wildlife, recreation, and archaeological resources.

This Comprehensive Conservation Plan (CCP) establishes a blueprint for how the U.S. Fish and Wildlife Service will manage Crane Meadows NWR over the next 15 years. By establishing goals for Refuge management and identifying objectives and strategies for achieving those goals, the Refuge's neighbors, the Minnesota Department of Natural Resources, Friends of Crane Meadows NWR, and others with an interest in the Refuge's future will have a clear picture of how the Service proposes to manage the Refuge and a rationale for that management.

Located in central Minnesota (see Figure 1 on page 2), Crane Meadows NWR falls in a transition zone between the northern forests and the mid-continental prairies and is situated on the Anoka Sand Plain only 5 miles from the Mississippi River. The critical and diverse wetland habitats characteristic of the Upper-Midwest provide important habitat for local and migratory wildlife, maintain essential ecological services, provide an element of water control and flood relief, and offer unique recreation, education, and research opportunities.

Presently, the Service has acquired just over 1,800 acres of the approved 13,540-acre acquisition area. Approximately 900 acres are owned and managed by the state, and the remaining land is privately owned (see Figure 2 on page 3). The resulting landscape is a mosaic of land ownership and land-use types surrounded predominantly by agriculture.

The Refuge is home to many native species and serves as a nesting ground and stopover location for several notable migratory bird species including the Greater Sandhill Crane. The Refuge also contains relatively rare habitat types including oak savanna, sand prairie and sedge meadows.

Horned Grebes. Photo credit: Beau Liddell

The first chapter of this plan presents the organizational, legal, and policy context of the U.S. Fish and Wildlife Service and the National Wildlife Refuge System. Also included in Chapter 1 is the establishment of the Refuge, its history, purpose, and vision. Chapter 2 outlines the process used to write this plan, and describes the major issues pertaining to management at Crane Meadows. Chapter 3 describes the Refuge in detail, including the current management program. In Chapter 4, the future management of the Refuge as defined in the preferred alternative of the Environmental Assessment is described. This chapter also describes the goals, objectives, and strategies chosen for implementation. Chapter 5 describes how the goals and objectives of the plan will be accomplished in terms of projects, staff, partnerships, and further planning needs. The appendices present detailed information not included in the narrative portion of the plan, including planning term definitions, all cited references, compliance requirements, refuge appropriate use and compatibility determinations, and lists of species, stakeholders, and projects.

Figure 1: Location of Crane Meadows NWR

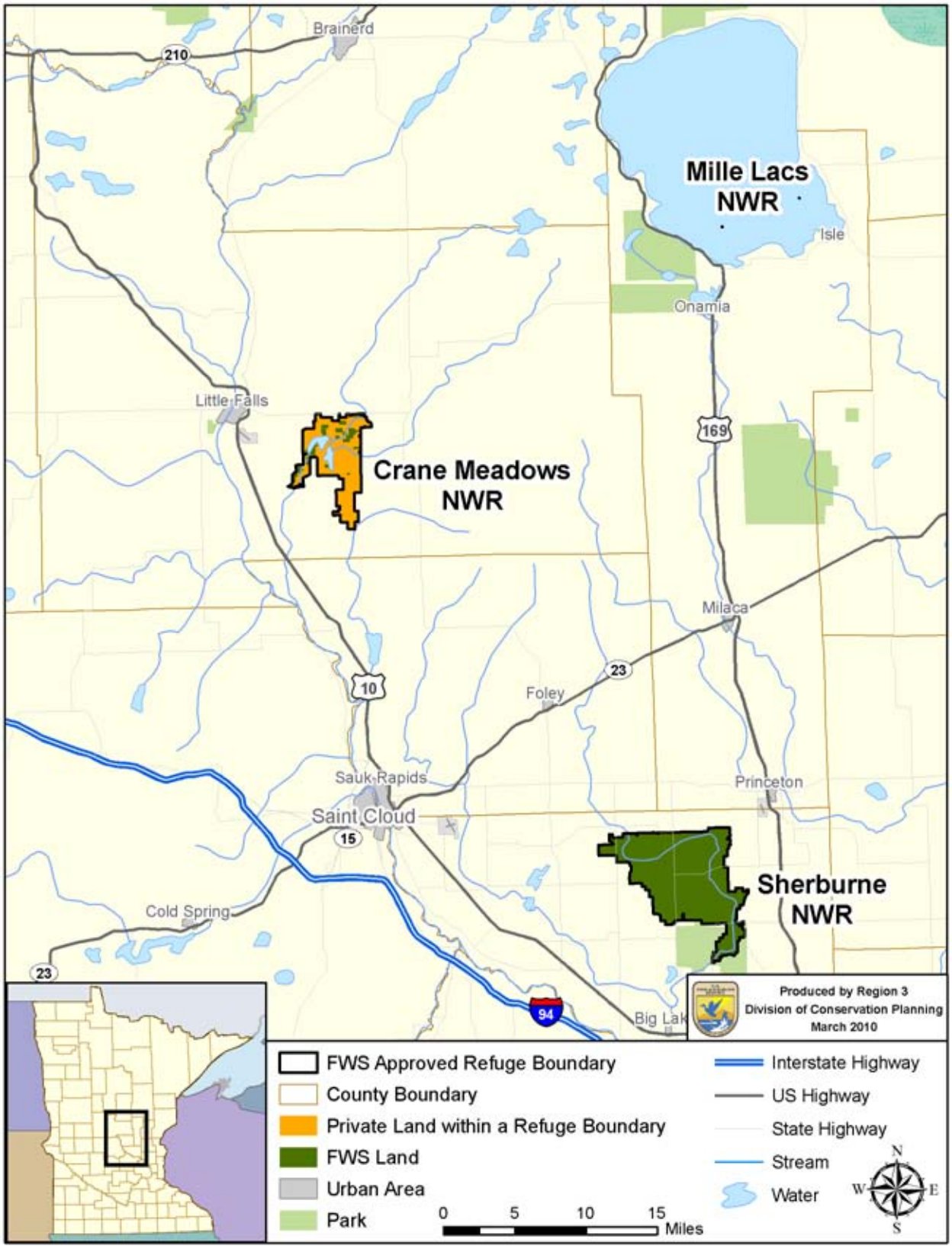
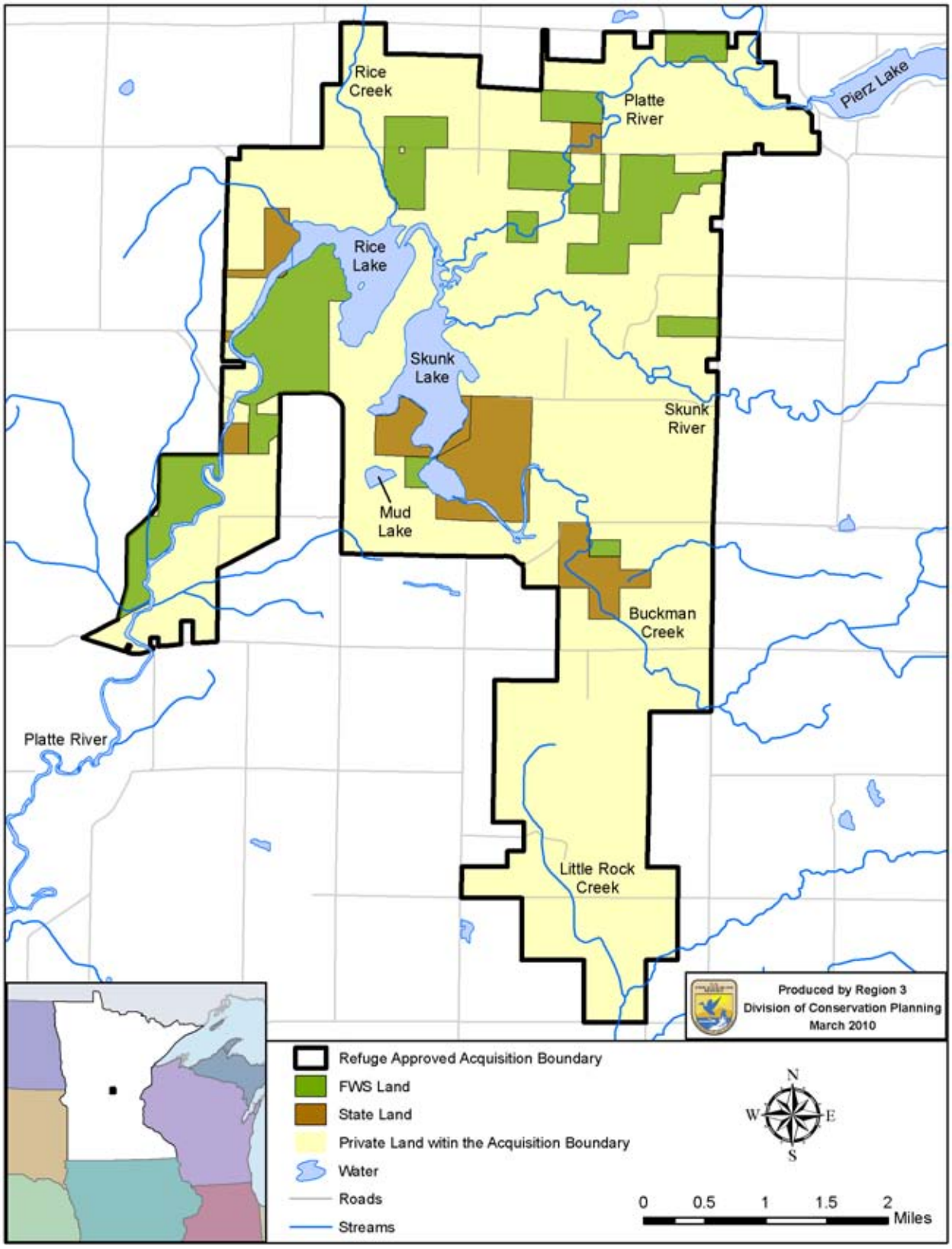


Figure 2: Land Ownership, Crane Meadows NWR



The U.S. Fish and Wildlife Service

Crane Meadows NWR is administered by the U.S. Fish and Wildlife Service, the primary federal agency responsible for conserving, protecting, an enhancing the Nation's fish and wildlife populations and their habitats. The Service oversees the enforcement of federal wildlife laws, management and protection of migratory bird populations, restoration of nationally significant fisheries, administration of the Endangered Species Act, restoration of wildlife habitat such as wetlands, collaboration with international conservation efforts, and the distribution of conservation funding to states, territories, and tribes. Through its conservation work, the Service also provides a healthy environment in which Americans can engage in outdoor activities. Additionally, as one of three land managing agencies in the Department of the Interior, the U.S. Fish and Wildlife Service is responsible for the Nation's National Wildlife Refuge System (NWRS).

Mission of the U.S. Fish and Wildlife Service

> The mission of the Service is working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

The National Wildlife Refuge System

The National Wildlife Refuge System was founded in 1903 when President Theodore Roosevelt designated a 3-acre island off the Florida coast, Pelican Island, as a sanctuary for colonial nesting birds. Today, the System has grown to a network of more than 550 refuges, 37 wetland management districts, and 49 coordination areas covering approximately 150 million acres of public lands and waters. Most of these lands are contained within Alaska's 16 national wildlife refuges with the remainder distributed throughout the other 49 states and U.S. territories. Since 2006 Marine National Monuments have been added to the Refuge System, adding more than 50 million acres in the Pacific Ocean to the Refuge System.

The National Wildlife Refuge System is the world's largest collection of lands and waters specifically designated and managed for fish and wildlife. Overall, it provides habitat for more than 700 species of birds, 220 species of mammals, 250 reptile and amphibian species, 200 species of fish, and more than 280 threatened or endangered plants and animals. As a result of international treaties for migratory bird conservation and related legislation such as the Migratory Bird Conservation Act of 1929, many refuges have been established to protect migratory waterfowl and their migration flyways that extend from nesting grounds in the north to wintering areas in the south. Refuges also play a vital role in preserving threatened and endangered species. For example, Aransas NWR in Texas serves as the winter home of the Whooping Crane, the Florida Panther Refuge protects its namesake, *Felis concolor coryii*, one of the nation's most endangered mammals, while the Hawaiian Islands Refuge is home to the Laysan Duck, Hawaiian monk seal, and many other unique species.

Refuges also provide important recreation and education opportunities for visitors. When public uses are deemed appropriate and compatible with wildlife and habitat conservation, they are places where people can enjoy hunting, fishing, wildlife observation, photography, environmental education, environmental interpretation, and other recreational activities. Many refuges have visitor centers, wildlife trails, automobile tours, and environmental education programs. Nationwide, more than 40 million people visit national wildlife refuges annually.

Mission of the National Wildlife Refuge System

The mission of the National Wildlife Refuge System is "…to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Improvement Act of 1997 - Public Law 105-57).

Goals of the National Wildlife Refuge System

Revised goals for the National Wildlife Refuge System were adopted on July 26, 2006, and incorporated into Part 601, Chapter 1, of the Fish and Wildlife Service Manual (601 FW 1). The goals are:

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.

Skunk Lake. Photo credit: Beau Liddell

- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife.

Laws and Directives for Refuge Planning

In addition to the National Wildlife Refuge System Improvement Act of 1997 and a Refuge's establishing and authorizing legislation, several federal laws, executive orders, and regulations govern the administration of each Refuge. Key legislative policies that direct refuge management include the Endangered Species Act (1973), Clean Water Act (1977), Land and Water Conservation Fund (1965), and the Migratory Bird Treaty Act (1918). Appendix F contains a partial list of the legal mandates that guided the preparation of this plan and those that pertain to Refuge management activities.

Blue-winged Teal drake. Photo credit: Beau Liddell

Laws and policies related directly to comprehensive conservation planning include:

- National Wildlife Refuge Improvement Act of 1997 (Public Law 105-57)
- Biological Integrity, Diversity, and Environmental Health Policy (601 FW3)
- Compatibility Policy (603 FW2)
- Wildlife-dependent Public Uses (605 FW 1)
- Coordination with State Natural Resource Agencies (601 FW 7)
- Public Participation in CCP Development (602 FW 3)

Purpose of a Comprehensive Conservation Plan

This CCP describes the management direction and desired future conditions for Crane Meadows NWR over the next 15 years. The plan provides guidance and rationale for management actions and will be used by the Refuge manager and staff as a reference document when developing work plans and making management decisions. Through the development of goals, objectives, and strategies, this CCP describes how the Refuge contributes to the overall mission of the National Wildlife Refuge System, fulfills the purposes designated for the Refuge, and uses the best available science for adaptive management.

This plan will enhance the management of Crane Meadows NWR by:

- Providing a clear statement of desired conditions and management direction for the Refuge
- Maintaining continuity in Refuge management over time
- Integrating Refuge activities with conservation activities that occur in the surrounding region
- Ensuring that Refuge management is consistent with all applicable laws, policies, and plans
- Providing Refuge neighbors, visitors, and the general public with an understanding of the Service's management actions on and around the Refuge
- Facilitating public involvement in Refuge management decisions by providing a process for effective coordination, interaction, and cooperation with affected parties, including federal agencies, state conservation organizations, adjacent landowners, and interested members of the public
- Demonstrating support for management decisions and their rationale using sound profes-

Opossum. Photo Credit: Beau Liddell

sional judgment, biological initiatives, and public involvement

- Ensuring that Refuge management considers the preservation of historic properties as part of Refuge management and planning
- Providing a sound basis for budget requests to meet Refuge operational, maintenance, and capital improvement needs

Refuge History and Establishment

In pre-colonial times a number of Native American groups including the Dakotah, and later the Ojibwe, inhabited the central region of Minnesota. Their life and culture are evidenced by the presence of burial mounds and other artifacts in the area. These Native American groups harvested wild rice (*Zizania spp.*) from Rice and Skunk Lakes and navigated adjacent creeks and rivers.

Among the first Europeans in the area were English and French fur traders in the 1600s. Morrison County itself was named in honor of William and Allan Morrison, two brothers who did a great deal of trapping and trading throughout central and northern Minnesota. In the early 1800s a number of explorers passed through the region along the Mississippi River, including Zebulon Pike (1805) and Joseph Nicollet (1836). Methodist missionaries were among the first permanent European settlers, arriving around the middle of the 19th century. Building missions and schools for the Ojibwe, they settled in areas surrounding the Refuge such as Belle Prairie, Sobieski, and Pierz. Logging interests increased here around the turn of the century, harnessing the Mississippi River to power a local sawmill in Little Falls, Minnesota. The Historical Atlas of Minnesota published in 1874 (Andreas) describes stands of 'pine and mixed timber' northeast of the Refuge, 'mostly oak' to the south and east, and 'bur oak and timber' to the west. In the same period as agriculture increased in the region additional mills were built in Little Falls to grind flour.

Located 8 miles southeast of Little Falls, Crane Meadows NWR is one of 12 refuges in the state of Minnesota. Located about a 1-hour drive to the southeast, Sherburne NWR is its closest neighboring refuge. The two refuges are under shared management.

The wetland complex that comprises Crane Meadows NWR includes two large shallow lakes, Rice and Skunk, one smaller open water basin, Mud Lake, and four watercourses that drain to this area; the Platte River, Skunk River, Rice Creek and Buckman Creek. These major hydrologic features are surrounded primarily by sedge meadow wetlands and other bottomland habitats. The complex has a history of extreme water fluctuations following seasonal variations in rainfall and runoff. Flooding is common in the spring due to snowmelt and runoff from surrounding uplands and watercourses that drain to the area. Typically, water levels decrease during the summer months, then a resurge and renewed flooding occurs in the fall. These natural cycles provide excellent habitat for fish, invertebrates, wild rice, and other aquatic vegetation, which in turn supports large concentrations of migratory waterfowl and other wildlife.

The wet conditions of this locality have limited the types of land use on the Refuge through history, and has directed attention in the area toward recreational uses such as hunting and fishing. This area was noted as a premier hunting destination in Minnesota as early as the 1930s. In the 1960s the Minnesota Department of Natural Resources (DNR) began purchasing land in the complex, adding to the agency's system of Wildlife Management Areas (WMA). In addition to acquiring almost 850 acres of land in the early 1970s, the DNR constructed a weir on the Platte River as it exits the wetland complex to stabilize water levels and facilitate seasonal water access to the shallow lakes. Over time, there has been a trend toward land conversion from natural cover types to agriculture and the intensification of agriculture in the watershed, including the draining and tiling of surrounding wetlands. These changes have altered the flow dynamics of the hydrologic system and impacted the quality of the water passing through the wetland complex.

In 1990, a Regional Wetlands Concept Plan was created by the Service for the Midwest Region (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) in response to the Emergency Wetlands Resources Act of 1986. Of the six sites identified for potential acquisition in Minnesota, the

Table 1: Land Acquisition History at Crane Meadows NWR

Year	Total Properties Acquired	Total Acres Acquired	Total Refuge Acres
1994	7	1,070.00	1070.00
1995	6	312.69	1382.69
1996	2	100.99	1483.68
1997	-	-	-
1998	2	140.00	1623.68
1999	-	-	-
2000	-	-	-
2001	1	-	1687.50
2002	-	-	-
2003	-	-	-
2004	1	26.67	1714.17
2005	-	-	-
2006	1	40.00	1754.17
2007	-	-	-
2008	1	48.42	1802.59

wetland system at Crane Meadows NWR was among the largest and most intact. The report indicated that this area is: "One of the last undisturbed wetland complexes in Central Minnesota. (An) important area for waterfowl, Sandhill Cranes, diverse vegetation communities, and nongame species (FWS, 1990, p. 36)." The report identified an area of 35,000 acres with conservation potential. Subsequently, an environmental assessment was conducted that, in June of 1992, authorized the acquisition of 13,540 acres for a new refuge, Crane Meadows National Wildlife Refuge.

The Nature Conservancy (TNC) was a key partner in the acquisition of the first set of properties for the Refuge. The organization purchased seven properties totaling 1,070 acres within the acquisition boundary in early 1990. The Nature Conservancy then donated one property and leased the remaining six to the Service in 1993, officially establishing a land base of the Refuge. In the years to follow, 14 additional acquisitions were made as shown in Table 1. The only congressional appropriation of funds for land acquisition at Crane Meadows NWR was made in 1995. Recent acquisitions have been made from willing sellers through grants, donations, and other funding sources.

Refuge Purposes

National wildlife refuges are established under a variety of legislative acts and administrative orders and authorities. These orders and authorities include one or more specific purposes for which the refuge lands are acquired. The purposes are of key importance in refuge planning, and are the foundation for management decisions. The purposes of a refuge are specified in, or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.

By law, refuges are to be managed to achieve their purposes, and unless otherwise indicated by the establishing document the following rules apply:

- Purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants, and their habitats take precedence over other management and administration purposes.
- When in conflict, the purpose of an individual refuge may supersede the Refuge System mission.
- Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict.

Ring-necked Ducks on Rice Lake, in front of Crane Meadows NWR property. Photo credit: Beau Liddell

- When an additional unit is acquired under a different authority than that used to establish the original unit, the addition takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the addition.

The Refuge's establishing authorities and related purposes include:

Fish and Wildlife Act of 1956

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4)

"... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1)

Emergency Wetlands Resources Act of 1986

"... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583

The Refuge is also responsible for 21 conservation easements in Morrison County totaling 1,683.2 acres. The purpose of these easements "…for conservation purposes…" is derived from the Consolidated Farm and Rural Development Act of 1961 (7 USC 2002). The Service administers Farm Service Administration (FSA) easements as part of the National Wildlife Refuge System.

Refuge Vision

The vision provides a simple statement of the desired future condition of the Refuge. It provides a sense of direction and an ideal for what the Refuge will become through effective management. The purposes of the Refuge and the mission of the System provide the foundation for the vision, and are enhanced by the unique characteristics of the Refuge and local environment.

Crane Meadows NWR Vision Statement

Crane Meadows National Wildlife Refuge is a unique sand plain wetland/upland complex with a rich mosaic of healthy sedge meadow, shallow lake, oak savanna, prairie, shrubland, and forest habitats. The Refuge encompasses a large intact wetland system at the confluence of four tributaries that feed high quality water to Rice and Skunk Lakes and the Platte River. The Refuge provides important habitat for cranes, waterfowl, and a diversity of other wildlife. Visitors enjoy a variety of wildlife-dependent recreation activities that inspire a heightened environmental ethic and active support for the Refuge and its programs. Crane Meadows NWR is an outstanding example of sound wildlife management and habitat restoration within the National Wildlife Refuge System.

Chapter 2: The Planning Process

The CCP Planning Process

The CCP for Crane Meadows NWR was written with contributions and assistance from citizens, universities, the Minnesota DNR, and non-governmental organizations (NGOs). The participation of these stakeholders is vital, and their contributions have been valuable in determining the future direction of the Refuge. Refuge and Service planning staff are grateful to all who have contributed time, expertise, and ideas throughout the CCP process.

Writing a comprehensive conservation plan takes an average of two to three years, and involves a great deal of effort on the part of the Refuge and regional planning staff. The process can be divided into five stages; preplanning, scoping, alternative development, draft preparation and review, and final document preparation and approval.

Preplanning

Preplanning occurs before the formal planning period begins, and at Crane Meadows NWR initial conversations commenced nearly a year in advance of the first official CCP meetings. During preplanning, policy is reviewed, the core planning team is established, a planning record is created, interest groups are identified, and an initial planning timeline is drafted. Studies, reports, surveys, research and monitoring activities, previous planning efforts, historical documents, and other background information and data resources were gathered and reviewed during this period, and a number of studies were conducted including a aerial imagery-based vegetation study and a green infrastructure assessment of the local conservation landscape.

Scoping

The formal planning process begins with the scoping period, which involves a thorough assessment of issues, concerns, opinions, thoughts, ideas, concepts, and visions for the Refuge.

The scoping period was officially launched in December 2008 with a kick-off meeting held at Crane Meadows NWR. Refuge and regional planning staff met to review existing baseline data, discuss the Refuge vision statement and goals, and review relevant planning documents. A list of required CCP elements was also developed at this meeting and during subsequent e-mail and telephone communications between Refuge staff and the Service's regional office. In addition to identifying information that would be needed in the planning process, Refuge staff also developed a list of stakeholders, and a preliminary list of issues, concerns, challenges, opportunities, new directions, and potential sources of conflict to be addressed in the CCP.

Oak savanna, Crane Meadows NWR. Photo credit: FWS

The next step was for the planning team to ask neighbors, state agencies, tribal government, non-government organizations and others interested in the future of the Refuge to identify the issues and opportunities they see confronting the Refuge. The public scoping period began on January 21, 2009, and ended on March 6, 2009. The comment period was announced in local media, and people were invited to submit comments to the Refuge. An open house was held in the Refuge maintenance building on February 19, 2009, to give the public an opportunity to discuss ideas with Refuge staff and regional

planners. More than 50 people attended the open house, and the Refuge received a total of 20 written comments during the public scoping period.

During the last week of March 2009, the Refuge hosted a planning workshop where participants helped review, evaluate, and plan the biological and visitor services programs at the Refuge. An initial set of alternative management themes was also developed during this workshop.

The semi-final stage of scoping took place at the regional office. During this step in the scoping process, leaders from the Refuge System, Migratory Birds, Ecological Services and other key Midwest Region programs further developed and refined the list of issues that would be addressed in the CCP. Refuge staff and planning staff met with a variety of Service personnel in the Regional Office in a meeting held the first week May 2009.

The final approval for scoping issues was received from the national FWS office in Washington, D.C., the third week of May 2009, following the preparation and routing of a scoping briefing statement.

The issues brought forth during the scoping phase bring important topics to the attention of the plan's authors, and are used to inform the writing of the alternative management scenarios in the Environmental Assessment. One of the proposed alternatives will ultimately be chosen as the future direction of the Refuge. The issues, concerns, and opportunities expressed during the first phase of planning have been organized under the following headings:

Habitat

Issue Statement: If the integrity of this unique, relatively unaltered wetland ecosystem is to persist, it must be protected. The remaining intact wetland and upland habitat needs to be combined with restored adjacent areas to achieve a healthy, natural system resembling historic conditions.

Background: The relatively unaltered state of Crane Meadows NWR's wetland habitats generated a great deal of interest in habitat conservation at the Refuge. In general, public comments emphasized a desire to protect intact habitats and restore altered habitats to historic conditions. The need to safeguard specific habitat types, including prairie and oak savanna, was brought up in numerous comments. Related comments acknowledged the need for a prescribed burn program to mimic historic disturbance cycles and maintain a diversity of successional habitat stages.

Yellow-headed Blackbird, Crane Meadows NWR. Photo credit: FWS

Land Acquisition

Issue statement: The slow growth of the Refuge has proven frustrating for numerous supporters of the Refuge. Small, scattered tracts of land make habitat management less efficient, diminish the benefit to wildlife, make law enforcement more difficult, and increase the potential for conflicts with neighbors.

Background: With ownership of approximately 1,800 acres of the 13,540 acres approved for acquisition, land acquisition continues to be among the primary concerns for Crane Meadows NWR. Since its establishment in 1992, the Refuge has worked with willing sellers inside the approved acquisition boundary, yet land acquisition has been slow and has faced a number of challenges. Land acquisition is dependent on the willingness of owners to sell to the Service, the availability of funding, the patience of private landowners with the lengthy process, and the resistance to competition from other interested buyers. As a result, property acquisition to date has been opportunistic and piecemeal, resulting in scattered land ownership and challenges to management and law enforcement. In addition, agricultural development has increased within and bordering the

Refuge acquisition boundary in recent years - specifically large-scale dairy, pork, and poultry installations. During public scoping, some people suggested that acquisition efforts focus on specific targets, such as critical habitat. Additional comments indicated that the public would like to see the Refuge shift from an opportunistic approach to land acquisition and conservation, in which the Service buys land anywhere within the boundary as willing sellers emerge and restores private lands as opportunities arise, to adopting a more strategic approach that targets critical habitat.

Water Resources

Issue Statement: Water quality, a key factor in the health of the Rice-Skunk wetland complex, is threatened by hydrologic alteration, pollution, and sedimentation from adjacent land uses.

Background: More than 55 percent of the Refuge is comprised wetland habitats and open water. Concerns related to water that were raised during scoping range from issues of quality to quantity. Furthermore, all open waters on the Refuge are under state management and publicly accessible, necessitating partnerships and larger collaborative efforts. Specific comments received expressed concerns about the impacts of increasing agricultural development in the form of field drainage, center pivot irrigation, and animal installations; nutrient loading, eutrophication, and the presence of other pollutants in area lakes and streams; water volume fluctuations in the wetland complex, associated effects on the annual wild rice crop, and the DNR weir on the Platte River; and the access to recreation on Rice and Skunk Lakes including potential effects on wildlife.

Wildlife

Issue statement: There are numerous threats to the long-term persistence of healthy wildlife populations at Crane Meadows NWR including habitat disturbance, contamination and disease, competition from exotic/invasive species, and the lack of monitoring and research necessary for management.

Background: Wildlife at Crane Meadows NWR includes an abundance of birds, mammals, fish, reptiles, amphibians, invertebrates, and both state-listed and federally-listed species. Comments received during scoping related to wildlife issues included the concern that increasing visitation on the Refuge could have negative impacts on wildlife; the need to further inventory and monitor plants and animals, particularly rare or declining plant species that may be present on the Refuge; the threat of invasive species on the Refuge such as purple loosestrife, reed canary grass, phragmites, and carp; concerns about the effects of animal installations on local wildlife, such as avian transmitted diseases; depredation of crops by cranes, geese, and deer; and the potential decline of the brown trout fishery on the south spur of the Refuge.

Visitor Services

Hunting

Issue Statement: Some people would like to have the opportunity to hunt on Refuge lands, others would like to see the Refuge maintained as sanctuary for wildlife. Nevertheless, the lack of a large, contiguous land base presents challenges to offering high-quality and safe hunting opportunities.

Background: Hunting was originally discussed during public meetings that led to the establishment of Crane Meadows NWR in 1992, and has remained a public expectation ever since. Currently no hunting is allowed on the Refuge because Service properties are small and scattered, boundary signage is limited, and boundaries are difficult to enforce.

Fishing

Issue Statement: Some individuals would like to see the Refuge allow shoreline fishing opportunities, and others expressed opposition to fishing from Refuge shores.

Background: Fishing from boats, as well as spear fishing are commonplace on the waters at Crane Meadows NWR because all open waters at the Refuge are managed by the state and are accessible to the public. Fishing from the shores of the Refuge, however, is not currently permitted.

Environmental Education

Issue Statement: Environmental education facilities and programming are currently limited at Crane Meadows NWR. There is interest in expanding the visitor services programming to include facilities such as an outdoor classroom and increasing staff so that the Refuge can offer environmental education programming in area schools.

Background: Education and associated interaction with area schools was the second most common topic found in public comments, after land acquisition. There is interest and potential for Crane Meadows NWR to become more active with environmental education in local communities. Paralleling this public interest, is the Service's recent initiative, "Connecting People with Nature" which has an emphasis on getting people outdoors, especially children. Nature is important to children's intellectual, emotional, social, and physical development. Recommendations were made that the Refuge establish an outdoor classroom, increase staff involvement with area schools, increase events and programs for the public, and work to better define

and increase public understanding of the Refuge's identity, purpose, role in the community, and responsibilities.

Trails

Issue Statement: Motorized vehicles that are prohibited on the Refuge are permitted on the Soo Line multiple-use trail that transects the Refuge, and some people would like to see greater education and law enforcement efforts to ensure appropriate trail use.

Background: Trails received some comment from the public – particularly the Soo Line multiple-use trail which transects the acquisition boundary and allows some motorized uses not typically associated with national wildlife refuges.

Facilities

Issue Statement: Visitor services facilities on the Refuge are not sufficient to welcome, orient, and inform visitors.

Background: Facilities have expanded and improved over the past few years at Crane Meadows NWR, and their use continues to increase. However, some people commented that visitor use can be improved by increasing staff available to greet the public, increasing landholdings within the Refuge acquisition boundary, and augmenting existing visitor facilities. Comments advocated for a permanently staffed visitor center, increased signage and brochures, a wetland boardwalk, and additional platforms for wildlife observation and fishing.

Archaeological Resources

Issue Statement: There are a number of cultural resources within the Refuge acquisition boundary that are not adequately identified or protected.

Background: The Refuge and surrounding areas were active Native American sites, and host a number of historical and cultural resources. Some studies have been conducted, but more research and surveys of the area are needed to understand the scope and extent of these cultural resources.

Support

Issue Statement: To meet current and future management needs at the Refuge, additional support in the form of staffing and partnerships will be needed.

Background: The Refuge currently has two full-time positions: a private lands biologist/refuge operations specialist, and a maintenance worker. During public scoping, some comments urged the Service to increase staffing to provide the resources for additional programming, research, monitoring, law enforcement, and other management activities. The needs noted by the public include a full-time manager, personnel to staff a visitor center, and additional help with the field activities such as prescribed burning and habitat restoration.

The importance of partnerships and the benefit of additional staffing at Crane Meadows NWR were commonly discussed topics during CCP scoping. With steadily increasing human populations and associated effects on the landscape, it has become imperative for natural resource agencies and organizations to collaborate and seek creative ways to coordinate conservation efforts. This can both reduce redundancy in conservation efforts, and increase efficiency in protecting natural landscapes. With approximately 900 acres of land within the acquisition boundary and a parallel mission, the Minnesota DNR offers a unique and important partnership opportunity. Recommendations were also made to augment the relationship with Camp Ripley north of the Refuge, whose 53,000 acres support over 600 plant species, 202 migratory birds, 51 species of mammals, and 23 species of reptiles and amphibians.

Alternatives Development

The practice of developing management alternatives as a part of the Refuge planning process is derived from the National Environmental Policy Act of 1970 (NEPA) [42 U.S.C. 4321 et seq.] This act requires federal agencies to consider the impacts of proposed actions and to develop a reasonable range of alternatives to those actions.

The development of an initial set of alternative management themes occurred during the Refuge planning workshop in March 2009. The resulting set of four alternatives was further refined and ultimately reduced to three during the Alternatives Workshop held in September 2009. The Alternatives Workshop included both Service and state representatives, and was used to define and clarify the details for management under each of the three alternatives. The draft objectives and strategies were finalized in a meeting at Sherburne NWR in January 2010.

Preparation, Review, and Finalization of the CCP

The CCP for Crane Meadows NWR was prepared by a team consisting of Refuge and Regional Office staff, and state partners. The first complete draft was completed in June 2010. The CCP was then published in two phases, draft and final, in accordance with the National Environmental Policy Act (NEPA). The Draft Environmental Assessment, Appendix A of the Draft CCP, presented a

Waterfowl on Rice Lake. Photo Credit: Beau Liddell

range of alternatives for future management and identified the preferred alternative, which was the basis for the CCP.

The Draft CCP/EA was first reviewed and revised by Refuge and Regional Office staff, a time period that culminated with an internal review meeting at the Midwest Regional Office on June 11, 2010. The Draft CCP/EA was then released to the public for a 31-day review period running from July 7 to August 6, 2010. The public was notified of the release with a notice in the Federal Register as well as through local media outlets.

A summary brochure or the full Draft CCP/EA was sent to approximately 265 individuals, organizations, elected officials, and local, state, and federal agencies; and an electronic copy was made available on the Service's website.

An open house was held during the comment period (July 20, 2010) in the Refuge maintenance building, providing the public with an opportunity to discuss the plan with Service staff. One comment was submitted and three individuals attended this event.

During the full public review period, only three written comments were received by the Service, none of which recommended changes to the preferred alternative. Due to limited feedback, only minor grammatical and editorial changes were made to the draft in preparing the final CCP. Consequently, no formal Response to Comments Appendix was produced for this CCP.

The final CCP will become the basis for guiding management on the Refuge over the coming 15-year period. It will also guide the development of more detailed step-down management plans for specific resource areas, and it will underpin the annual budgeting process through Service-wide allocation databases. Most importantly, it will lay out the general approach to managing habitat, wildlife, and visitor services at Crane Meadows NWR, and will direct day-to-day decision-making and actions.

Wilderness Review

As part of the CCP process, lands within the legislative boundaries of the Refuge were reviewed for wilderness suitability. The Wilderness Act of 1964 defines and outlines the requirements for a wilderness area as follows:

> "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined…(as) an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

No lands at Crane Meadows NWR were found suitable for designation as Wilderness as defined by the Wilderness Act. The Refuge does not contain 5,000 contiguous roadless acres, nor does it have any units of sufficient size to make preservation practicable as Wilderness. Lands and waters within the defined acquisition boundary have been substantially affected by humans, particularly through agriculture, transportation infrastructure, and water control.

Chapter 3: Refuge Environment and Current Management

Section 1 – Refuge Environment

Introduction

Crane Meadows NWR was established in 1992 to protect one of the largest, most intact wetland complexes remaining in central Minnesota. Described as a 'sand plain wetland/upland complex', the Refuge habitats are a unique mosaic of droughty, sandy uplands consisting of prairies, oak savannas, and mixed forests; and diverse, poorly-drained wetland habitats including sedge meadow, shallow lake, scrub-shrub, and bottomland forest communities. These habitats provide valuable respite from surrounding agricultural and developed land uses for many species of migratory birds, fish, reptiles, and other wildlife. Species present on the Refuge include a number of state and federally listed plants and animals such as the tubercled rein-orchid and Blanding's turtle.

In the thin transitional zone between the continent's central prairies and northern boreal forests, Crane Meadows NWR's location provides an interesting case study for the effects of global climate change as weather patterns and disturbance regimes change, biomes shift, and species distributions, phenologies, and interactions evolve. The Refuge also drains nearly 275,000 acres of upstream watershed area extending northeast to the periphery of Lake Mille Lacs, making it an important filter for the Mississippi River just 5 miles downstream.

Within the 13,540-acre area proposed for acquisition encompassing the wetland system, the mix of land ownership includes the Service (just over 1,800 acres), state landholdings (approximately 900 acres), as well as hunt clubs, a diversity of agriculture interests, and private residences. Land acquisition for the Refuge continues slowly as resources permit. Beyond the natural resource conservation innate to national wildlife refuges in the form of ecological services, habitats, and wildlife, the acquisition boundary also contains an array of archaeological sites and recreation opportunities. With a local staff of two and support from Sherburne NWR (the two refuges form the Sherburne-Crane Meadows National Wildlife Refuge Complex), Crane Meadows NWR maintains strong relationships with conservation partners and surrounding communities through its Partners for Fish and Wildlife Program, Friends group, and a number of popular Refuge programs.

Crane Meadows NWR Office. Photo Credit: FWS

As one of the most recent additions to Minnesota's 12 national wildlife refuges, it contributes to the Refuge System mission by enhancing the "…national network of lands and waters for…fish, wildlife, and plant resources, and their habitats…"

Other Units Administered

Farm Services Administration Conservation Easements

The 1985 Farm Bill's 'Consolidated Farm and Rural Development Act' contained provisions for the protection of wetlands against conversion to agriculture. The Farmers Home Administration (FmHA) was given authority for the Farm Debt Restructure and Conservation Set-aside Conservation Easements – properties foreclosed on by the federal government, otherwise known as "inventory properties." Lands appropriate for the conservation easement program had important natural resource interests such as wetlands, floodplains, riparian corridors, endangered species habitat, and the uplands necessary to protect bottomland habitats.

An agreement between the FmHA and the FWS authorized the Service, as the 'easement manager,' to protect these lands for conservation, recreational,

and wildlife purposes. The Service Easement Manual (DOI 2005) states that, "The agreed upon purposes of this easement are the preservation and maintenance of the wetland and floodplain areas existing as of the date of this conveyance as well as protection and enhancement of plant and animal habitat and populations." Farm Service Administration (FSA, previously FmHA) easements are administered by the Service as part of the National Wildlife Refuge System pursuant to the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd et. seq.), and thus they are subject to compatibility regulations and other relevant NWRS policy.

The Sherburne-Crane Meadows NWR Complex is responsible for the FSA easements in six Minnesota counties: Benton, Isanti, Kanabec, Mille Lacs, Morrison, and Pine. Of these counties, Crane Meadows NWR staff is responsible for the oversight and management of the 21 easements in Morrison County, including a total of 1,683.2 acres (see Figure 3 on page 16).

The Service is authorized to protect and manage important natural resource interests on FSA easement properties. Ownership of the easement land is typically retained by private individuals, but with deed restrictions related to conservation management. Because of the high degree of variability between individual FSA easements, review of the easement files is necessary in evaluating Service-related management actions and enforcement activities.

In general, service employees are responsible for habitat management and are granted access for maintenance, monitoring, enforcement, and other necessary management activities. The Service Easement Manual describes management rights as follows:

> "…include, but are not limited to, inspection for compliance with the terms of this easement; research regarding water, wetlands, fish and wildlife and associated ecology; and any other activity consistent with the preservation and enhancement of wetland functional values (D.O.I. 2005)."

Lesser and Greater Scaup, Crane Meadows NWR. Photo Credit: Beau Liddell

There is no public access to these easement properties unless explicitly stated in an individual easement document. According to policy, FSA conservation easements are checked annually using aerial or ground surveys for compliance, including boundary signs, trespass, and various other infractions.

The Local Conservation Landscape

With a greater emphasis now being placed on land conservation networks, habitat corridors, and the strategic growth of the conservation estate, existing conservation landholdings may serve as the foundation on which a web of lands with conservation values can be designed and created.

The Minnesota DNR is the single largest player in the conservation landscape of Minnesota. There are also a number of other constituent groups that contribute to the conservation estate of the area surrounding Crane Meadows NWR. See Figure 4 on page 17 and Figure 5 on page 18 for illustration of the conservation lands within the acquisition boundary, those within 5 and 10 mile buffers of the acquisition boundary, and the large conservation landholdings in the broader landscape.

Within the Crane Meadows NWR authorized acquisition boundary, three DNR divisions own a combined acreage of almost 900 acres. The largest is held by the Division of Fish and Wildlife (848 acres) and is divided among the four units of its Rice-Skunk Wildlife Management Area and the single-unit Crane Meadows Wildlife Management Area. State Wildlife Management Areas (WMAs) form the backbone of Minnesota DNR wildlife management by providing important habitat for wildlife, as well as public recreation opportunities including hunting, trapping, fishing, hiking, cross-country skiing, snow shoeing, and wildlife observation. Currently there are more than 1,380 WMAs in the state of Minnesota, encompassing over 1.2 million acres.

The larger of the two WMAs inside the Refuge acquisition boundary is the Rice-Skunk WMA at 659 acres. The largest of its four units is the Skunk Lake East Unit (426 acres), and as the name infers it is located on the southeast side of Skunk Lake. This unit is accessible from 113 Street on the north side of the parcel, with some limited access from the Soo Line trail, and provides public access onto Mud Lake during waterfowl season. The other Rice-Skunk WMA units include the Skunk Lake West

Figure 3: FSA Easements Administered by Crane Meadows NWR

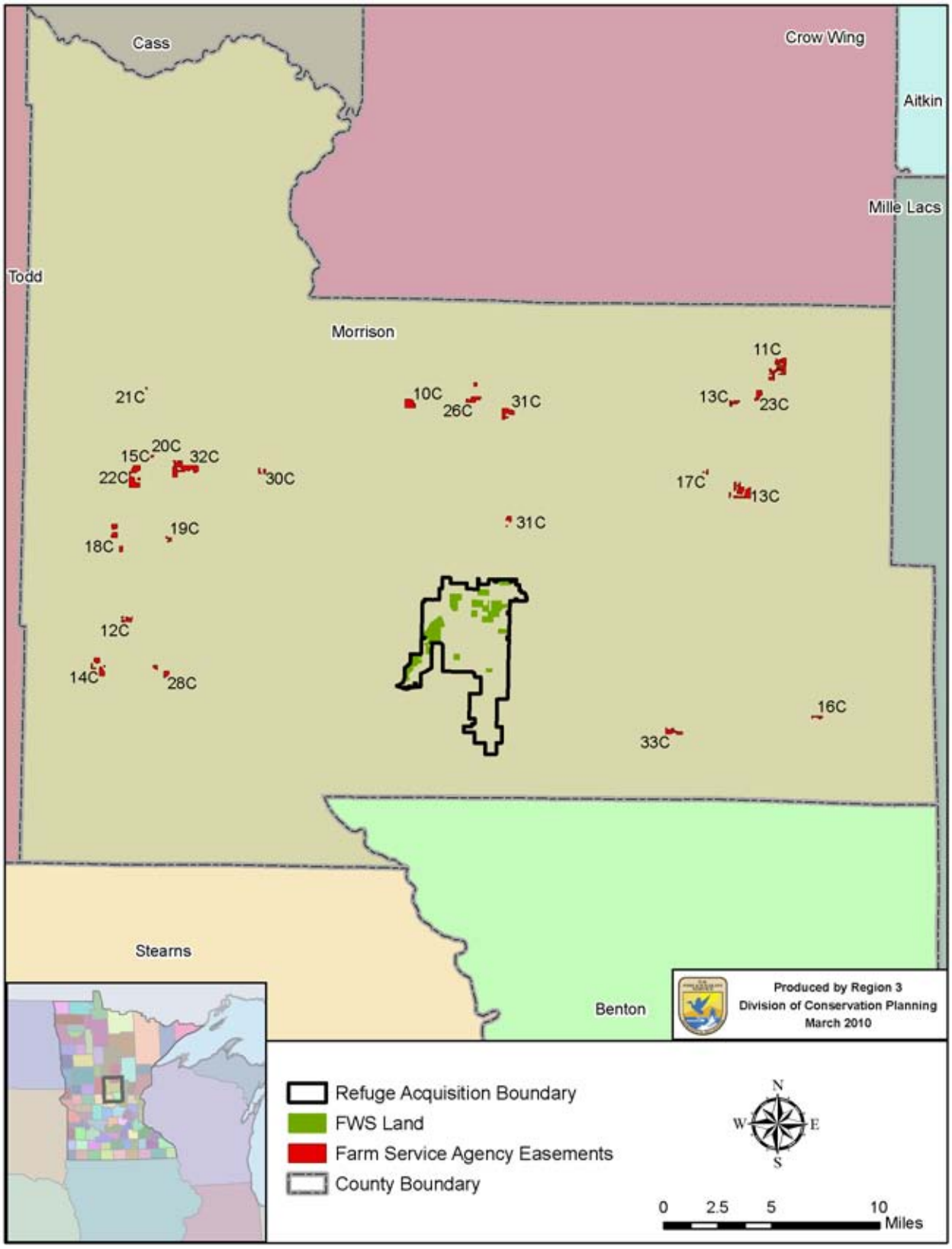


Figure 4: Surrounding Conservation Lands, Crane Meadows NWR (1)

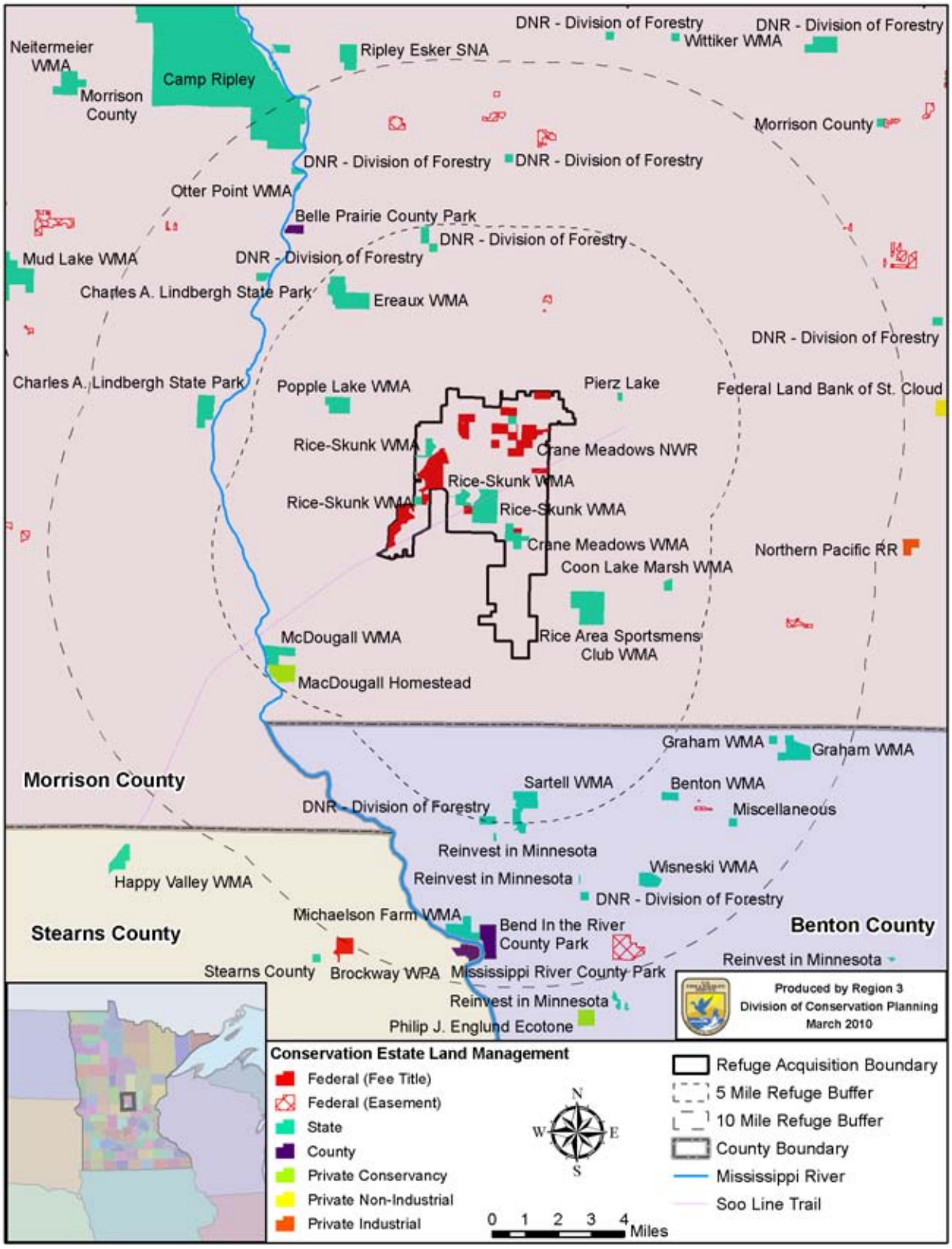
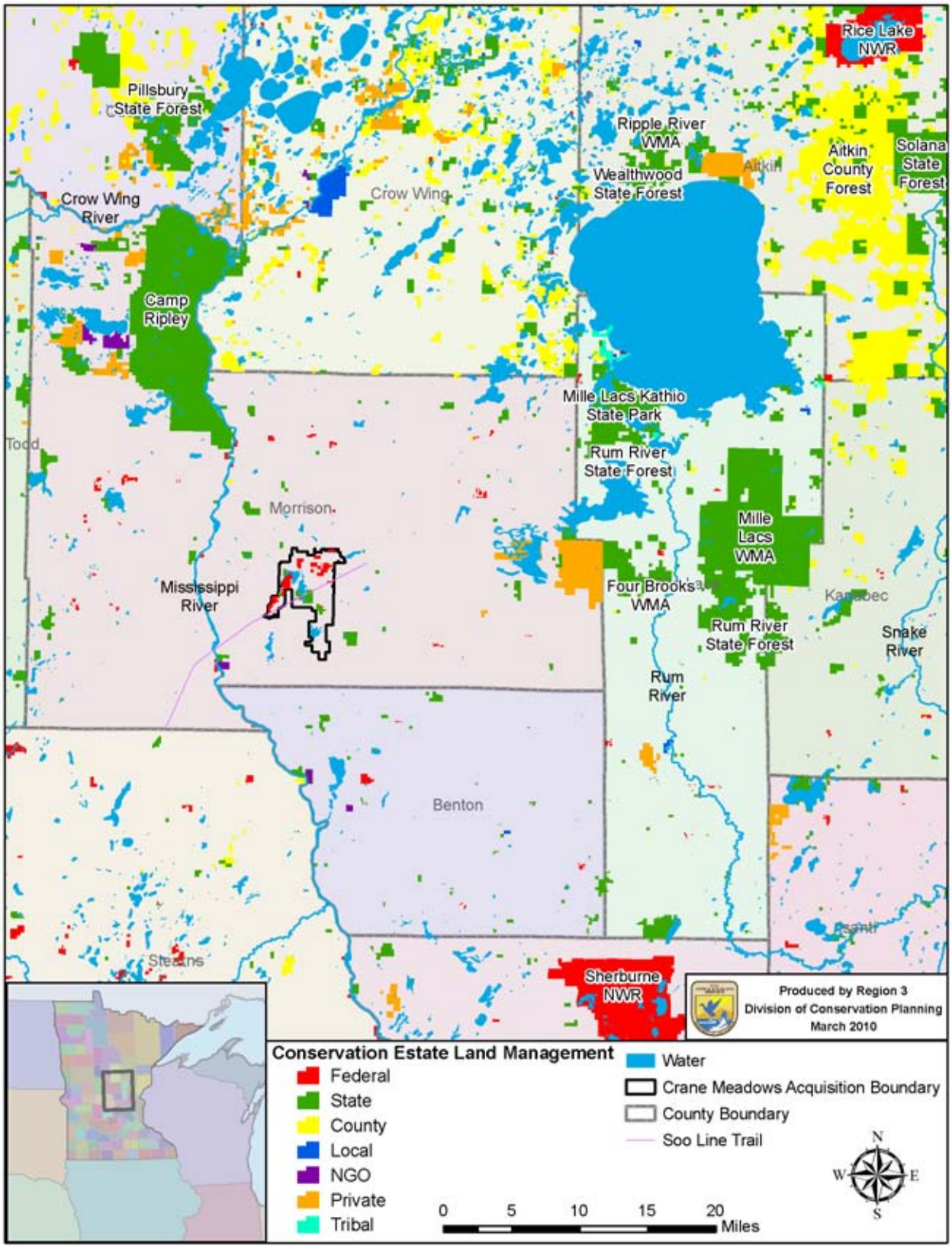


Figure 5: Surrounding Conservation Lands, Crane Meadows NWR (2)



Unit, 112 acres located on the southwest edge of Skunk Lake, just north of a Crane Meadows NWR tract, and providing access to Skunk Lake; the Rice Lake Unit located east of where Rice Lake empties into the Platte River. This 84-acre area contains the George Selke Memorial Dam and provides public access to the Platte River above the dam and to the entire shallow lake complex. The last unit of the Rice-Skunk WMA is called the Platte River 40. This 37-acre tract is located along the east side of the Platte River south of County Road 35.

The other WMA within the Refuge boundary is the Crane Meadows WMA. Its 189-acre tract is located just south of Kettle Road and provides water access onto Buckman Creek.

The Division of Forestry owns a 40-acre property located in Agram Township (southeast quarter, southeast quarter, Section 16). During the original land surveys in Minnesota, sections 16 and 36 of each township were given to the state as timber units to help fund local school systems. If sold, the revenue generated from these sections would either go into a trust for the school or be used for the betterment of the school system. Because the 40-acre section in the Crane Meadows NWR acquisition boundary consists of predominantly bottomland and wetland habitats, it is not considered productive forest land and little interest has been shown in the property.

The third and final state division represented within the authorized acquisition boundary is the Division of Parks and Trails Sauk Rapids office, which owns an unnamed 3.5-acre public water access area on the west side off County 256. This parcel gives boaters access to the Platte River south of the low-flow dam.

There are six additional WMAs and a few miscellaneous conservation lands outside of the Refuge acquisition boundary but within 5 miles of the Refuge. Rice Area Sportsmen's Club WMA (580 acres) is located approximately 1 mile east and Coon Lake WMA (54 acres) is just over 3.5 miles east of the Refuge. Four miles due south in Benton County there is a 368-acre WMA, Sartell, which is the site of the first habitat project funded by the state Duck Stamp. The McDougall WMA (228 acres) is 4 miles southwest of the Refuge, and it is bordered on the south by 215 acres of The Nature Conservancy land know as the McDougall Homestead. Popple Lake (223 acres) is just over 2 miles west of the Refuge and Ereaux WMA (527 acres) is located 3.5 miles northwest of the Refuge. The same DNR Division (Fish and Wildlife) also manages the Pierz Lake Fish Management Area 1.5 miles northeast of the Refuge, and a number of additional Division of Forestry School Trust Fund sections are found within the 5-mile radius.

Several conservation areas are located within a 10-mile radius of the Refuge's acquisition boundary. Areas south of the Refuge and east of the Mississippi River in Benton County include:

- Graham WMA (Main Unit is 329 acres, Northwest Unit is 40 acres)
- Benton WMA (82 acres)
- Wisneski WMA (164 acres)
- Michaelson Farm WMA (276 acres along the Mississippi River)
- Bend in the River Regional Park (289 acres)
- The Minnesota DNR, Division of Waters, Benton County Water Bank

The Mississippi River County Park (209 acres) and the Brockway Waterfowl Production Area (FWS) in Stearns County are southwest of the Refuge and west of the Mississippi River. The Charles A. Lindbergh State Park has two units west and northwest of the Refuge, the Main Unit (436 acres) and North Little Elk Heritage Preserve Unit (93 acres) respectively. With both units are located along the Mississippi River, there is a visitors center, the Lindbergh House and Weyerhaeuser Museum, trails for hiking and skiing, picnic areas, fishing, and canoeing access. Adjacent to the Main Unit of the State Park is the 7.3-acre Pike Creek/ Mississippi Boat Landing, which provides boat access, a parking area, fishing dock, and restrooms. Otter Point WMA (34 acres) and Belle Prairie County Park (138 acres) in Morrison County are west and northwest of the Refuge, respectively. The Belle Prairie County Park offers a variety of recre-

Green-backed Heron, Crane Meadows NWR. Photo Credit: FWS

ational amenities such as hiking trails, a boat landing, parking areas, a picnic shelter, a playground, restrooms, scenic overlooks, and open-site picnic areas.

The southeastern tip of Camp Ripley also falls within the 10-mile radius. Camp Ripley is a military training site occupying 52,758 acres (approximately 82 square miles) in the northwestern extension of Morrison County. The Mississippi River forms its eastern boundary, and the Crow Wing River runs along its northern border. Although the state-owned land is managed by the Department of Military Affairs and serves as a National Guard training site, the site is managed via dual objectives to provide military training and minimize disturbance to the compound's natural resources. The site is a mosaic of upland and bottomland habitats, historical sites, old farmsteads, unrestricted training areas, and restricted access sites. The forests and other vegetative communities are actively monitored and managed, including 16 Forest Inventory and Analysis (FIA) plots located on the compound. There are active wildlife monitoring programs ranging from fisheries surveys to monitoring two gray wolf packs that inhabit the site. There is also an active hunting program. The facility's land conservation mission extends beyond the boundaries in the form of an Army Compatible Use Buffer (ACUB). Using conservation easements and other means, the goal of this zone is to limit development and encroachment within a 3-mile buffer of the site. By 2007, approximately 175 willing landowners had enrolled in the program, representing 25,000 acres of conserved land (Dirks, Diets, and DeJong 2008).

Major conservation landholdings in the broader landscape surrounding Crane Meadows NWR include Sherburne NWR (30,700 acres) to the southeast, Camp Ripley (see above) and the Pillsbury State Forest – Minnesota's first state forest (25,612 acres) to the northwest, and to the west are Mille Lacs Kathio State Park (10,585 acres), Mille Lacs WMA (38,729 acres), and the Rum River State Forest with 33,180 acres in the statutory boundary – 17,164 acres are state-owned and 16,016 are privately owned.

One additional feature of the conservation landscape in the vicinity of the Refuge is a former railroad grade of the Soo Line Railroad that has been converted to a recreation trail. Administered by the county, west of trailhead at Highway 10 the Soo Line Recreational Trail is paved. From April 1 through October 31 of each year the west trail is available to walkers, hikers, cyclists, and in-line skaters, and with adequate snow cover (3-plus inches) from December 1 through March 31 the trail is open to snowmobilers and cross-country skiers. The east portion of the trail, which bisects the Refuge, is considered a multi-mode trail. It's open to walkers, hikers, cyclists, horseback riders, and all-terrain vehicles from April 1 through October 31 each year. The remainder of the year the east trail has the same use as the west section.

The Refuge System is positioned well to play an integral role in the design and implementation of a regional conservation network, the foundation of which is likely to be the existing conservation estate. The growing emphasis on landscape-level issues has demanded a shift in the scale at which environmental problems are approached. To continue providing the ecological services that sustain wildlife and human populations alike, the Service is looking outside Refuge boundaries and engaging in conversations with other members of the conservation community. It is only through collaborative efforts and partnerships – both public and private – that natural resource issues of modern magnitudes and larger geographic scales can be effectively addressed.

Ecological Context

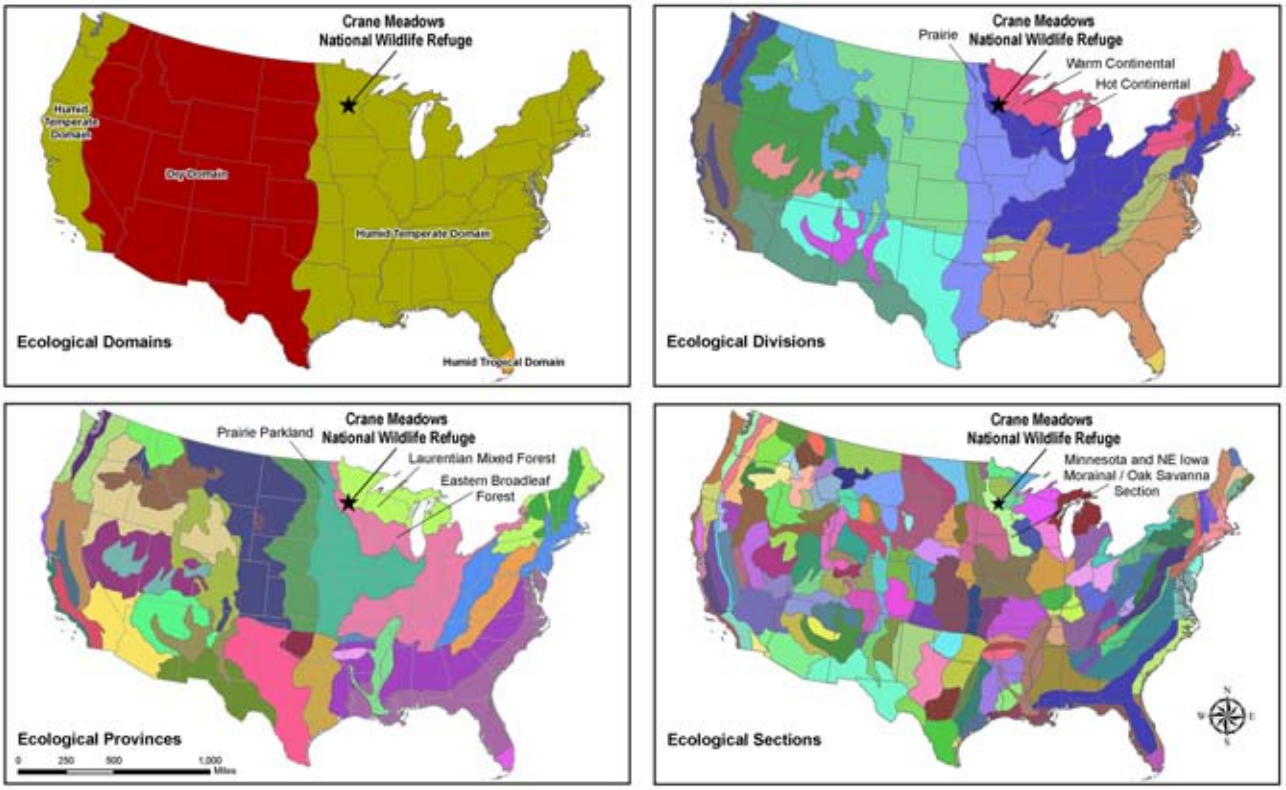
From largest to smallest spatial extent in the National Hierarchy of Ecological Units, which delimits geographic areas of different biological and physical potential, Crane Meadows NWR lies in the Humid Temperate Domain, the Hot Continental Division, Eastern Broadleaf Forest Province, the Minnesota and Northeast Iowa Morainal/Oak Savanna Section, the Anoka Sand Plain Subsection, and the Agram Sand Plain Landtype Association (Bailey 1980, 1995; Cleland, et al. 1997).

The Humid Temperate Domain (see Figure 6 on page 21) encompasses the non-arid mid-latitude land masses from 30 to 60 degrees north latitude. This includes the West Coast of the United States, and most of the eastern half of the country. Polar and tropical air masses interact in these zones creating a diversity of weather conditions, and in general there is a strong seasonality to temperature and precipitation regimes.

The geographic variability of winter frost determines to which division an area belongs, with Crane Meadows NWR in the Hot Continental Division (see Figure 6). This division is characterized by hot summers and cool winters, with a growing season of 3-6 months, varying with latitude. It is also dominated by tall broadleaf trees with canopy cover in the summer and a leafless, dormant winter period (Bailey 1995).

The Eastern Broadleaf Forest (Continental) Province (see Figure 6) marks the transition zone between open grasslands to the west and the mixed forests to the east, covering approximately 270,000

Figure 6: Ecological Context, Crane Meadows NWR

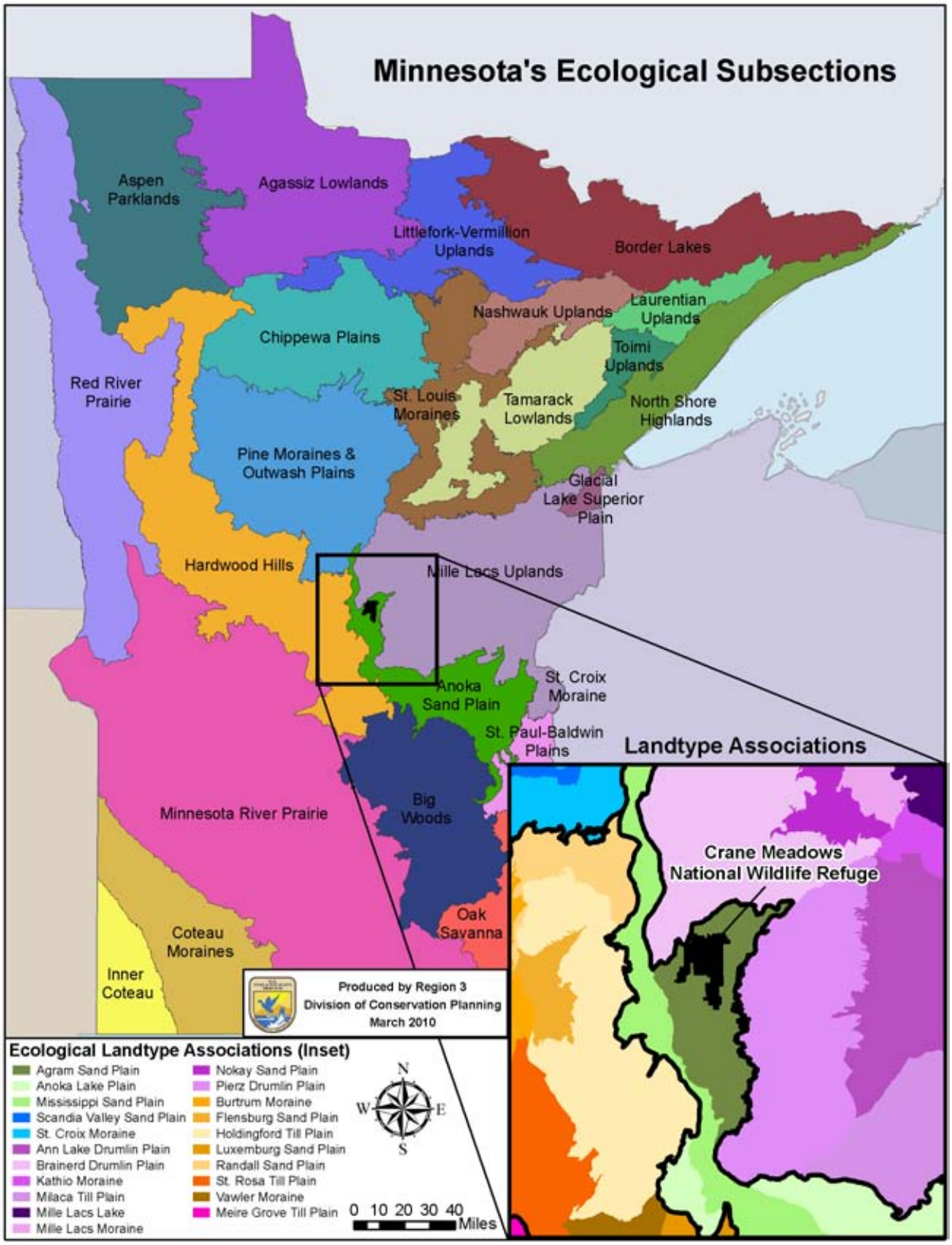


square miles of the nation. This ecotype extends in an arc from Minnesota along the southern edge of the Great Lakes, and reaches as far south as the top of Alabama. It is typified by rolling moderate relief and drought-resistant oak-hickory associations of broadleaf forest with increasing maple-basswood associations in northern ranges. The Minnesota portion of this province encompasses nearly 12 million acres and is characterized by a precipitation that is approximately equal to the rate of evapotranspiration, an annual precipitation range from 24 to 35 inches northwest to southeast, and a normal annual temperature that varies from 38 degrees to 46 degrees Fahrenheit northwest to southeast. This is a species-rich province, and many of the species are at the western edge of their ranges. The Minnesota DNR recognizes 205 Species of Greatest Conservation Need (SGCN) in this province, citing habitat loss and degradation, invasive species, pollution, and interactions with humans as major factors affecting their survival (Minnesota DNR 2005, 2006b and 2009b, Bailey 2009).

The Minnesota and Northeast Iowa Morainal/ Oak Savanna Section (see Figure 6) is a mosaic of morainal, till, and outwash plain areas 30 to 500 feet thick resulting from past glacial activity. In general, poor drainage is associated with the section, leading to an abundance of fluvial systems but relatively few open water and wetland features. However, terminal moraines in the northern reaches near Crane Meadows NWR have led to an abundance of surface waters, wetlands, and undeveloped drainage networks. Fire frequency, duration, and intensity played a major role in the configuration of pre-settlement habitats, therefore, the landscape came to be dominated by prairie, savanna, and oak and aspen woodlands; and patches of forest were able to form along rivers, streams, and lakes. Descriptions of the historic vegetation vary by account, but include tallgrass prairie, oak savanna, maple-basswood forest, oak-hickory forest, and floodplain forest. Elevation in the Section ranges from 1,000 to 1,600 feet (Minnesota DNR 2009c, USFS 2009).

The Anoka Sand Plain Subsection (see Figure 7 on page 22) is nearly 1.2 million acres of broad, flat, sandy lake plain deposited by Gransburg sublobe meltwater from the Des Moines lobe of receding Pleistocene glaciers. Both drought and fire played major roles in shaping the vegetation structure. The vegetation communities consisted of aspen woodlands, oak barrens, prairie and savanna openings, dry prairies, and brushlands on the droughty

Figure 7: Minnesota's Ecological Subsections and Landtype Associations



uplands, with bogs, fens, wet prairies, emergent marshes, shrub swamps, and bottomland forest in low-lying areas. Trees characteristic to this subsection include bur oak, northern pin oak, and jack pine (Kratz and Jensen 1983). Bottomland forest formed along the Mississippi, and upland prairie formed in areas with enough moisture to sustain a diversity of prairie grasses. Ninety-seven Species of Greatest Conservation Need occur in this subsection, 39 of which are threatened, endangered, or of special concern at the federal or state level. This subsection contains some of the best oak savanna habitats in Minnesota, and provides important stopovers for migratory birds (Albert 1995, Minnesota DNR 2006b and 2009a).

Crane Meadows NWR falls completely with the Agram Sand Plain Landtype Association (LTA), one of 291 LTAs in Minnesota defined primarily by their soil complexes and vegetation communities (see Figure 7 inset). The description of the LTA portrays a rolling glacially-formed outwash plain, sandy soils with a coarse loamy surface mantle, and a pre-settlement vegetation mixture of oak savannas, wet prairies, and brush prairies.

Historic Vegetation

Land surveys were conducted by the General Land Office (GLO) between 1848 and 1907 in Minnesota. These records note tree species and diameters, general topography, soil quality, and vegetative cover along a 1-mile by 1-mile grid of section line transects. It is important to note that the Public Land Survey notes were not taken with the intention to objectively document vegetation, but were instead compiled to record land information for the sale of the nation's lands to generate revenue for the federal government (Almendinger 1997). Despite certain biases, these records can be used to gain insights into the pre-settlement landscape and to establish a baseline for historic vegetation conditions.

The survey descriptions for the lands within the Crane Meadows NWR acquisition boundary occur primarily in two townships. The Rice-Skunk wetland complex is in Agram Township, (T40N, R31W), and the southern extension of the Refuge is in Buckman Township, (T39N, R31W). Both townships were surveyed in December 1849 and August 1852.

There are countless accounts of entering and exiting marshes, swamps, rivers, streams, and brooks in survey descriptions for Agram Township. The land is described as ranging from level, slightly/gently rolling, to hilly, with widths of brush areas and streams measured in links, with one link equaling 7.92 inches. The bearing trees described consist of only five species. The dominant bearing tree species is bur oak with an average diameter of 8-10 inches, and ranging from 5-24 inches. Black oak and jack pine are also commonly used as reference trees. The black oaks are slightly larger in diameter than the bur oaks, with an average of 10-15 inches, and the jack pines ranged from 8-30 inches with no distinguishable average. All three of these wooded areas were encountered as "oak and pine barrens," "scattering timber," or "occasional oaks" alluding to an oak savanna cover type. Areas of willow-alder brush are also very common in the descriptions. Aspen appear sporadically, and there is only one mention of a 10-inch maple in the entire set of survey notes. Prairie and grass areas are mentioned less often, perhaps due to the limited utility of these areas for survey delineation. There are numerous accounts of "marshes unfit for cultivation" and "mostly uncultivable willow and alder swamps." Interestingly, the Rice-Skunk wetland area has at least two descriptions of wild rice, including, "The lake is full of wild rice," and "The lake is so filled with vegetation and wild rice that it is impassible (US OSG 1852)."

To the south, Buckman Township tends to have slightly less marsh areas and wetlands, more grass, more aspen, and a larger surface area described as oak barrens with slightly smaller tree diameters (5-10 inches) than the northern. There are more descriptions of soil conditions being either poor or great, and even occasional references to marshes being good for hay. Again, bur and black oak, aspen, and jack pine are the dominant bearing trees. A typical description in this township may state something similar to, "The land is broken marshy prairie, some scattering oaks," or "The land is gently rolling, soil great, the timber is scattering oak and pine (US OSG 1852)."

The GLO Public Land Survey Notes in Minnesota were analyzed in 1930 by Francis Joseph Marschner, a geographer with the USDA's Bureau of Agriculture Economics. The survey notes, along with supplementary information such as landforms, were used to classify the state lands by vegetation type, then compiled into maps subsequently digitized by the Minnesota DNR. Consistent with the GLO notes but adding the spatial distribution, the Marschner map for Crane Meadows NWR (see Figure 8 on page 24) shows two dominant vegetative types: wet prairie and oak openings/barrens. Small areas within the acquisition boundary are also depicted as prairie, brush prairie, or conifer bogs/swamps (Marschner 1930). Approximate GIS acreages for these historic cover types are illustrated in Table 2 on page 25.

In addition to the GLO survey notes describing historic vegetation conditions, information contained in soil surveys can be used to understand the

Figure 8: Presettlement Vegetation Based on the Marschner Map, Crane Meadows NWR

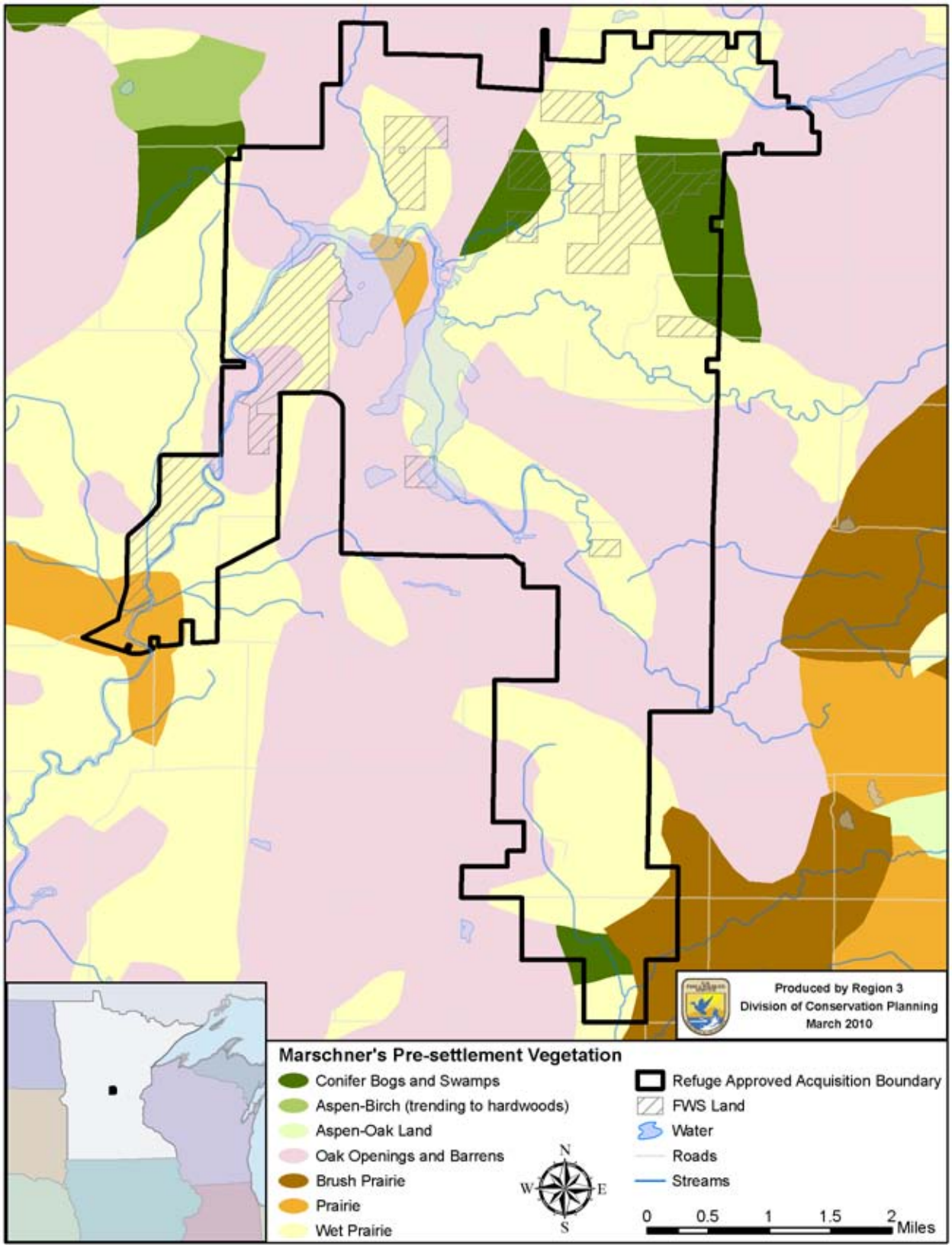


Table 2: Marschner's Pre-settlement Vegetation

General Vegetation Type	GIS Acres[a]	
	Acquisition Boundary	Service-owned land
Conifer Bogs and Swamps	803.2	203.5
Oak openings and barrens	5871.5	242.5
Brush Prairie	197.1	0.0
Prairie	3,48.2	40.1
Wet Prairie	6,630.0	1,269.6
Total Calculated GIS Acres	13,850.0	1,755.7

a. All acreages are approximate GIS acres.

vegetative capacity of a landscape. The soils in a given locality are a result of the parent rock material, organisms, climate, and relief as they interact over time. These factors, and the resulting soils, limit which vegetation communities can take hold in a geographic locale. Soil survey data collected over the past century by the USDA's Natural Resource Conservation Service includes written descriptions of native vegetation, which can be linked to the primary soil unit and mapped. Figure 9 on page 26 uses data from the Soil Survey Geographic (SSURGO) Database to display the potential natural vegetation at Crane Meadows NWR. Using the information from this database, wetland areas and open water constitute nearly half of the area in the acquisition boundary (6,332 acres), another quarter (3,679 acres) is in upland forest, and the remainder is either upland forest with prairie openings/oak savanna (1,836 acres), bottomland forest with wetland openings (1,717 acres), or simply bottomland forest (245 acres). All acreages (see Table 3 on page 27) are approximations based on USGS NRCS GIS data (USDA 2009).

Current Land Use / Land Cover

According to work done by the University of Minnesota and the Minnesota Pollution Control Agency, Morrison County's 1,124 square miles are less than 6 percent developed, and agriculture is the dominant land use comprising approximately 37 percent of the county. Additionally, over a quarter of the county is forested (29 percent) and another quarter is some form of grass/shrub/wetland (26 percent) cover type. Open water comprises just over 2 percent of the County (University of Minnesota 2007).

The 21-class land cover dataset developed by the Multi-Resolution Land Characteristics Consortium using 2001 Landsat imagery[1] can be used to understand the geographic distribution of land use in the area around the Refuge (USGS 2003). Using a 10-mile buffer, 67.7 percent of the land use surrounding the Refuge is row crops or pasture, forests make up another 14 percent, herbaceous wetlands 7 percent, grasslands another 3 percent, and open water is just under 2 percent. Developed or urban areas comprise just over 5 percent of the 10-mile peripheral zone, including the towns of Little Falls, Pierz, Royalton, and Rice, parts of the Camp Ripley National Guard Training Center, and major roadways. Figure 10 on page 28 and Table 4 on page 29 portray and summarize these data.

The land use proportions change in an analysis of the land only within Crane Meadows NWR's acquisition boundary. Agriculture is still a major component at approximately 33 percent, but is surpassed as the largest cover type by herbaceous wetlands (36 percent). Roads become the only distinguishable developed areas, and natural cover types increase slightly in proportion; forest is over 18 percent, and open water and grassland are around 5 percent each (see Figure 11 on page 30 and Table 4 on page 29).

Migratory Bird Conservation Initiatives

North American bird conservation efforts have evolved in recent decades from predominantly localized efforts to landscape-level initiatives with separate planning emphases on guilds of birds and a greater emphasis on collaborative management. With more than 700 species of birds in the United States, Crane Meadows NWR hosts a diversity of waterfowl, waterbirds, shorebirds, and landbirds. The Refuge's position in the Mississippi Flyway (see Figure 12 on page 31) makes this wetland complex

1. This medium resolution data is based on a classification of 30-meter Landsat imagery from 2001. The land surface is generalized to some extent in assigning pixel values, and land uses may have changed since the data was created.

Figure 9: Soil Survey Vegetation Data, Crane Meadows NWR

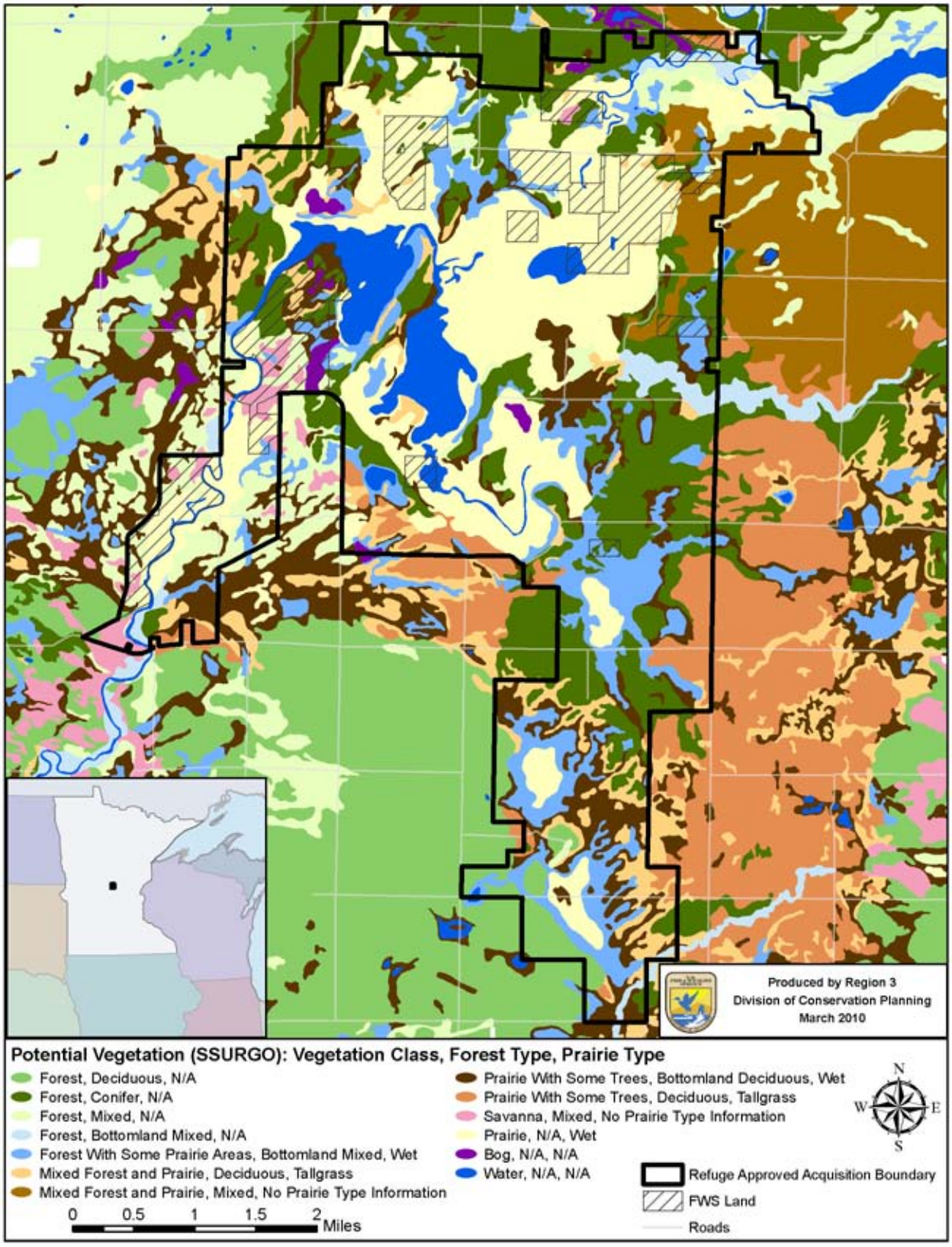


Table 3: Potential Vegetation Derived from Soil Survey (SSURGO) Information

Landscape Position	Cover Type Classification	Forest Type	Prairie Type	GIS Acres[a]	
				Acquisition Boundary	Service-owned Land
Upland	Forest	Deciduous	-	316.9	2.3
Upland	Forest	Conifer	-	2,601.9	197.5
Upland	Forest	Mixed	-	759.9	173.8
Upland	Savanna	Mixed	No Prairie Type Info	179.4	110.6
Upland	Mixed Forest and Prairie	Deciduous	Tallgrass	827.3	60.8
Upland	Mixed Forest and Prairie	Mixed	No Prairie Type Info	352.1	37.0
Upland	Prairie With Some Trees	Deciduous	Tallgrass	476.7	19.9
Bottomland	Forest	Bottomland Mixed	-	245.0	20.0
Bottomland	Forest With Some Prairie Areas	Bottomland Mixed	Wet	1717.4	89.1
Bottomland	Prairie With Some Trees	Bottomland Deciduous	Wet	1,461.6	129.4
Bottomland	Prairie	-	Wet	3,864.1	797.8
Bottomland	Bog	-	-	118.3	52.2
Bottomland	Water	-	-	887.6	62.8
Total Calculated GIS Acres				13,808.2	1,753.2

a. All acreages are approximate GIS acres.

an important stopover as birds travel from their breeding grounds in the North to their wintering areas in the South.

North American Waterfowl Management Plan

Waterfowl (family Anatidae, including ducks, geese, and swans) are economically important for both hunting and wildlife observation activities, can be used as indicators of environmental health, and are an important part of wetland ecosystems. Habitat loss resulting from agriculture, urbanization, and industrial activities has caused their numbers to decline in recent decades.

The North American Waterfowl Management Plan (FWS 1986, updated in 1994, 1998, and 2004) is a 15-year plan that sets up a framework for cooperative planning and coordinated management between the United States and Canada to increase populations to acceptable and desired levels. It describes appropriate waterfowl population goals, and also provides recommended actions for reaching the population levels. One major result of the plan was the establishment of joint ventures between private and government organizations within geographic regions to coordinate waterfowl research and management activities. These joint ventures assist in integrating continental migratory bird priorities into regional, state, and local level conservation programs. Constituents include individuals, businesses, nongovernmental organizations, and local, state and federal government representatives.

Crane Meadows NWR lies within the Upper Mississippi/Great Lakes Joint Venture (UM/GL JV) region, yet it is only 10 miles from the border with the Prairie Pothole region (see Figure 12 on page 31). The UM/GL JV was formed in 1993 and has protected, restored, and enhanced more than 522,000 acres of habitat. Habitat conservation strategy handbooks for each bird-group – shorebirds, landbirds, waterbirds, and waterfowl – along with an overarching implementation plan were released in 2007 to provide guidelines for the habitat types and quantities required to sustain target bird populations. These new plans use the latest geospatial

Figure 10: Land Cover Within a 10-mile Radius of Crane Meadows NWR

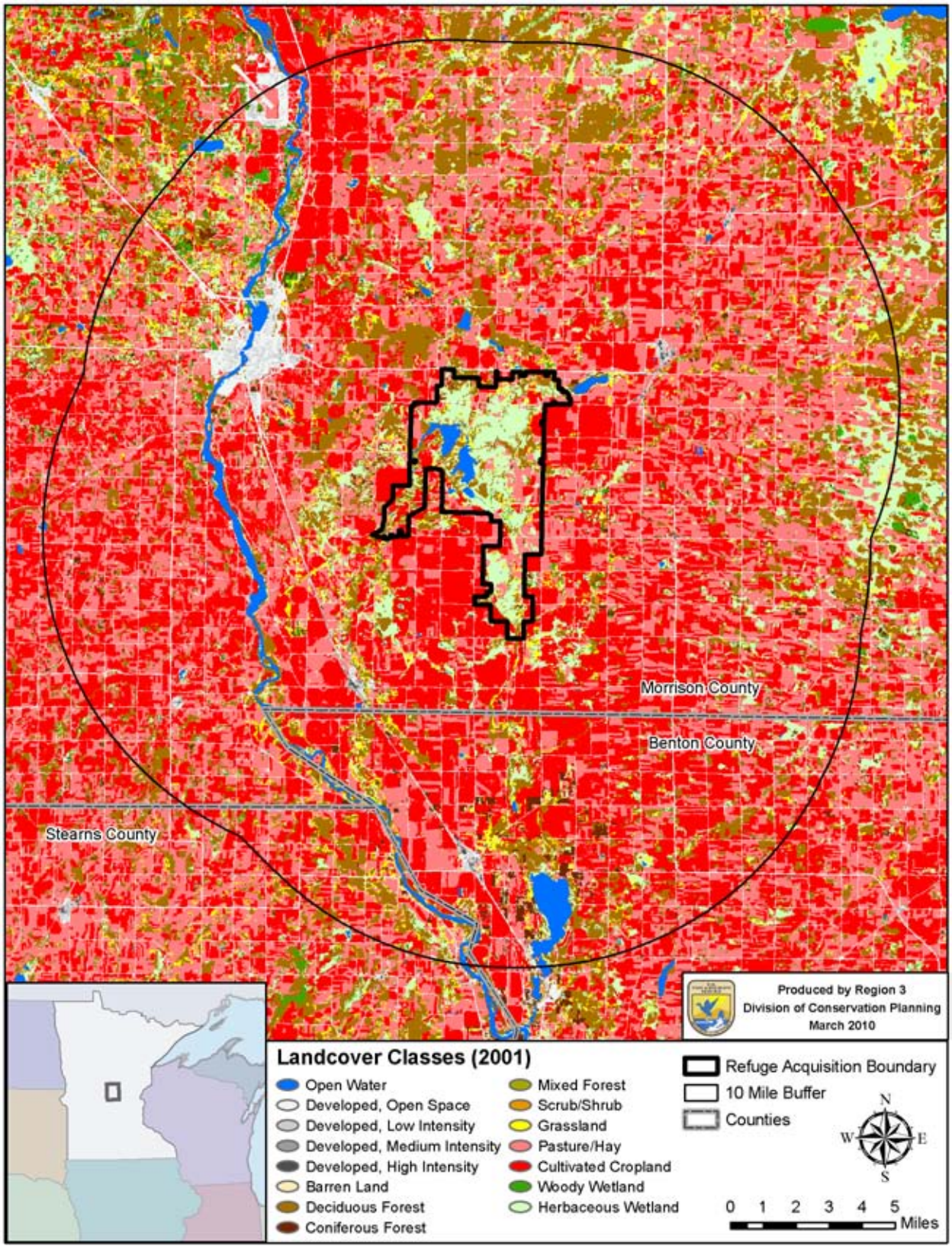


Table 4: Land Cover Types in the Vicinity of Crane Meadows NWR

Cover Type	Percent	
	10 Miles	Acquisition Boundary
Open Water	1.7	5.1
Developed, Open Space	4.7	1.7
Developed, Low Intensity	0.5	-
Developed, Medium Intensity	0.1	-
Developed, High Intensity	-	-
Barren Land	-	-
Deciduous Forest	12.8	17.6
Coniferous Forest	1.3	0.9
Mixed Forest	-	-
Scrub/Shrub	0.2	0.1
Grassland	2.8	4.5
Pasture/Hay	32.1	19.2
Cultivated Cropland	35.6	14.2
Woody Wetland	0.9	0.5
Herbaceous Wetland	7.2	36.2

analysis tools along with the most current scientific knowledge in their biological planning, regional landscape design, and strategies for projects, monitoring, research, communication, and outreach.

Established in 1987, the Prairie Pothole Joint Venture includes one-third of North America's Prairie Pothole Region contained within the United States (approximately 100,000 square miles). This landscape of depressional wetlands and grasslands combined with the Prairie Pothole Region in Canada constitute one of the largest and most productive concentrations of wetland habitat in the world. Native birds include 18 species of waterfowl, 96 species of songbirds, 36 species of waterbirds, 17 species of raptors, and five species of upland game birds. Due to productive soils and abundant water, much of the Prairie Pothole region has been drained and used for agriculture or grazing. The Joint Venture works to counter this trend by saving or restoring high priority wetland areas and adjacent native prairie and grassland habitat throughout the region. Their 2005 Implementation Plan calls for the protection of 1.4 million additional wetland acres and 10.4 million acres of grassland (Ringelman 2005).

North American Landbird Conservation Plan

In contrast to the other three bird plans referenced here, the target species of the North American Landbird Conservation Plan (Partners in Flight 2004) focuses on birds that inhabit predominantly terrestrial habitats.

Approximately 448 landbirds breed in the U.S. and Canada, and as international resources this plan is drawn at a continental scale. Landbirds contribute to the economy in a number of ways. First and foremost they provide ecosystem services including pollination, seed dispersal, and the consumption of insect pests. They also provide recreation opportunities such as wildlife observation and photography. The loss, modification, degradation, and fragmentation of habitat constitute the primary threat for landbirds, including neotropical migrants, short-distance migrants, and largely resident species. This plan identifies 192 species of continental importance. Approximately half (100) of these species are on a 'Watch List' because of a threatened/endangered population status. The remaining 92, as well as 66 species from the Watch List, are considered 'Stewardship Species' because they characterize and typify biogeographic regions of North America (See Figure 12 on page 31). These regions are based on Bird Conservation Regions (BCRs) devised by

Figure 11: Land Cover Within Crane Meadows NWR

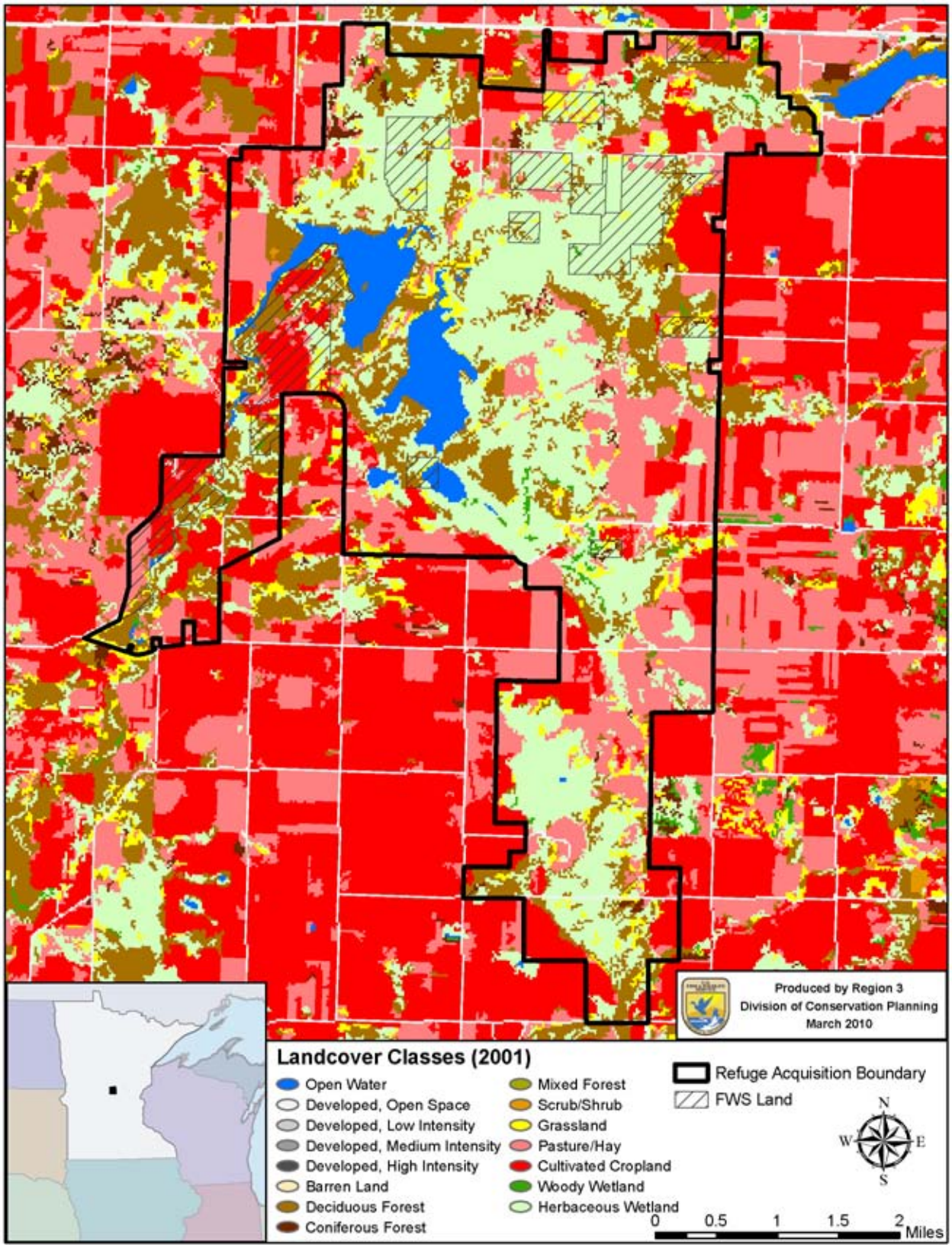


Figure 12: Ecological Regions Related to Crane Meadows NWR

the North American Bird Conservation Initiative (NABCI), but have been merged into larger biogeographic units shown in Figure 12 (Rich et al. 2004).

Second only to portions of the western U.S., the next highest diversity of breeding landbirds occurs in the transition zone between the eastern deciduous and northern boreal forest. Crane Meadows NWR lies in this transition zone and is classified as just inside the Prairie Avifaunal Biome. This area forms the heart of North America's grasslands, with tallgrass prairie and oak-savanna on the eastern edge where Crane Meadows NWR is located. Just over 99 percent of the original tallgrass prairie has been lost to agriculture and urban development. Another characteristic of this region is the glacial depressions forming diverse wetland complexes and large river systems. This biome provides the wintering habitat for many Arctic species of landbirds, and nearly 40 percent of the species on the 'Watch List' used to identify species with multiple reasons for conservation concern across their entire range breed in this biome.

U.S. Shorebird Conservation Plan (2001)

The U.S. Shorebird Conservation Plan (2001) was drafted by a national partnership of national, state, private, and academic organizations committed to shorebird conservation. The designation 'shorebird' is applied to those birds commonly known as sandpipers, plovers, oystercatchers, avocets, and stilts. Of the 214 shorebirds worldwide, 50 regularly breed or occur in the United States.

The challenges of shorebird conservation stems from their great migration distances crossing multiple jurisdictions, low rates of reproduction, concentrated use of dispersed migration stopovers, a general loss of their habitat across the landscape, and a lack of shorebird population data. This plan groups the Bird Conservation Regions to create 11 shorebird planning regions. Within each, a regional working group sets conservation goals, identifies critical habitats, assesses research needs, and recommends strategies for outreach and education. Founded on collaboration and cooperation between partners, the goal of the plan is to stabilize populations of shorebird species by protecting adequate quantities of wetland, shoreline, and grassland habitat to meet their breeding, wintering, and migrating needs (Brown et al. 2001).

Crane Meadows NWR lies within the Upper Mississippi Valley/Great Lakes (UMVGL) Shorebird Planning Region (see Figure 12 on page 31). This region contains five BCRs and 32 shorebird species, nine of which are of high conservation priority: Greater Yellowlegs, Whimbrel, Buff-breasted Sandpiper, Short-billed Dowitcher, Marbled Godwit, Wilson's Phalarope, Upland Sandpiper, American Woodcock, and the Piping Plover. This region is noted for its climatic variability, and its primary habitat threats are agriculture, river manipulation, and urban development. Objectives for meeting shorebird needs in this region include the protection of 9.6 million acres of ephemeral and permanent wetlands with associated upland habitats.

North American Waterbird Conservation Plan (2002)

The North American Waterbird Conservation Plan (2002) was created through voluntary, collaborative efforts of many individuals and organizations interested in the future of seabirds and other colonial nesting birds. In response to threats like habitat loss, invasive and exotic species introductions, pollution, industrial activity, and site disturbance, the activities proposed by the plan range from continent-wide monitoring to local conservation actions that promote the distribution, diversity, and abundance of waterbirds. The plan covers 210 species, including seabirds, coastal waterbirds, wading birds, and marshbirds. Of the freshwater habitats noted in the plan, nearly all are found at Crane Meadows NWR. These habitats provide for the nesting, feeding, roosting, and resting needs of waterbird species. Through inventory and monitoring this plan is able to help identify the most threatened birds and the most critical habitats (Kushlan et al. 2002).

Crane Meadows NWR falls within the Upper Mississippi Valley/Great Lakes (UMVGL) Waterbird Planning Region (See Figure 12 on page 31). Though the other regions differ between the waterbird and shorebird plans, the UMVGL region for waterbirds follows the same geographical boundary as the UMVGL for shorebirds. The region contains approximately 40 species of waterbirds, among them are priority species of terns, herons, bitterns, rails, and loons. Also, superabundant species are present including Double-crested Cormorants and Ring-billed Gulls. Freshwater habitats at Crane Meadows NWR that are used by waterbirds include wetlands, lakes, shorelines, rivers, floodplains, and small islands. Because of the Refuge's proximity to the Mississippi River, it serves as an important stopover for migratory waterbirds within the Mississippi Flyway.

Region 3 Fish and Wildlife Conservation Priorities

Every species and habitat is important, however there is a subset that requires immediate attention and efforts for their conservation, protection, and/or recovery. At the federal level, conservation priority is directed first toward migratory birds, interjurisdictional fish, and those species that are nationally threatened or endangered with extinction.

In accordance with the Government Performance and Results Act (GPRA) the Service must direct ample resources towards its most important functions and responsibilities. In 1997 a group of employees and subject specialists in the Midwest Region (Region 3) of the Service gathered together to create a list of Fish and Wildlife Resource Conservation Priorities. The report, published in January of 2002, identifies 243 species in the region as resource conservation priorities, along with habitat indicators, obstacles, strategies, and desired outcomes (FWS 2002). The report emphasizes species as conservation targets over habitats for three primary reasons:

- Species are the primary element of biological diversity; irreplaceable if extirpated.
- Identifying species implies maintaining specific habitats in a way that meets the life cycle requirements of the target species.

- By assessing multiple species within a single landscape, locations can be identified where elements overlap and the most essential habitats occur.

In the report, Crane Meadows NWR falls within what is identified as the Mississippi Headwaters/ Tallgrass Prairie ecosystem. Appendix D gives a complete list of the Resource Conservation Priority species found at Crane Meadows NWR.

Minnesota Comprehensive Wildlife Strategy

In 2005, Minnesota completed the Minnesota Comprehensive Wildlife Strategy (CWCS) (2006b), a 10-year strategic plan for managing Minnesota's populations of rare, declining, or vulnerable animals, or "species in greatest conservation need (SGCN)." The plan, developed with the support of funding from the State Wildlife Grant Program created by Congress in 2001, assesses nearly 1,200 animal species and identifies 292 species in need of conservation. This strategic plan is the result of a partnership of conservation organizations across Minnesota dedicated to sustaining viable wildlife populations and the habitats that sustain them. Headed by the Minnesota Department of Natural Resources, the partnership also includes the U.S. Fish and Wildlife Service, The Nature Conservancy, Audubon Minnesota, the University of Minnesota, and over 100 other agencies and conservation organizations.

The 10-year plan is designed to provide information on the distribution and abundance of species, describe key habitats, identify threats, prioritize research and monitoring needs, outline and prioritize conservation actions, facilitate coordination with other wildlife conservation and land management agencies and organizations, and engage the public in the process. The plan adheres to a wildlife conservation approach which first protects the key habitats used by species in greatest conservation need, thereby also providing habitat for the majority of Minnesota's wildlife. Consideration is then given to individual, species-specific needs and requirements that are not met by more general approaches to wildlife conservation.

Based on climate, geology, topography, soils, hydrology, and vegetation, Minnesota's Ecological Classification System delineates four ecological provinces, 13 sections, and 25 subsections (see Figure 6 on page 21 and Figure 7 on page 22). At the province level, the Eastern Broadleaf Forest Province in which Crane Meadows NWR is located contains both the largest number of SGCN (205) and the greatest number of species (51) unique to any single province.

However, the primary organizational units used in the CWCS are the 25 ecological subsections in Minnesota. Crane Meadows NWR is located in the Anoka Sand Plain subsection, which contains 97 SGCN, and one species that is unique to the subsection. Thirty-nine of these species are endangered, threatened, or of special concern at the federal or state level. Highlighted species in the area include Sandhill Cranes, Trumpeter Swans, Bald Eagles, Bobolinks, Lark Sparrows, badgers, Blanding's turtles, and gopher snakes. Out of 14 generalized habitat types identified for Minnesota's SGCN, the Anoka Sand Plain subsection contains seven. The habitat types used most by the SGCN are prairies, rivers, and wetlands, all of which are found at Crane Meadows NWR. Some of the best examples of dry oak savanna in Minnesota also occur in this subsection. Landcover summarized within the subsection finds over 50 percent of the subsection in agriculture and pasture, another 12 percent developed, approximately 5 percent as water, which leaves just under 30 percent in forest or wetland/open cover types (Minnesota DNR 2006b and 2009a).

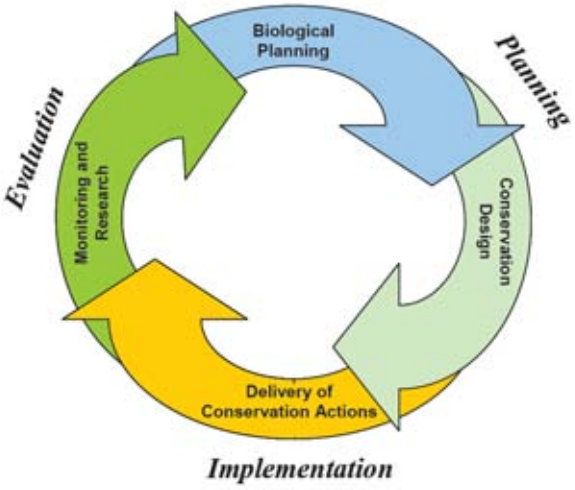
The information and strategies of the CWCS were used as a means to assist with development of Refuge objectives in the CCP. The townships that contain Crane Meadows NWR have been identified as having a high abundance of species of greatest conservation need within the Anoka Sand Plain subsections, which suggests that the Refuge plays an important role in the state's conservation partnership. Appendix C of Minnesota's CWCS contains a summary of other conservation plans and efforts for each subsection (Minnesota DNR 2006b).

Strategic Habitat Conservation

Recognizing numerous advancements made in the fields of conservation, ecology, adaptive management, and technology, a panel of policy and technology experts from the Fish and Wildlife Service, U. S. Geologic Survey (USGS), and the National Conservation Training Center (NCTC) formed the National Ecological Assessment Team (NEAT) in June of 2004. The goals of this team were to discuss and make recommendations to the FWS on its approach to trust resource conservation, with efficiency, prioritization, and transparency as key drivers. The outcome of these meetings was the Strategic Habitat Conservation (SHC) framework, which is an iterative cycle of: 1) biological planning, 2) conservation design, 3) conservation delivery, and 4) monitoring and research (see Figure 13 on page 34 – from FWS 2006).

The principles of SHC are not new to Service programs and projects, but the NEAT report formally establishes SHC as the new 'business model' or

Figure 13: Diagram of the Strategic Habitat Conservation Framework



operating platform for the Service in light of the 21st century's changing conservation landscape. Trends in the new millennium addressed by SHC include a focus on conservation science that is increasingly collaborative and interdisciplinary, spans multiple jurisdictions, uses a range of scales, and intertwines ecology with socio-economic considerations. In addition, the face of the conservation workforce is changing, expectations from the public are increasing, and the complexity of environmental issues is intensifying. Whereas the previous era sought balance in the conservation and utilization of natural resources, the upcoming era has forced a recognition of limits to our environmental systems and the challenge of sustaining resources despite increasing pressures from threats such as urban development, energy consumption, water use, and climate change (FWS 2008a).

Stratetic Habitat Conservation emphasizes a landscape-scale consideration of resources and the importance of understanding and integrating the goals of collaborative partners as key ways to effectively achieve conservation objectives. This will require management support for work that not only spans program areas within the Service, but support that extends beyond our agency to the interests and programs of our conservation partners. The Service has been encouraged to take immediate steps in implementing the SHC framework. These steps involve setting measurable, outcome-based objectives to guide visible progress towards conservation goals, using spatially-explicit models to provide the means for systematic identification of conservation targets, and increasing the integration of science into planning and management decisions (FWS 2006 and 2008b).

The work outlined in this CCP for Crane Meadows NWR adheres to the SHC framework by conducting a thorough review of science relevant to management at the Refuge, feeding that information and issues identified during scoping directly into near- and long-term goals and objectives, and defining strategies to guide conservation delivery through the 15-year life of the plan and beyond.

Landscape Conservation Cooperatives

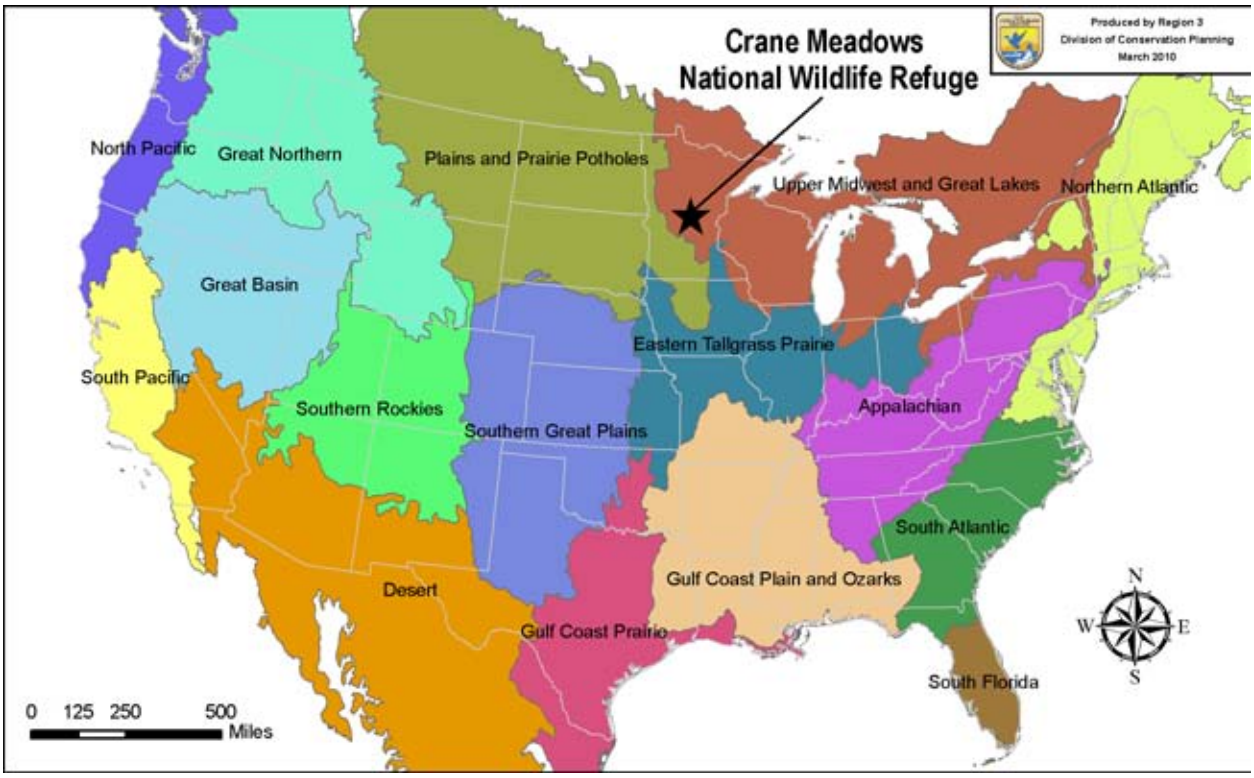
In 2009, with SHC as the guiding philosophy, the Service established a national 'geographic framework,' or a continental platform on which to establish landscape-level conservation partnerships and implement conservation actions in the 21st century. The framework establishes boundaries for 22 geographic areas, each to serve as a base for the establishment of a Landscape Conservation Cooperative (LCC). Landscape conservation cooperatives will provide a spatial context and an organizational structure for facilitating conservation planning, shared science, information exchange, and decision support in response to broad-scale, complex, and dynamic issues such as climate change.

Crane Meadows NWR falls within the Upper Midwest and Great Lakes LCC geographic area (see Figure 14 on page 35). This LCC formed near the end of 2009 to provide science support and engage partners in the Great Lakes region. The Great Lakes are the largest system of fresh, surface water in the world, and contains 5,472 cubic miles of water. The region has a diversity of habitats including deepwater zones, beaches, coastal wetlands, more than 35,000 islands, major river systems, boreal forests, and prairie-hardwood transition zones - the latter of which includes Crane Meadows NWR. Work has begun to assess driving issues, set conservation priorities in the form of species and habitats, and undertake research needed to fill gaps in our scientific understanding of the region.

Conservation Corridors and Green Infrastructure

Increasing urbanization and widespread land use changes are greatly affecting natural landscapes and healthy ecological systems by fragmenting and degrading habitats (Ahern 1995). In addition, the effects of global climate change have severe implications for natural systems and ecological balances. Strategically conserving lands to protect habitat, wildlife, and ecosystem services is an attempt to reduce and mitigate human impacts on the land-

Figure 14: U.S. Fish and Wildlife Service Landscape Conservation Cooperatives



scape. Traditional approaches to land conservation are often opportunistic, piecemeal, site specific, and narrowly focused. However, an increasing emphasis is being given to collaborative landscape conservation efforts that are proactive, strategic, comprehensive, and integrative. Regional analyses that consider larger geographic extents are helping to focus conservation efforts among a growing consortium of stakeholders and partners. Creating a network of ecological hubs and linkage corridors can increase the connectivity, resiliency, and effectiveness of the biological systems that preserve biodiversity and essential ecological services.

Green infrastructure is one planning framework for strategic, landscape-level conservation design. This framework emphasizes the need to integrate ecologic, social, and economic considerations in the design of truly sustainable landscapes. A green infrastructure case study (Bowman, 2008) was conducted using basic GIS models to understand the opportunities and challenges of establishing conservation networks between Sherburne NWR and Crane Meadows NWR. Two overlay models incorporating a diversity of information and decision factors were developed to assess the biophysical and social suitability for green infrastructure in the five-county area between and surrounding these Refuges. The results are displayed in Figure 15 on page 36 and Figure 16 on page 37. Areas in green identify regions with the greatest ecological integrity in the biophysical suitability model (Figure 15) and highest potential social support in the social suitability model (Figure 16) for future land conservation, with a gradation to red indicating lesser degrees of suitability.

The biophysical suitability model incorporates GIS layers such as land cover; sensitive species; native plant communities and areas of biodiversity significance; wetlands, lakes, rivers and streams, floodways, watersheds, and major drainages; and roads, railroads, and municipalities. The results show strong support for connectivity between the Refuges, between Crane Meadows NWR and state landholdings to the east, and to areas across the Mississippi River directly southwest of Crane Meadows NWR. The red silhouettes of municipalities and transportation corridors are distinguishable as less suitable areas and potential barriers to a land conservation network.

The second model (Figure 16) assesses social implications for conservation corridors using marketing indices and past conservation activities summarized by zip code and township respectively. Though sets of social data are less common and

Figure 15: Biophysical Suitability Model Results for Green Infrastructure

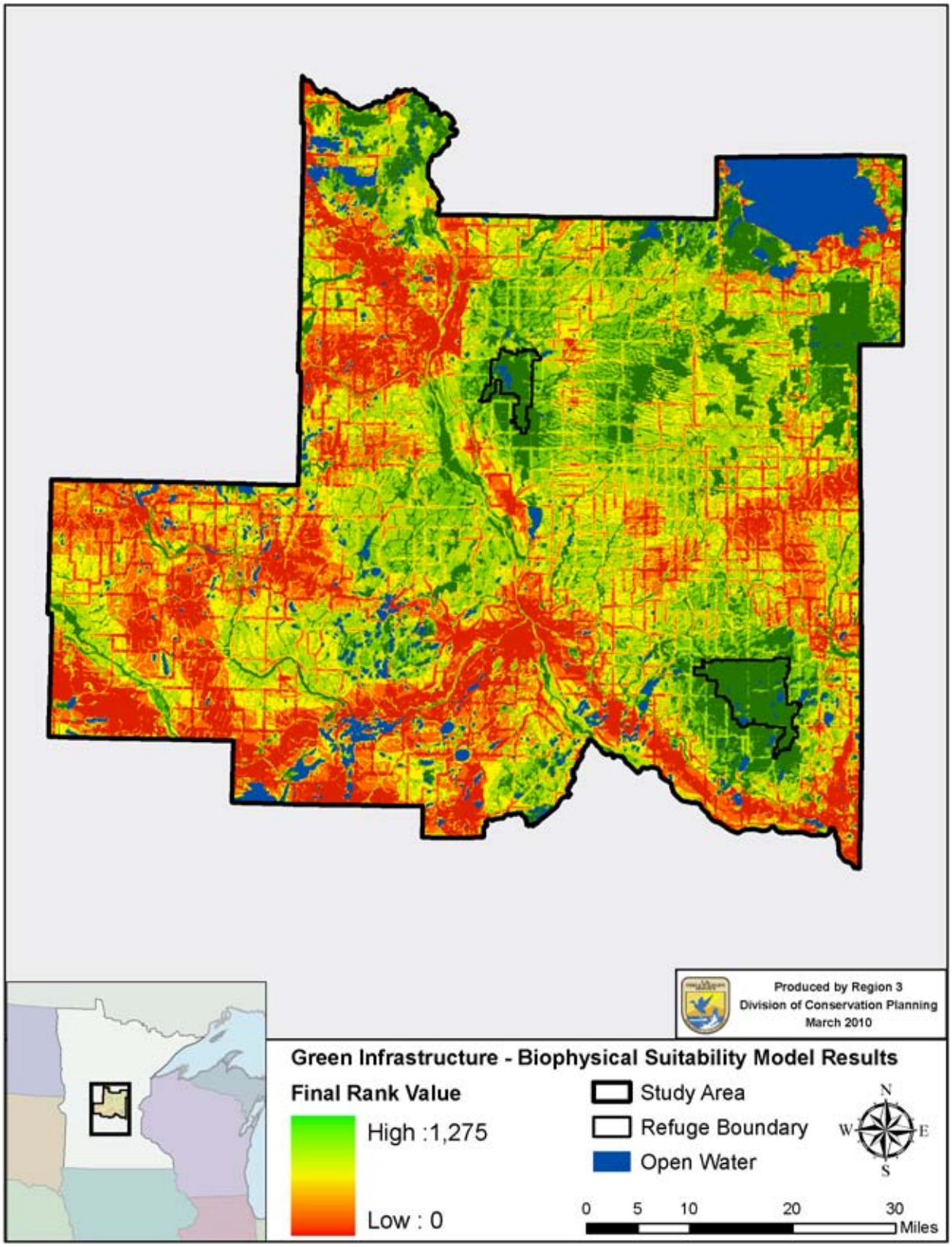
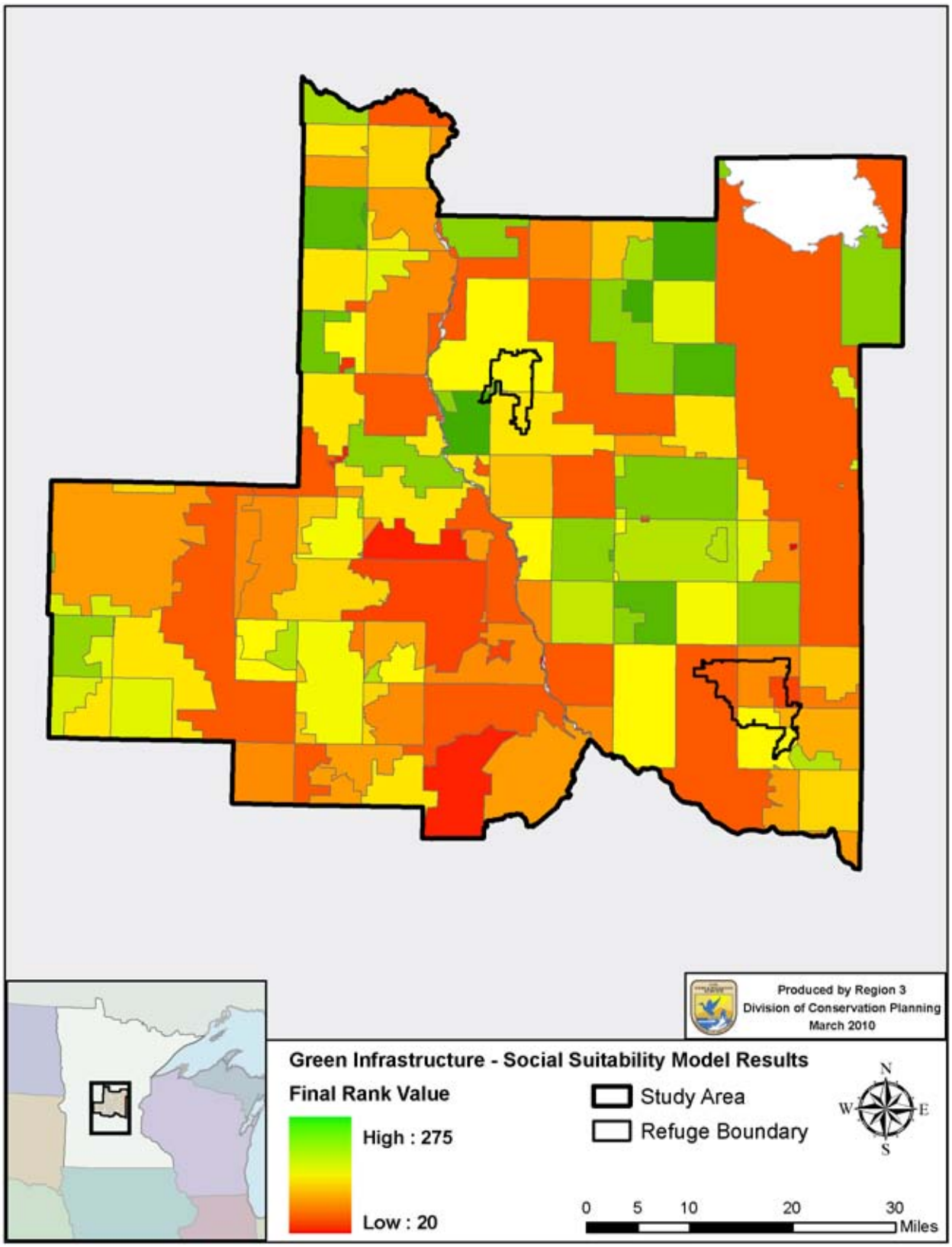


Figure 16: Social Suitabililty Model Results for Green Infrastructure



more difficult to acquire, this type of assessment may help identify areas and populations that favor and support the development of a network of conservation lands. Again, this data indicates stronger support between the Refuges, as well as in pockets east and southwest of Crane Meadows NWR.

Comparing these maps to the current lands with some form of conservation value (see Figure 17 on page 39) provides a measure of progress towards the network concept. A number of ecological hubs exist, and many small parcels are in potential corridor zones. This and other models and design criteria can be used to direct strategic conservation in the form of acquisitions, easements, and partnerships to fill gaps in the current conservation system.

A similar analysis could also be used to assess potential corridors and connectivity between Crane Meadows NWR and Rice Lake NWR 50 miles to the northeast. Multiple corridor pathways may be possible due to the course of the Mississippi River west the Refuges, the presence of Lake Mille Lacs directly between the two, and the large quantity of protected lands north and east of Crane Meadows - south and west of Rice Lake (see Figure 5 on page 18).

Socioeconomic Setting

Crane Meadows NWR's entire acquisition area falls within Morrison County, Minnesota, whose population accounts for only 0.6 percent of the state population of over 5 million people. Compared to state averages, the county's population is growing more slowly, is less ethnically diverse, has a lower maximum education status, greater home ownership rate, a higher number of people per household, a greater number of persons below the poverty level, and is less densely populated (U.S. Census Bureau 2009).

Population, Demographics, and Housing

The last decennial census was conducted in the year 2000. According to this data, Crane Meadows NWR's acquisition boundary acreage (13,540) is approximately 1.9 percent of the total landmass in Morrison County (1,124.5 square miles). The county's 2000 population was 31,712, indicating a 6.6 percent increase over the 1990 population of 29,604, and a 27.8 percent increase over the 1900 population of 22,891. A 2008 estimate places the population at 32,893 people. Larger communities, from greatest population to least, include Little Falls (county seat), Pierz, Royalton, and Randall, and the county averages 28.2 people per square mile (U.S. Census Bureau 2009).

A study by the Minnesota State Demographic Center used the cohort-component method to project that the state population will grow to 5,709,700 by 2015 and 6,446,300 by 2035, with the majority of growth occurring in the major suburbs of the Twin Cities, in the cities of Saint Cloud and Rochester, as well as in the lakes area in north central Minnesota. Morrison County is contained within this north central development region (Region 5), as are Cass, Wadena, Crow Wing, and Todd Counties. Morrison County is projected to grow to 36,050 by 2015 and 40,110 by 2035; an 8.8 percent and 21 percent increase respectively (McMurry 2007).

The average age of the county residents is 36.9 years, with 6.6 percent of the population under 5 years of age, and 15.6 percent over 65. The county is of relatively homogenous ethnicity, with non-white minorities accounting for less than 3 percent of the population, no single minority comprising over 1 percent of the county population, only 1 percent foreign born persons, and 3.9 percent (over 5 years of age) speaking a language other than English in the home. Perhaps influenced by the presence of Camp Ripley, 14.7 percent of the county residents are civilian veterans.

There are 13,870 housing units in the county. Of these, 11,816 are occupied; 81.9 percent are owner occupied. There is an average of 2.64 persons per household (U.S. Census Bureau 2009).

Employment and Income

According to the 2000 Census, of the available working population in Morrison County 16 years or older (16,043), 62.9 percent are employed, 3.8 percent unemployed, and 33.1 percent are not in the labor force. The economic sectors providing employment in the county include the following:

- 29.2 percent management, professional, and related occupations
- 21.8 percent production, transportation, and material moving occupations
- 20.7 percent sales and office occupations
- 14.3 percent service occupations
- 11.5 percent construction, extraction, maintenance, and repair occupations
- 02.4 percent farming, fishing, and forestry occupations
- At 73.1 percent, the majority of workers are private wage and salary, another 13.7 percent work for the government, and 12.5 percent are self-employed.

The average income for all types of households in Morrison County is $37,047, but increases to $45,451 if counting only families generating income. According to 2000 data, 7.5 percent of the population lives

Figure 17: Green Infrastructure Hubs and Links with Conservation Lands

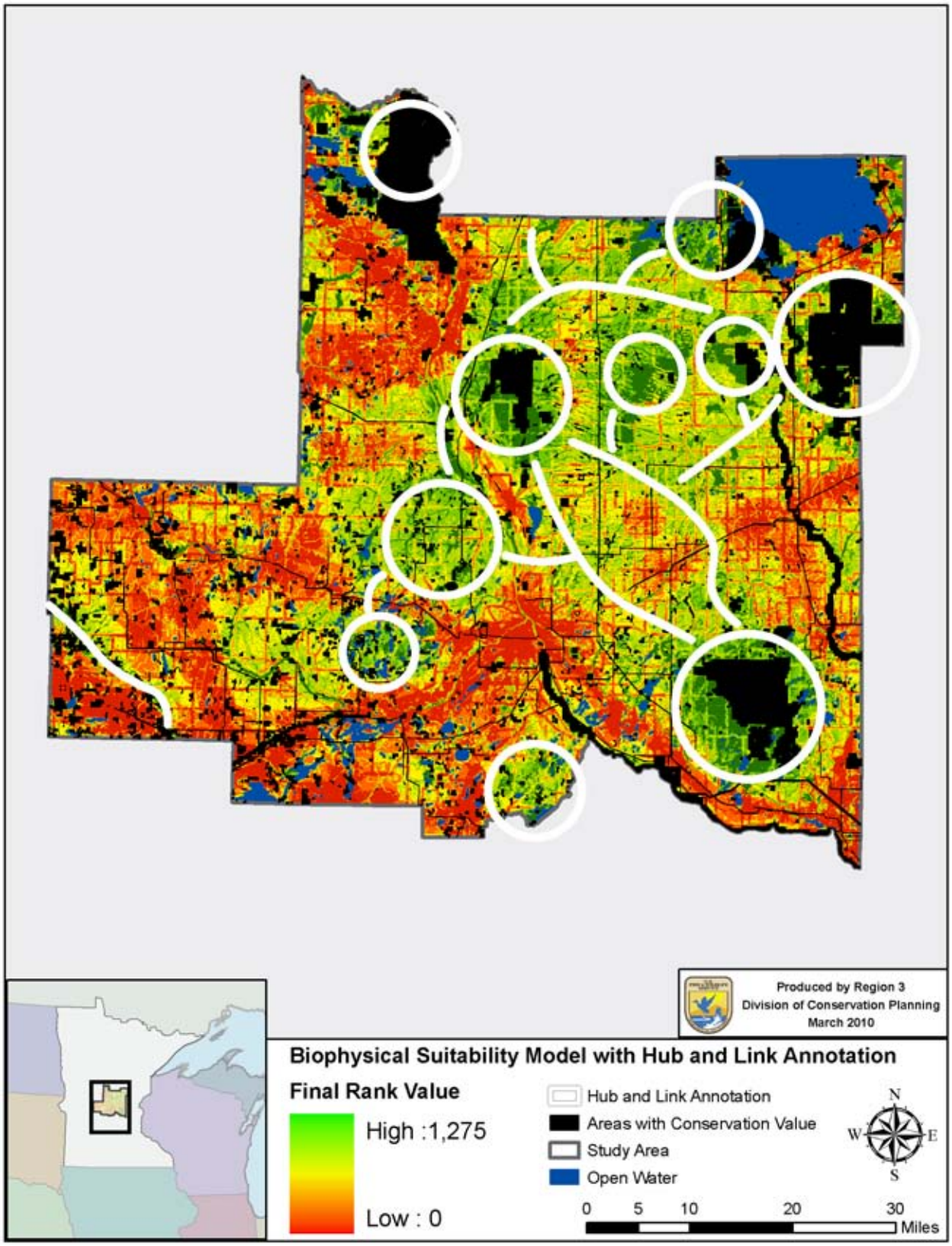


Table 5: Potential Visitation to Crane Meadows NWR in Five Categories

Approximate Driving Distance to Refuge	No. Zip Codes	Total 2001 Population	Photography	Birdwatching	Fishing	Hunting	Contribute to Environmental Organizations
10 Miles	11	56,262.0	1,069.0	2,545.0	1,505.0	1,746.0	1,064.0
30 Miles	55	316,602.0	5,371.0	11,763.0	7,391.0	8,356.0	5,195.0
90 Miles	426	3,700,930.0	41,052.0	73,987.0	51,569.0	57,007.0	41,846.0

below poverty level, slightly above the state average of 5.1 percent. More recent census estimations from 2007 indicate that the county average is closer to 10.4 percent, and the state, 9.5 percent. Average male income is $31,037, and average female income $22,244 (U.S. Census Bureau 2009).

Education

According to 2000 data, 25.7 percent of the population over 3 years of age is enrolled in school at some level. Education levels are lower than the state averages; 79.7 percent are high school graduates as compared to 87.9 state-wide, and 12.6 percent have bachelor's degrees compared to the state average of 27.4 (U.S. Census Bureau 2009). The county public education system in Morrison County includes five high schools, three middle schools, and seven elementary schools. There is also one private high school, and two private elementary schools. Schools in the communities of Little Falls, Pierz, and Royalton are closest to the Refuge. There are no colleges or universities in the county, but there is an extension office of the University of Minnesota in Little Falls. Crane Meadows NWR works with two institutions of higher education in the region: Central Lakes College in Brainerd and Saint Cloud State University in Saint Cloud.

Economic Value of Crane Meadows to the Regional Economy

National wildlife refuges provide a number of benefits and services to individuals and society as a whole. Some can be tracked fiscally such as expenditures in local communities, payroll, and operations costs, while benefits such as recreation opportunities, species protection, ecosystem services, and environmental education do not come as directly connected with economic values.

According to an assessment of the economic benefits of visitation to national wildlife refuges, in 2004 Crane Meadows NWR had 4,998 (4,498 residents, 500 non-residents) visits for non-consumptive recreational activities; primarily the use of nature trails, observation platforms, wildlife observation in general, and other similar recreation activities. It is estimated that individuals associated with these visits brought approximately $15,600 ($9,300 residents, $6,300 non-residents) in recreation-related expenditures (i.e. food, lodging, transportation, and other expenses) that year to local communities, and that a total benefit of $21,200 and two jobs in final demand was added to the regional economy because of the Refuge (Caudill and Henderson 2005.) The final demand calculation simply takes actual visitor expenditures and adds benefits gained by those local individuals who earned income from the visitors' activities.

Potential Refuge Visitation

In order to estimate potential Refuge visitation, 2007 consumer behavior data was acquired and summarized for approximately 10, 30, and 90-mile zones around the Refuge (Table 5). The data is organized by zip code areas and tied to census demographics data. The three distances were selected because they represent reasonable driving distances to the Refuge for an outing by different groups, and because they encompass a number of major and minor population centers. The three closest local communities, Pierz, Royalton, and Little Falls, all fall within the 10-mile radius; Saint Cloud, Brainerd, and numerous smaller communities fall within the 30-mile radius; and the 90-mile area includes the major communities of the Twin Cities metropolitan area, as well as Fergus Falls, Willmar, and Hutchinson. Visitors from local communities are known to come to the Refuge for hiking and wildlife viewing. Little is currently known about Refuge visitation from longer distances, but their proximity to the Refuge makes these populations potential audiences.

The consumer behavior data used in the analysis is derived from Mediamark Research Inc. The company collects and analyzes data on consumer demographics, product and brand usage, and exposure to all forms of advertising media. The results are then associated with other populations of similar demographic and socioeconomic composition throughout the country. A basic assumption in the analysis is that people in demographically similar neighborhoods will tend to have similar consumption, owner-

Table 6: Outdoor Recreation Activities of Minnesota Adults [a]

Activity	Percent Population
Walking	54
Boating of all types	43
Swimming or wading all places	41
Driving for pleasure on scenic roads	37
Picnicking	36
Fishing of all types	30
Biking outdoors of all types	29
Visiting outdoor zoos	27
Camping of all types	26
Visiting nature center	25

a. Table from Minnesota SCORP (Minnesota DNR, 2008a).

ship, and lifestyle preferences. Because of the assumptions made in the analysis, the data should be considered as a relative indication of potential recreation activity, not actual participation.

The marketing categories chosen as surrogates to potential interest in recreating at Crane Meadows NWR include photography, birdwatching, fishing, and hunting. In order to estimate the general environmental orientation of the population, the number of people who might contribute to environmental organizations was also considered. Table 5 displays the consumer behavior numbers for each of the three distances to the Refuge. The projections represent the maximum local and regional populations that may travel to the Refuge with drive times of 10 minutes, 1 hour, and 1 and one-half hours. These numbers estimate a maximum, thus only a fraction of these people can be expected to travel to the Refuge and actual visitor numbers will be smaller.

We also considered the maximum number of students that might potentially participate in environmental education offered by the Refuge by looking at the school populations in Morrison County. The school enrollment in preschool through grade 12 was 7,293 according to the 2000 census (U.S. Census Bureau 2009). The projected school age (5-19) population for the county in 2005 was estimated at 6,942, and is expected to increase only slightly to 6,990 by 2015 and 7,020 by 2035 (McMurry 2007).

Additional perspective on wildlife-dependent recreation is gained from Minnesota's Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2008-2012. Outdoor recreation is an important component of a healthy lifestyle, and when faced with a state-wide 132 percent increase in obesity since 1990 (United Health Foundation 2006), may play an important role in the health of the state populations. The SCORP report outlines the trends in outdoor recreation in the state, identifying priorities and recommendations to increase and improve recreation experience opportunities. The report points out the importance of recreation to Minnesotans. A 2004 outdoor participation survey found that recreation is very important to 57 percent of those surveyed, and moderately important to an additional 25 percent. It identifies the top 10 recreation activities of Minnesotans 20 years of age or older (see Table 6), citing that more adults participate in boating and fishing activities than any other state, and that two-thirds of all recreation occurs within 30 minutes drive from home. Despite these facts, participation in outdoor recreation such as hunting, fishing, boat usage, and park visits has decreased nationally and in Minnesota over the past decade. In Minnesota, and nationwide, the population is aging, becoming more ethnically diverse, and is increasingly concentrated in urban areas. These trends are changing the nature of recreation throughout the country, and recognizing these changes affords land managers the opportunity to adapt their approach to recreation provision (Minnesota DNR 2008a).

Climate

The climate of east-central Minnesota is classified as 'sub-humid continental' and is characterized by significant variations in seasonal temperatures.

This region has four distinct seasons with moderate spring and fall temperatures, short, warm summers, and cold, dry winters. The town of Little Falls, Minnesota, near Crane Meadows NWR, has an annual average temperature of 43.4 degrees Fahrenheit.

For all of Morrison County the average temperature during the winter months is approximately 12 degrees Fahrenheit with an average daily minimum of 1 degree. The lowest recorded temperature was minus 41 degrees Fahrenheit on January 9, 1977. Summer temperatures average 68 degrees Fahrenheit with a maximum daily average of 81 degrees. The highest recorded temperature in Little Falls was 101 degrees Fahrenheit on August 18, 1976. There is an average of approximately 136 frost-free days throughout the year, which constitutes the growing season. Frost often persists until mid-May and returns the end of September. The latest occurring frost in the spring is June 9, and the earliest in fall is September 3.

Annual precipitation in Morrison County is well distributed throughout the growing season. Approximately 17.1 inches, or 65 percent of the total annual precipitation, occurs from May through September. The annual average precipitation in Little Falls is 26.3 inches. The heaviest daily rainfall recorded in the county was 4.70 inches in Little Falls on August 1, 1953. Snowfall persists from October through April and occasionally falls in May. The average annual snowfall in Little Falls is 50.4 inches, and snow usually persists on the ground all winter.

Air Quality

Greenhouse gasses, fine particles, ozone, air toxins, mercury, and lead are all airborne pollutants that affect human health, as well as the health of natural ecosystems. The protection of air quality has been formally monitored and regulated since the passage of the Clean Air Act in 1970, and its subsequent revisions in 1977 and 1990 have intended to keep policy at pace with the evolving state of science and technology. The threats associated with global climate change have reinvigorated efforts to monitor both point sources of contaminants and non-point sources such as transportation and residential combustion.

According to the Minnesota Pollution Control Agency's (PCA) 2009 report to the legislature, Minnesota air quality is "generally good and has been improving for most pollutants (MPCA 2009a, pg.1)." Partially because it cannot as easily be regulated, non-point sources are by far the greatest overall contributors to air pollution emissions. These emissions come from highway vehicles (38 percent), off-highway equipment (18 percent), or other small, non-point stationary sources (34 percent). Point source pollution by major facilities only contributes 10 percent of the total state emissions (MPCA 2009a).

To monitor the sources of air pollution, the EPA maintains composite databases of air pollution emissions estimates derived from state and local regulatory agencies, industry, and EPA records. The National Emission Inventory (NEI) contains emissions data from 2002 divided into two groups: criteria air pollutants and hazardous air pollutants.

Criteria Air Pollutants

To protect public health, the Clean Air Act established concentration limits on six criteria air pollutants: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, particulate matter, and lead. The NEI database documents 27 facilities in Morrison County whose emissions are estimated for one or more criteria air pollutants by state and federal agencies. The list includes a diversity of farms and industrial businesses such as a boat manufacturer, a food preparation company, an ethanol cooperative, and several stone processing or construction enterprises. The list also includes the major county wastewater treatment plants, Camp Ripley, and a local high school, airfield, landfill, and hospital. In 2002, the total quantity of criteria pollutants emitted yearly by these facilities was approximately 1,555 tons. Morrison County ranks it at 36 of 87 Minnesota counties with 0.28 percent of the state's total point source emissions. The total quantity emitted by the state in 2002 from all sources was 40,009 tons (EPA 2009).

Hazardous Air Pollutants

The National Emission Inventory also identifies 15 facilities in Morrison County that emit hazardous air pollutants. The NEI monitors 188 hazardous air pollutants that are known to or suspected to cause serious health problems. This list of facilities

Prairie opening. Photo Credit: FWS

directly overlaps and is a subset of the criteria air pollutant emitters. All but three facilities (wastewater treatment plants) are in Little Falls. In this list, the number of pollutant types emitted by each facility ranges from 17 to 33, and all but 3 emit 0.01 percent or less of the total state emissions. According to these 2002 data, approximately 455,000 pounds of hazardous air pollutants are emitted yearly by these facilities (EPA 2009). The county ranks number 22 of 87 Minnesota counties in the quantity of hazardous air pollutants emitted at 1.14 percent of the state total (EPA 2009).

Though an ambient air quality station was active in Little Falls from 1996-1997, there are currently no air quality monitoring stations in the county.

Geology and Soils

Crane Meadows NWR is located on the Anoka Sand Plain, a large, flat sandy outwash landscape thought to be lacustrine in origin and created by glacial recession (Minnesota DNR 2009a). This landform contains small dune features, low ground moraines, outwash plains, kettle lakes, and tunnel valleys (Wright 1972). The Refuge consists of primarily flat uplands with some gently rolling hills, and peat-filled lowlands interspersed with shallow lacustrine wetlands.

Morrison County is underlain by layered bedrock of both metamorphic and igneous rock – primarily Cambrian and Ordovician dolomite, sandstone, and shale (Morey 1976). The bedrock surface slopes southward and subsurface depth to bedrock can range from 0-200 feet.

Nearly all of the Midwest was covered by glaciers during portions of the Pleistocene Epoch, which ended about 10,000 years ago. There were four major southward advances of the Laurentide Ice Sheet over the last 2 million years, including the Nebraskan, Kansan, Illinoisan and Wisconsinian stages. The Wisconsinian was the most recent, with three glacial maxima. The last of these maxima (Tioga) began 30,000 years ago, reached its maximum extent 21,000 years ago, and ended 10,000 years ago. The Tioga glaciation had the greatest impact on the modern interglacial landscape configuration in North America by leveling large areas, creating numerous lakes, rivers and wetlands, and leaving a number of glacial deposits. As a result, Morrison County is characterized by glacial features such as rolling morainic hills, drumlins, eskers, kames, and outwash plains. Two major lobes of ice advanced during the most recent glacial period. The Superior Lobe came down first, extending from eastern Ontario, across what is now Lake Superior, and down through the Anoka Sand Plain, depositing reddish-brown sandy loam soils. The second, the Des Moines Lobe, came down from Manitoba and reached as far south as Iowa. The Grantsburg Sublobe of the Des Moines lobe also pushed into the Anoka Sand Plain area, carrying a limestone-derived, light brown sandy loam. These two lobes formed a substrate over which large amounts of sediment-laden water ran as the lobes retreated. An evolving sequence of large rivers, streams, and lakes distributed sand deposits over the glacial till layers. Dunes and other aeolian features were added to the diversity of landscape features during a warm period from 4,000-8,000 years ago. The sand plain wetland/upland complex at Crane Meadows NWR is the result of this turbulent geologic history. It is located within a geographic area characterized by its flat topography, sandy soils, and shallow water table (Anoka Conservation District 2009).

Information on farmland suitability and drainage characteristics has been collected by the USDA Natural Resources Conservation Service and is contained in their Soil Survey Geographic Database (SSURGO). According these data 95 percent of the area in the Refuge acquisition boundary is not prime farmland, with only 352 acres of prime farmland, and 309 acres of farmland of statewide importance (see Figure 18 on page 44). Drainage is also an important soil characteristic affecting land suitability for a number of human uses and determining habitat type for wildlife. SSURGO information indicates that 58 percent of the Refuge lands have poor drainage characteristics, 35 percent have good drainage, and the remaining 6.4 percent is open water (see Figure 19 on page 45) (USDA-NRCS 2009).

According to the SSURGO database, 18 major soil series occur within Crane Meadows NWR acquisition boundary, with open water comprising 6.4 percent of the Refuge (See Table 7 on page 46 and Figure 20 on page 47). All of the soils found on the Refuge are very deep and were formed as a result of glacial events. The primary constituent soil series are Menahga, Seelyeville, Markey, Isan, Bowstring, and Duelm, together accounting for over 75 percent of the Refuge soils. The remaining minor constituent soil series each constitute less than 5 percent of the Refuge acreage (USDA-NRCS 2009). Most soils in this area are subject to wind or water erosion without conservation measures in place, contain excess water, or have insufficient water holding capacity.

Major Soil Constituents

The major soil constituents are organized by landscape position – upland to bottomland.

Figure 18: Soil Survey Farmland Status, Crane Meadows NWR

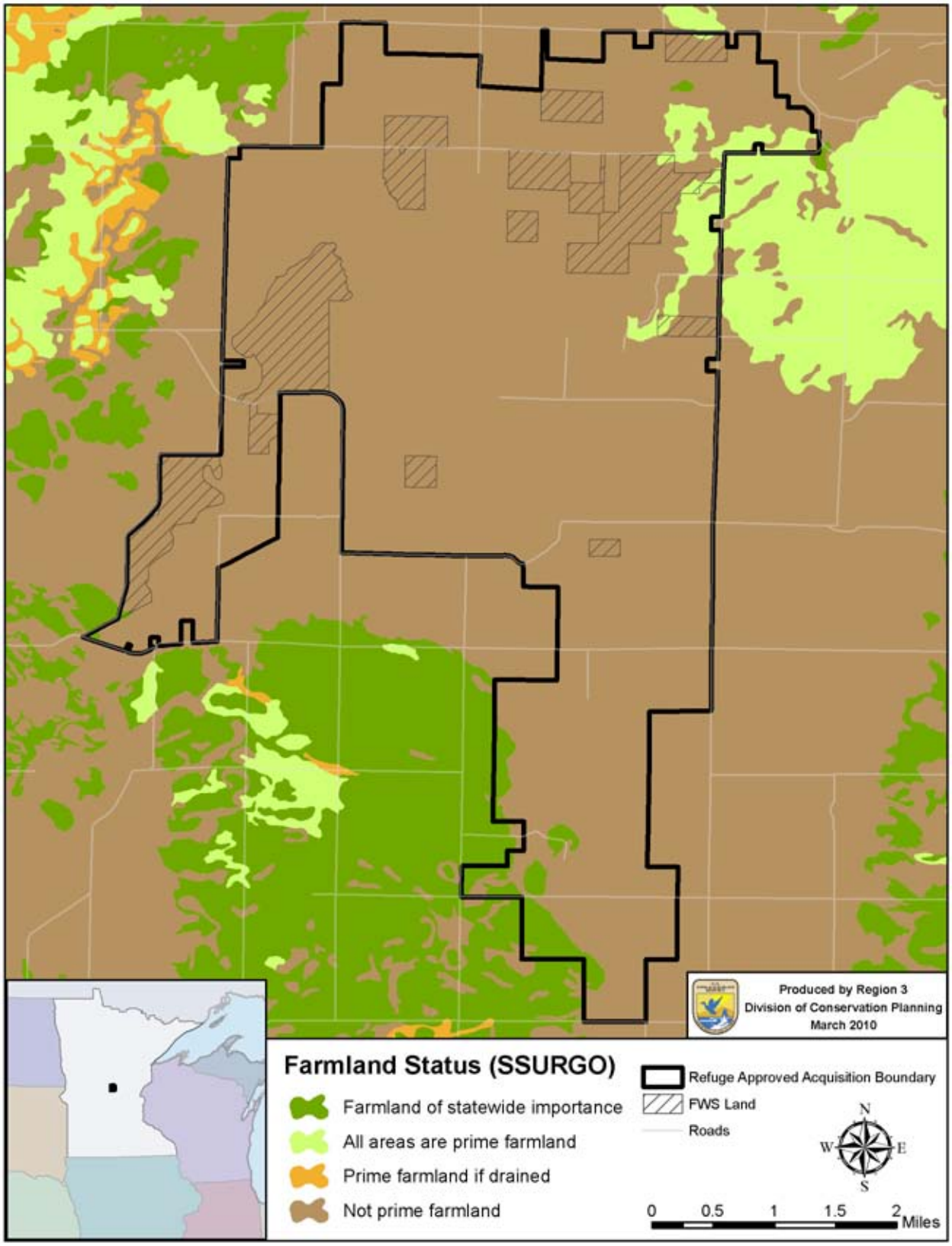


Figure 19: Soil Survey Drainage Classes, Crane Meadows NWR

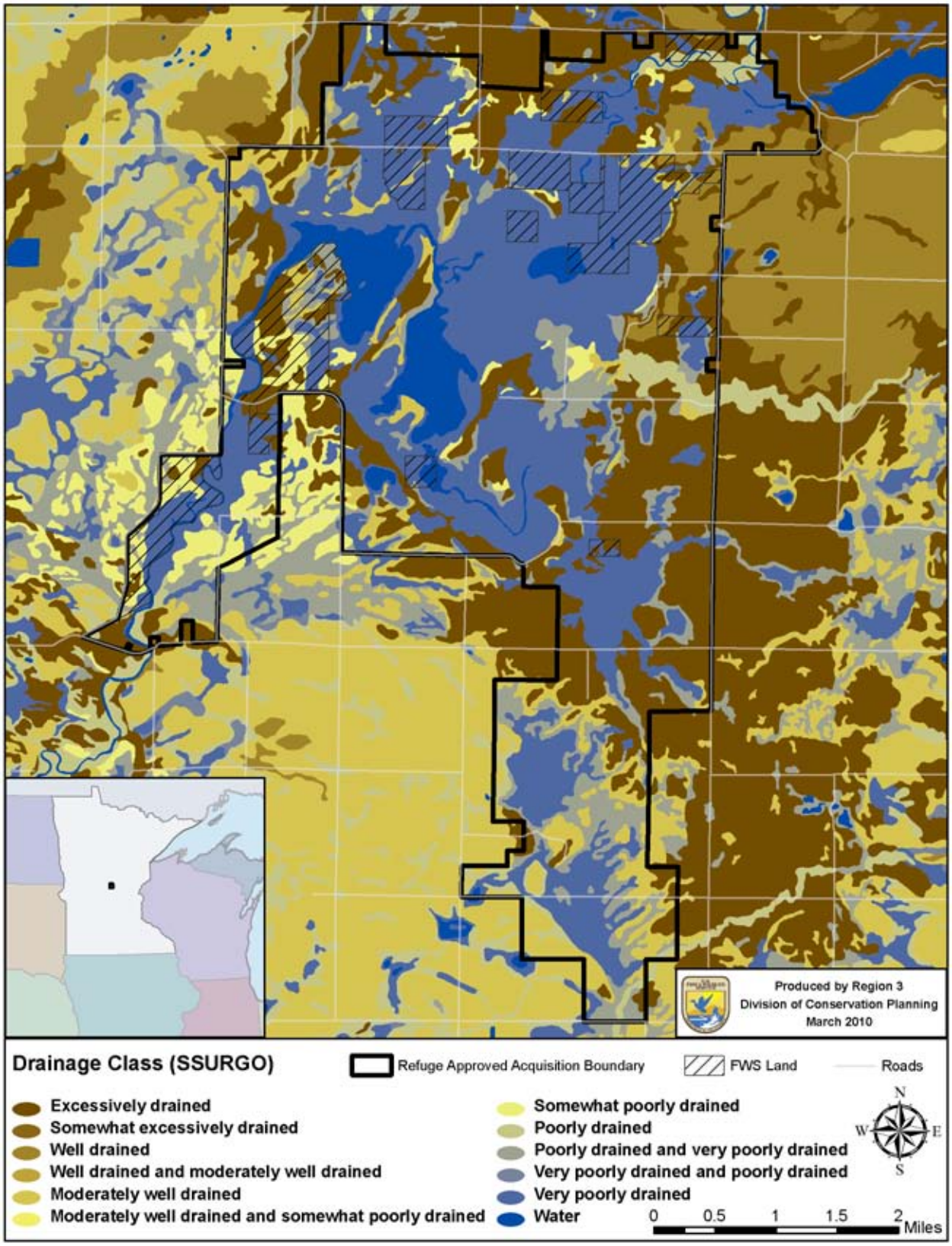


Table 7: Soils Present at Crane Meadows NWR

Soil Series Name	GIS Acres [a]	Percent
Menahga	2601.9	18.8
Seelyeville	2538.7	18.4
Markey	1717.4	12.4
Isan	1459.4	10.6
Bowstring	1325.4	9.6
Water	887.6	6.4
Duelm	827.3	6.0
Meehan	555.1	4.0
Hubbard	476.7	3.5
Pierz	352.1	2.6
Fordum	245.0	1.8
Pomroy	211.4	1.5
Mahtomedi	196.7	1.4
Sartell	179.4	1.3
Rifle	118.3	0.9
Watab	105.4	0.8
Chetek[b]	7.3	0.1
Nokasippi[b]	2.2	0.0
Flak[b]	0.7	0.0

a. All acreages are approximate GIS acres.
b. Written description not included.

Menahga soils (18.8 perent) cover the largest extent of any soil series on the Refuge and form many of the sandy upland areas at Crane Meadows NWR. Often supporting jack pine forest, Menahga soils are very deep, excessively drained or well drained soils with rapid permeability, formed in thick, sandy glacial outwash sediments on outwash plains, and may include moraines and drumlins.

Duelm soils (6 percent) are also primarily upland soils, but represent conditions more favorable for tall prairie grasses and deciduous forest habitats. They are very deep and moderately well-drained sandy soils on outwash plains.

Isan soils (10.6 percent) are often found in the interface between sandy uplands and poorly drained bottomland areas on the Refuge. Isan soils are very deep, poorly and very poorly drained, have moderately rapid permeability, and formed in sandy glacial outwash plains. Native vegetation was grasses and sedges with occasional willow and alder.

Seelyeville soils (18.4 percent) are second most abundant in total Refuge acres and form many of the bottomland sedge meadow areas on the Refuge. Like the upland soils on the Refuge they are very deep and formed on outwash plains, glacial lake plains and moraines. However, these soils are very poorly drained – often forming in depressions, composed of up to 51 inches of organic material from decomposed herbaceous plants, and have only moderate permeability. Vegetation typically consists of sedges, grasses, and scattered alters, willow, tamarack, and bog birch.

Markey soils (12.4 percent) are similar to Seelyeville, very deep, very poorly drained, and organic, but are at the interface between sandy and organic bottomlands and tend to have more forest cover. The herbaceous organic material ranges from 15-50 inches in depth, but is typically overlying sandy deposits from outwash plains, lake plains, flood plains, river terraces, and moraines. Permeability and drainage varies depending on the soil horizon, with slow permeability in the organic layers and rapid permeability in the sandy horizons. Most of these bottomlands are forested with black ash, quaking aspen, balsam fir, black spruce, tamarack, northern white cedar, and paper birch, with some areas in cattails, marsh grasses, reeds, and sedges.

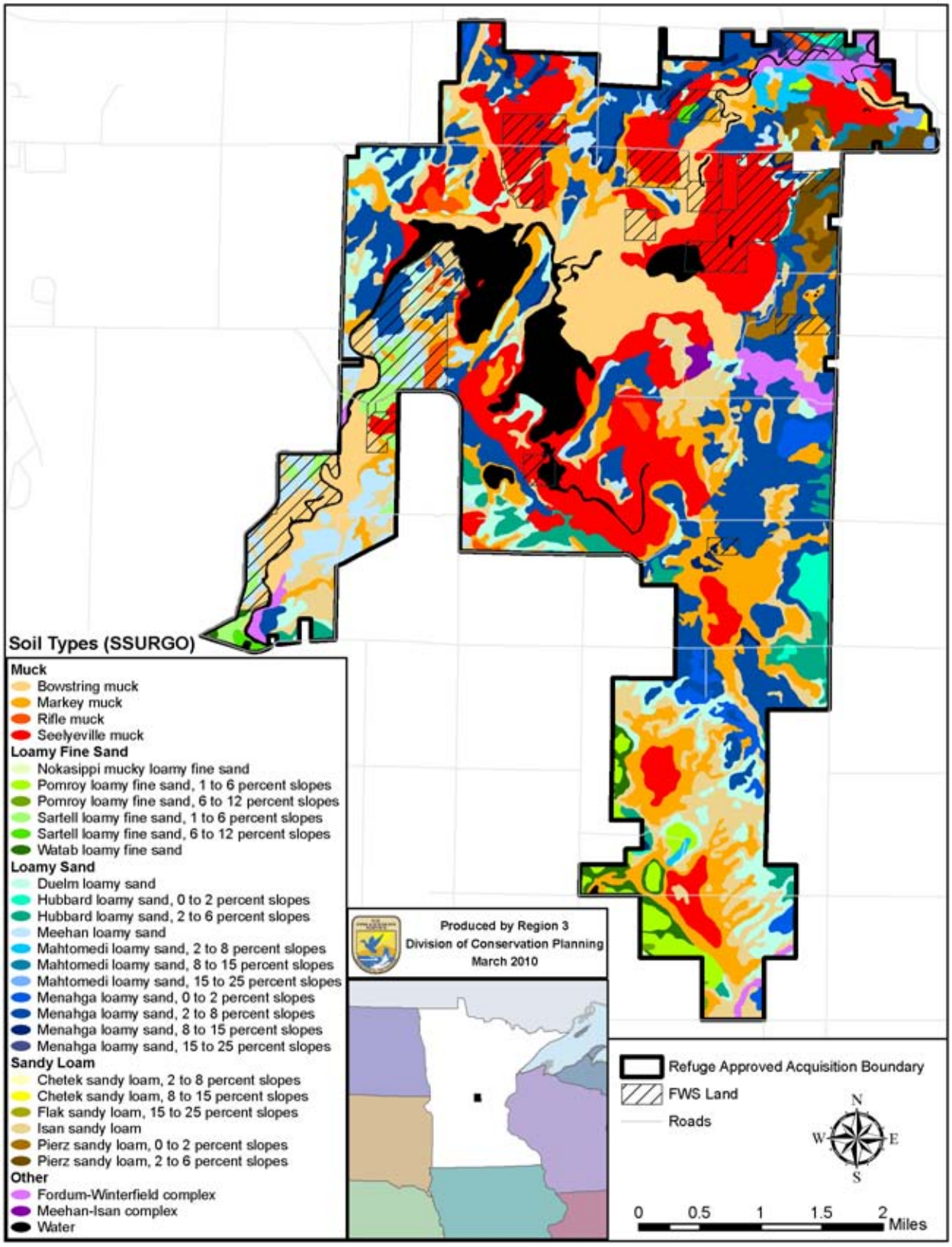
Bowstring soils (9.6 percent) are formed in floodplain environments and tend to surround the main stream courses on the Refuge. Bowstring soils are very deep, poorly drained, and formed as a stratification of decomposed organic material and thin layers of sandy or loamy material. Native vegetation is sedges with scattered willows and alders, and in some locations these soils are used to produce wild rice.

Minor Soil Constituents

Meehan (4 percent – some areas complexed with Isan) form mixed upland forests, and are deep, somewhat poorly drained, have rapid or very rapid permeability, and form in deep sandy alluvium on outwash plains. These areas tend to be a mix of conifer and deciduous forests, with trees such as jack pine, white and black spruce, paper birch, northern pin oak, red pine, eastern white pine, quaking aspen, balsam fir, and red maple.

Hubbard (3.5 percent) soils are commonly vegetated by upland oak savanna or tall grass prairie, and are very deep, excessively drained, and form in sandy glacial outwash plains.

Figure 20: Soil Types, Crane Meadows NWR



Pierz (2.6 percent) typically begin as upland prairie and later succeeded to a mixture of upland deciduous and conifer forest. They are very deep, well-drained, and form in a loamy mantle over sandy and gravelly sediments.

Fordum (1.8 percent – complexed with Winterfield) soils are a bottomland soil series. Recently formed soils, they are a part of floodplain systems directly adjacent to stream or river channels and are created as a part of meanders, overflow channels, scours, and other micro-relief features. They are poorly drained, moderately deep, and contain a loamy upper alluvium strata and sandy lower alluvium strata. The vegetation can be either forest (silver maple, red maple, quaking aspen, big tooth aspen, paper birch, American elm, white spruce, yellow birch, and tag alder are common) or marsh grasses, reeds, sedges, and shrubs.

Winterfield (1.8 percent – complexed with Fordum) are very deep, somewhat poorly drained, rapidly permeable sandy alluvium soils on flood plains with frequent, short-term inundations. They are often covered by lowland hardwoods including elm, red maple, swamp white oak, and quaking aspen.

Pomroy (1.5 percent) are often forest or wooded pasture – primarily deciduous, with scattered conifer areas. The soils are very deep, moderately well drained, and form in a mantle of glacial outwash or loamy glacial till.

Mahtomedi (1.4 percent) hosts mixed deciduous and conifer forests, and are very deep, excessively drained, readily permeable, and form from sandy glacial outwash.

Sartell (1.3 percent), like Hubbard, are covered by savanna habitat with occasional red oak, bur oak, or jack pine trees. They are very deep, excessively drained, have rapid permeability, and form from glacial outwash sediments.

Rifle (0.9 percent) are characterized by bog woodland vegetation, including tamarack, black spruce, paper birch, balsam fir, black ash, northern white-cedar, and a ground cover of sphagnum moss, leather leaf, blueberry, and Labrador tea. They are very deep (51 inches or greater), very poorly drained, have rapid permeability, and form in ground and end moraines, or outwash and lake plains.

Watab (0.8 percent) are often deciduous forest, and very deep, compact, poorly drained, and form in a mantle of sandy glacial outwash or dense loamy glacial till.

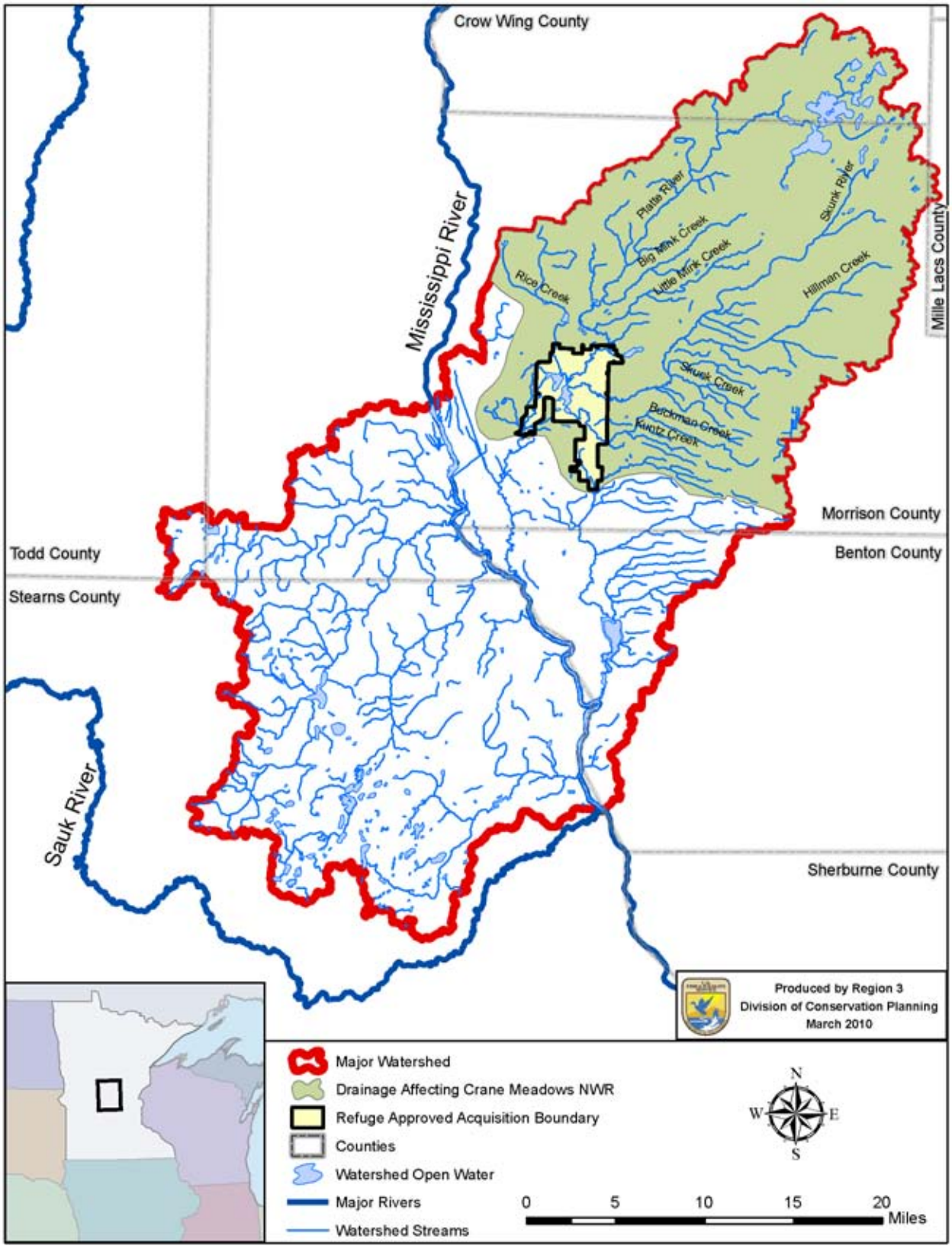
Water and Hydrology

Crane Meadows NWR falls within the Platte-Spunk Watershed (MN HUC 7010201) of the Upper Mississippi River Basin. The Upper Mississippi River Basin begins at the headwaters of the Mississippi River, extends southward throughout central Minnesota, and ends near the city of St. Paul, Minnesota. The Platte-Spunk River sub-watershed begins in southern Crow Wing County, runs diagonally northeast to southwest through Morrison County, includes the northwest section of Benton County, and ends in northeast Stearns County (see Figure 21 on page 49). There are approximately 56,000 people and 1,919 farms within the 652,667-acre watershed. The primary resource concerns include soil erosion, woodland management, surface and groundwater quality, and surfacewater and wetland management (USDA NRCS 2008.)

The wetland complex that comprises the majority of Refuge includes two large shallow lakes, Rice Lake (320 acres) and Skunk Lake (314 acres), and one smaller open water basin, Mud Lake (56 acres). The Rice-Skunk Lakes wetland complex is also the confluence of four major waterways: Rice Creek and the Platte River, which flow into Rice Lake from the north, and Skunk and Buckman Creeks, which enter Skunk Lake from the east and southeast and pass through to Rice Lake (see Figure 2 on page 3). The headwaters of these four creeks ultimately pass through the Refuge as well, and include Wolf, Little Mink, and Big Mink Creeks above the Platte River, Hillman Creek above Skunk Creek, and Kuntz and Mischke Creeks above Buckman Creek. In addition to waters that drain through the wetland complex, the southern spur of the Refuge contains the upper reaches of a cold water stream, Little Rock Creek. There are approximately 32 linear miles of stream and river channels within the acquisition boundary that migrate and meander slowly through the wetland complex. In total, the drainage from more than 272,000 acres of upstream land passes through the Refuge. The majority, (256,254 acres or approximately 400 square miles) passes directly through the Rice-Skunk Wetland Complex (353:1 watershed to basin ratio) before eventually making its way to the Mississippi River near Rice, Minnesota 8 miles down the Platte River (DNR 2006a). The remaining effective watershed area drains through the Little Rock Creek System and finally drains into the Mississippi River just north of the city of Sartell.

This wetland complex has a history of extreme water level fluctuations following seasonal variations in rainfall and runoff. Flooding is common in the spring due to snowmelt and runoff from surrounding uplands and via watercourses that drain into the area. Typically water levels decrease during the summer months, then a resurge of flooding

Figure 21: Platte-Spunk Watershed



occurs in the fall. The Federal Emergency Management Agency (FEMA) maintains information on the 100-year floodplain levels for insurance purposes. An area of 6,888 acres, approximately 50 percent of the Refuge acquisition boundary, falls within these designated flood zones (see Figure 22 on page 51). These zones overlap, and are a surrogate for areas of bottomland habitat, and indicated that less than 50 percent of the Refuge is suitable for development – residential or agricultural – based solely on flood potential.

All open waters in the area of the Refuge are public and are managed by the state. During the first half of the 20th century there was high demand from local sportsmen in the area to provide minimum water levels in the Rice-Skunk shallow lake complex for hunting and boating navigability – particularly during drier periods of the year. In response, in 1961 the Minnesota Legislature mandated the construction of a weir for water level stabilization where the Platte River exits Rice Lake. After acquiring flowage easements, purchasing physical properties, and conducting studies and monitoring activities in the area, the George Selke Memorial dam was constructed between 1971 and 1974. The dam consists of 300 feet of sheet piling with six 5-foot variable crest stoplog bays on the west end. Historical average annual water level fluctuations in the area of the dam varied from El. 1,095 to 1,104 feet (mean sea level datum), with occasional flooding events of up to 1,107 feet. The crest of the dam was set at El. 1,097.0 feet – the normal full pool elevation of the Rice-Skunk wetland system. Stoplogs are placed in the bays only between late July and November 23 as necessary to facilitate public access (Minnesota DNR 2006a). Despite this major water structure, the remainder of the hydrology in the wetland complex remains relatively intact, its streams unchannelized, and its open waters undeveloped.

According to the 2001 land cover data (see Figure 23 on page 52), the portion of the watershed upstream of Crane Meadows NWR is comprised of 31 percent pasture/hay, 24 percent deciduous forest, 20 percent cultivated cropland, 14 percent herbaceous wetland, 4 percent grassland, 3 percent developed/open space, and 2 percent open water. The other cover types all have 1 percent or less coverage within the affected watershed for the Refuge. Pasture land and agriculture make up the dominant land use in the watershed at over 50 percent. Though agricultural land retains some natural value, there are a host of concerns and threats associated with this land use. See "Threats to Resources" on page 64 for more information these issue.

Water quality in the watershed, and within the Crane Meadows NWR wetland complex, has been sampled by various agencies over the past few decades. There are more than 40 sites in the drainage affecting the Refuge with data relative to the quality of waters, according to the Minnesota Pollution Control Agency's Electronic Data Access database (MPCA 2009b). Figure 24 on page 53 shows the location of these monitoring sites. With the exception of Buckman Creek, all other tributaries leading into and flowing out of the Refuge, as well as some of the lakes within the Refuge, have some degree of water quality data available. The distribution of these sites allow for the assessment of waters entering the Refuge, the impact on the wetland complex, and the quality of waters exiting the Refuge. Data from these sites indicate that water quality within the watershed ranges from good, during low water conditions, to poor, during high water event samples. Poor water quality during high water events are likely the result of non-point source run-off upstream of the Refuge. Continued and expanded monitoring is needed throughout the watershed to assess the impacts of specific contaminants and identify their pathways into Refuge waters.

Additional data provided by the MPCA indicate that portions of three waterways are state-listed as impaired within the Refuge Boundary. "Section 303(d) of the Clean Water Act requires states to publish and update a list of waters that are not meeting one or more water-quality standards" (MPCA 2009c). The list, known as the 303(d) Total Maximum Daily Load (TMDL) list, designates streams and lakes with impairments based on state water quality standards. Skunk Creek, Little Rock Creek, and the Platte River (downstream of the shallow lake complex) are all on Minnesota's 2010 Draft List of Impaired Waters (MPCA 2009c) for a variety of water quality impairments. Of the three, only Little Rock Creek currently has a Total Maximum Daily Load pollution reduction study under way to identify pollution sources and improve water quality to meet state standards. It will be important for the Refuge to collaborate with state and local partners as additional work is done to monitor and address water quality issues in the watershed.

Wild Rice

Wild rice (*Zizania sp.*) in Minnesota has great cultural, ecological, and economic value, and has been harvested in the Great Lakes region for thousands of years (Valppu 2000). It is important from an ecological perspective as well, by providing food and shelter for many fish and wildlife species. Wild rice serves as one of the most important food sources for waterfowl in North America, with an ability to produce more than 500 pounds of seed per acre and host a diversity of invertebrates that also

Figure 22: Federal Emergency Management Agency Floodplain Map, Crane Meadows NWR

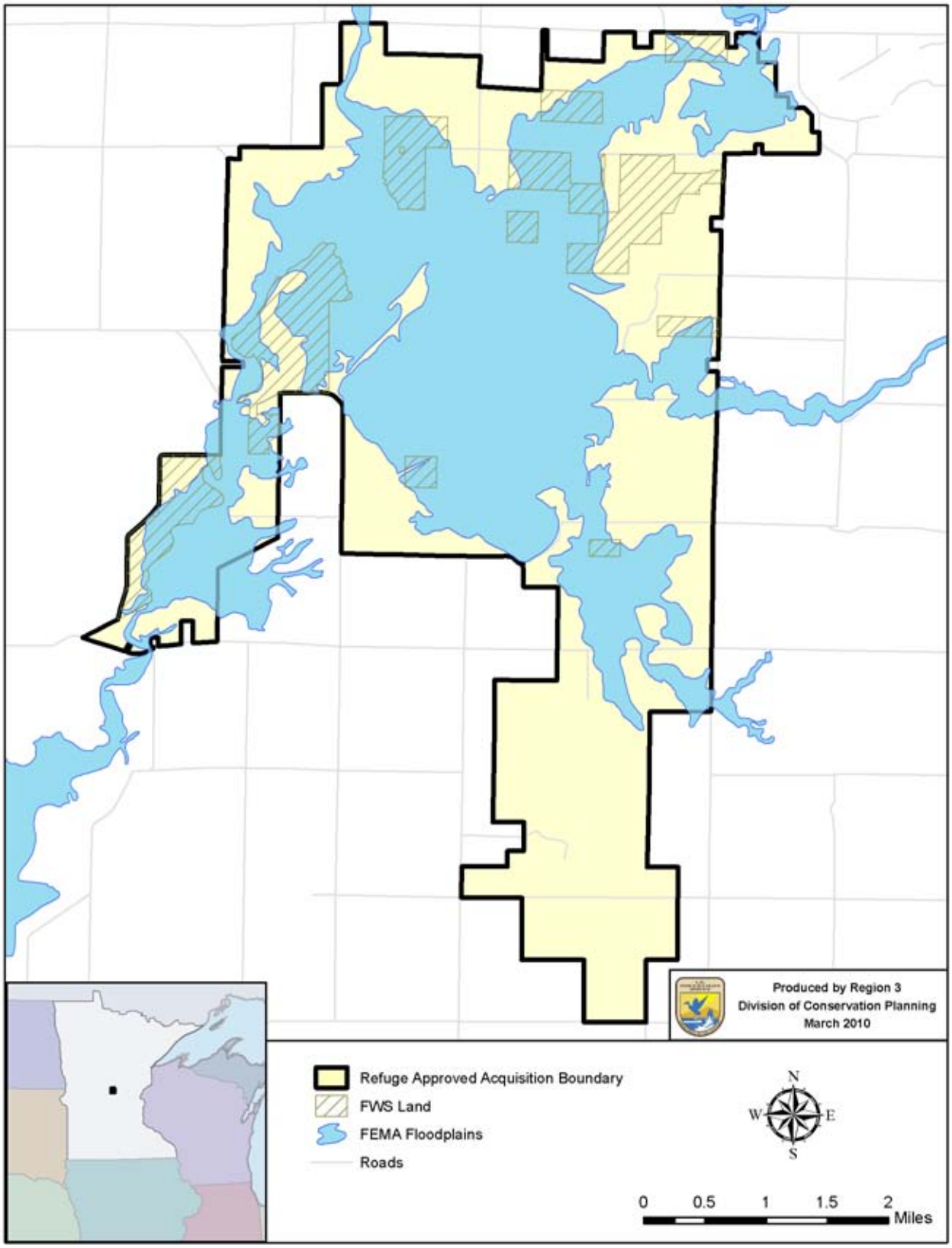


Figure 23: Land Cover in the Platte-Spunk Watershed

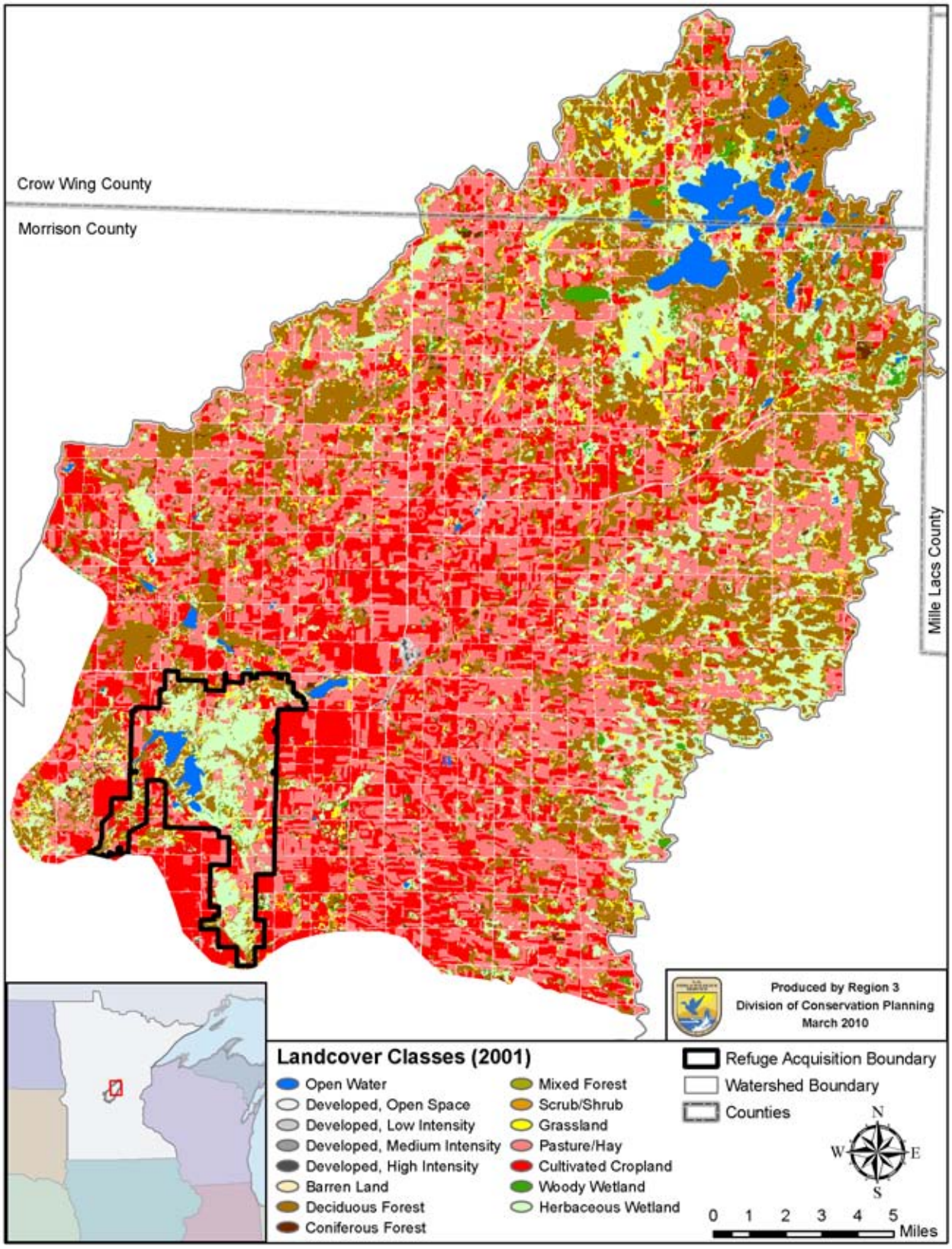


Figure 24: Water Quality Monitoring Sites, Crane Meadows NWR

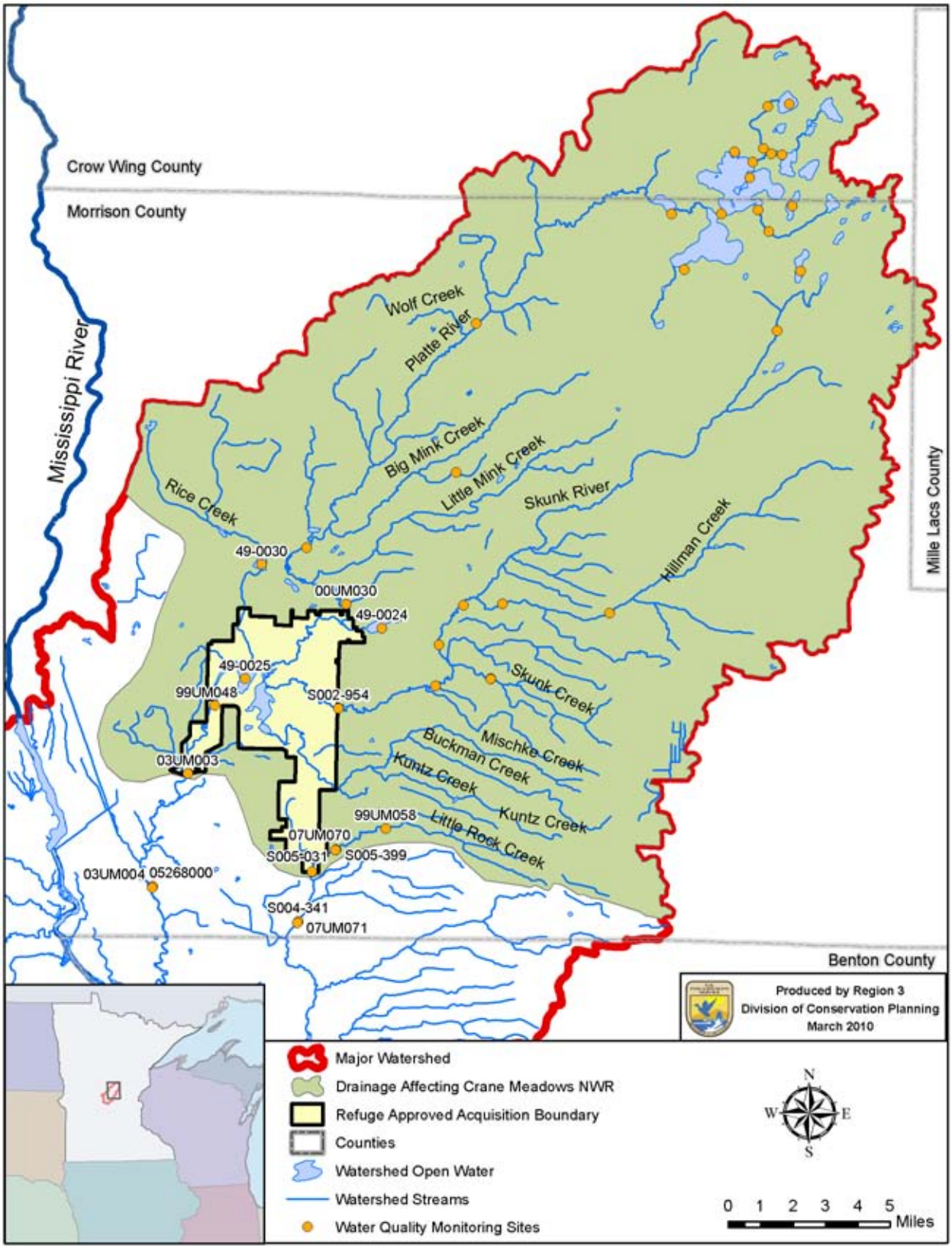


Table 8: Wild Rice Productivity at Crane Meadows NWR (2008)

Lake Name	Size (Acres)	Estimate Wild Rice Coverage (Acres)
Mud	23	9
Rice	323	250
Skunk	320	256

help feed many wetland species. At least 17 bird species on Minnesota's 'species of greatest conservation need' list use the habitat provided by wild rice – primarily for reproduction and foraging (Minnesota DNR 2006b). The historic range of wild rice included the entire state, but it now occurs most commonly in the central and north-central portions of the state (55 Minnesota counties.) As an 'annual', the plant requires moving, relatively shallow water (0.5 – 3 feet), and germinates each spring from seeds dropped in previous fall seasons. The growth cycle and productivity can be threatened by a number of factors: water quality, seasonal water levels, lakebed conditions, climate change, other aquatic vegetation (including invasives), genetic modification, water-based recreation, shoreland development, and industrial activities (Minnesota DNR 2008b). Although the productivity of natural wild rice populations varies on a 3-5 year cycle, annual crops can be greatly affected by the aforementioned threats. The time period from late May to mid June is a particularly critical stage at which floating leaves first appear and fluctuations in water levels can uproot or otherwise significantly stress the plant.

Limited development in the area has minimized a number of the aforementioned threats, but a few of the issues such as system water fluctuations and climate change could be affecting the annual production of wild rice at Crane Meadows NWR. The wild rice study submitted by the DNR to the Minnesota Legislature in 2008 stresses the importance of water levels during the critical floating leaf stage. The following passage may provide insights to factors influencing wild rice stands within the Crane Meadows NWR complex:

> "At the (floating leaf) stage, any rapid increase in water level can cause damage to natural stands. Changes in lake outlets that reduce flow capacity can also significantly impact wild rice by increasing the frequency and severity of these temporary flood events. For example, permanent dams, beaver dams, culverts, and debris such as mats of vegetation can reduce outlet flow capacity and impact wild rice habitat (Ustipak 1983)…Changes in upstream watersheds can also reduce the productivity of natural wild rice stands. Drainage ditches and tiles, pumps, and channelization can increase the quantity and speed of waters moving downstream. The resulting peaks in water levels can produce the same effects as reduced outlet capacity by creating abrupt "bounces" or rapid increases in water depth…Dams that maintain stable water levels can have long-term deleterious effects on natural wild rice, as well. Water levels that are held stable year after year can create conditions that favor perennial vegetation and shoreline encroachments that impair wild rice habitat (p. 21-22)."

In this same report, wild rice inventories were noted for the water bodies within the Crane Meadows NWR wetland complex; Rice, Skunk, and Mud Lakes (see Table 8). This information estimates the potential wild rice coverage and associated productivity in each lake within the complex.

Refuge Habitats

As discussed earlier in this CCP, the Refuge lies within the Anoka Sand Plain Subsection of the Eastern Broadleaf Forest Province of Minnesota (Minnesota DNR 2005). The narrow band of this province traverses diagonally (from northwest to southeast) across the state, forming a transition zone between tallgrass prairie to the southwest and deciduous forests to the northeast-leading to a distinctive set of vegetative communities. In pre-settlement times the flat, sandy outwash plain of the Anoka Sand Plain was characterized predominantly by oak barrens and openings in uplands prior to European settlement (Minnesota DNR 1993, Marschner 1930). Lowlands consisted of mostly conifer bogs, swamps, and wet prairies (Marschner 1930). Conifer bogs were important in the landscape historically, but are no longer present on the Refuge due to land draining efforts for agriculture. This habitat type was a tamarack-dominated swamp; typically on shallow to deep peat in lowland basins and occasionally on floating mats at edges of ponds. Other trees species that may have been present in this habitat include elm, red maple, and paper birch (Minnesota DNR 2005). Fire suppression and agricultural practices began with European settlers around 1850. Such activities altered the landscape and significantly changed vegetative communities from those that existed previously in the presence of fire initiated by weather events and Native Ameri-

cans. Fire suppression in the uplands resulted in succession from oak savanna to oak woodlands (Wovka et al. 1995).

The Refuge acquisition boundary currently contains a great variety of upland habitat types including woodlands, prairie, southern dry savanna remnants, conifer plantations, and agriculture. Refuge woodlands contain jack pine, northern pin oak, bur oak, and aspen. Small pockets of open prairie knolls and southern dry savanna remnants can be found throughout the area. Although many of these remnant communities are altered because of past cultivation or grazing, they contain native sand prairie species such as big bluestem, Indian grass, little bluestem, porcupine grass, junegrass, prairie sand reed, rough dropseed, and prairie dropseed. Common native forbs include hoary puccoon, prairie violet, rough blazing star, prairie larkspur, heath aster, black-eyed Susan, stiff goldenrod, lead plant, purple prairie clover, butterfly weed, and prairie smoke.

The lowland habitats on the Refuge consist of emergent marsh, sedge meadow, and willow-dogwood shrub swamp. The vegetative communities along the edges of Rice and Skunk Lakes and associated rivers/creeks, include wild rice, bulrushes, bur-reed, arrowhead, cattails, sedges, reed canary grass, and phragmites. Lowland marshes and meadows with completely saturated soil or areas covered with shallow water are dominated by sedges, blue joint grass, and prairie chordgrass. Pockets of floating sedge mats can be found in these areas as well. Lowlands also support a variety of shrub species such as willow, red-osier dogwood, and bog birch.

The diverse vegetative composition and habitat types of this area correlate to a high diversity of wildlife species that are typical of wetlands, forests, and grasslands. The current habitat composition of the Refuge acquisition boundary consists of approximately 50 percent wetland, 20 percent agriculture, 17 percent woodlands, 6.6 percent grassland/prairie, 1.4 percent conifer plantation, 1.3 percent oak savanna, 1.2 percent pasture, and 2.5 percent developed areas. A list of habitat types, definitions, and acreages for both the acquisition boundary and Service-owned property can be found in Table 9 on page 56. For consistency, the habitat names used in Table 9 and throughout this document have been adapted from general vegetation classes to habitats defined by the Minnesota DNR (2005). See Table 10 on page 58.

Wetlands and Open Water

Due to its low position in a relatively flat landscape, diversity of water features, and distinctive geologic history, the wetland complex at Crane Meadows NWR supports a unique combination of wet bottomlands and droughty uplands. According to the National Wetlands Inventory, the proposed Refuge acquisition boundary encompasses approximately 7,787 acres (56 percent) of various wetland and open water habitats that together comprise an extensive and diverse wetland complex (FWS 2004). This inventory included areas recorded as partially drained/ditched; approximately 1,792 acres (13 percent) within the Refuge acquisition area, 267 of which occur on properties currently owned by the Service. The wetland types in the inventory include open water, emergent, scrub-shrub, forested, unconsolidated bottom, and a few lacustrine and riverine areas. The 2004 NWI inventory classified most of the system as palustrine, and 852 acres as either riverine or lacustrine. Of the palustrine environments, 4,509 acres were classified as emergent, 941 acres were scrub/shrub, 181 were forested, 61 were considered unconsolidated bottom, and 1,243 acres contained a mixture of these classes (see Figure 25 on page 59, Cowardin et al. 1979, FWS 2004).

Similarly, a 2006 vegetation mapping project for the Refuge acquisition boundary (see Figure 26 on page 60) cites 6,894 acres of wetland habitat excluding forested wetlands, which are covered in the following section. Habitat classes for this 2006 classification include open water, rivers and streams, emergent marshes, sedge meadows, and willow-dogwood shrub swamps. Rice and Skunk Lakes account for approximately 643 acres of these Refuge wetlands and are characterized as emergent marsh. The four tributaries flowing into the lakes – the Platte River, Rice Creek, Skunk River, and Buckman Creek – combined with the Platte River exiting the complex, together account for a total of 32 stream miles within the acquisition boundary. The Platte River flows into Skunk Lake from the northeast corner of the Refuge and flows out the southwest spur and ultimately into the Mississippi River. The Platte River watershed drains approximately 345 square miles. Rice Creek is further west and flows into Rice Lake from the north. The Skunk River flows into the Refuge from the east side, and Buckman Creek, located further south, flows into the Refuge from the southeast. Buckman Creek flows into Mud Lake first, then into Skunk, then Rice, and finally exits the Refuge via the Platte River (refer to map in Figure 2 on page 3). In addition to the lakes (emergent marshes) and tributaries, other important wetland habitats within the complex include a relatively intact, extensive sedge meadow and willow-dogwood shrub swamp. These two habitats extend along the perimeter of the lakes (emergent marshes), rivers and creeks and together cover approximately 5,140 acres of proposed Refuge lands (Figure 26 on page 60). During periods of heavy rainfall or high spring runoff, the entire complex can be inundated. During regular flow cycles,

Table 9: Habitats Found at Crane Meadows NWR

HABITAT[a]	DESCRIPTION	ACRES[b]	
		Authorized for Acquisition	Currently Owned
Open Water	Portion of a lake with a water depth of >1m and without emergent vegetation (Cowardin et al. 1979). Skunk, Rice, and Mud Lakes are the three lakes with varying 'open water' status.	153.9	17.8
River/Stream	Lotic or running water environment (Goldman and Horne 1983). The Platte and Skunk Rivers, and Rice and Buckman Creeks flow through the Refuge.	32.0 miles	3.1 miles
Emergent Marsh	Shallow water wetland (water depths 20-60 inches) dominated by cattails, bulrushes, and submergent and floating aquatic plants (coontail, milfoil, pondweeds, water-lilies, etc.); floating mats; areas along shorelines of lakes, ponds, rivers, or in shallow basins.	1,599.3	102.2
Sedge Meadow	Open wet meadow dominated by sedge, with broad-leaved graminoids and < 25 percent shrub cover.	2,640.4	458.9
Willow-Dogwood Shrub Swamp	Open wetlands dominated by broad-leaved graminoids and > 25 percent shrub cover. Shrubs include willows, red-osier dogwood, speckled alder, and bog birch.	2,499.9	410.0
Southern Rich Conifer Swamp	Tamarack-dominated swamps on shallow to deep peat, occasionally on floating mats at edges of ponds. Found in basins on moraines and outwash plains. Other trees species include elm, red maple, and paper birch.	0	0
Northern Floodplain Forest	Deciduous riparian forests on sand alluvial soils along rivers and streams. Typically dominated by silver maple, but on the Refuge this habitat includes ash, American elm, box elder, basswood, etc.	435.3	52.4
Wet Prairie	Tallgrass-dominated herbaceous vegetation, some forbs, shrub layer is absent to sparse, and no trees. Typic species include prairie cordgrass, big bluestem, Indian grass, woolly sedge, and Canada goldenrod.	911.0 [c]	379.1[c]
Southern Mesic Prairie	Tallgrasses dominant, but several mid-height grasses also important, forb rich, shrub layer sparse, no trees. Typic species include big bluestem, Indian grass, little bluestem, porcupine grass, stiff goldenrods, purple and white prairie clovers. Some Refuge areas have been planted to this habitat type.		
Southern Dry Prairie	Shortgrass-dominated herbaceous vegetation, some forbs, no trees. Typic species include little bluestem, side-oats grama, prairie dropseed, porcupine grass, junegrass, silk aster, purple coneflower, pasqueflower, harebell, etc.		
Southern Dry Savanna	Scattered trees 25-50 percent canopy cover (mostly bur oak with some black oak and jack pine), typically graminoid-dominated, forb-rich herbacious layer includes side oats grama, prairie dropseed, stiff goldenrod, silk aster, etc.	185.1	5.3

Table 9: Habitats Found at Crane Meadows NWR (Continued)

HABITAT[a]	DESCRIPTION	ACRES[b]	
		Authorized for Acquisition	Currently Owned
Jack Pine Woodland	Dry-mesic pine or hardwood forest dominated by evergreens (primarily jack pine). Other species may include red pine, quaking aspen, bur oak, and northern red oak.	84.5	8.8
Oak Woodland	Dry-mesic hardwood forests; typically deciduous-dominated, but at times mixed deciduous-conifer. Tree species include bur oak, pin oak, northern red oak, white oak, basswood, and American elm.	1,181.5	201.9
Oak-Aspen Woodland	Commonly dominated by northern pin oak, with quaking aspen, paper birch, big-toothed aspen, bur oak, northern red oak or red pine also abundant. At Crane Meadows, this habitat is dominated by aspen.	671.9	66.0
Agriculture	Land used for crop production and raising livestock. Common crops cultivated within the proposed Refuge boundary includes corn, small grain, and alfalfa. Livestock is dairy, pork, or poultry.	2,942.2	10.8
Conifer Plantation	Planted native or non-native conifers. Jack, red, and white pine are native to the area.	199.5	11.9

a. For consistency, vegetation classes from the 2006 vegetation assessment were compared to habitats defined by Minnesota DNR (2005) and reclassified to these standards (see Table 10).
b. All acreages are approximate GIS acres.
c. The 3 prairie types are not easily distinguished on the aerial imagery used to assess these habitat types. Acreages for all three prairie sub-types are combined here.

Rice, Skunk, and Mud Lakes are generally less than 3 feet deep and are rich in aquatic vegetation including dense stands of wild rice when growing conditions are favorable. In the past decade the wild rice crop throughout the wetland complex has been poor, with an exception in 2007 when the state of Minnesota experienced a severe drought and the rice crop was fairly dense.

Woodlands

Based on the 2006 vegetation map (Figure 26 on page 60), the Refuge acquisition area has approximately 2,572.2 acres of woodlands including both upland and bottomland forests that support a variety of tree species. Areas of upland forest include oak woodlands (1,181.5 acres) dominated by bur oak and northern pin oak, oak-aspen woodland (671.9 acres) dominated mostly by aspen species, and jack pine woodland (84.5 acres) comprised mostly of jack pine but interspersed with quaking aspen and northern pin oak. Bottomland forests are designated as northern floodplain forests (435.3 acres) which is essentially a riparian zone following the watercourses and/or forested areas near and adjacent to the lakes. Tree species inhabiting bottomland forests include silver maple, aspen, elm, ash, basswood, box elder and a small amount of tamarack. Also included in this total are 199.5 acres of conifer plantations in private ownership, including spruce, and jack, red, scotch, and white pines.

Oak Savanna

The distribution of oak savanna throughout the Midwest was widespread before European settlement. This habitat type once occupied as much as 50 percent of Midwestern landscape covering 11 to 13 million hectares (Nuzzo 1986). Most oak savanna habitat has been lost due to timber cutting, fire suppression, conversion to agriculture, and development. Only 0.02 percent of pre-European oak savannas remain today in small fragments and scattered remnants. Today, oak savanna is among the world's most threatened plant communities. Small patches totaling approximately 185 acres of a native oak savanna subtype, identified as southern dry savanna, have been retained in the Refuge acquisition area from pre-settlement times. This oak savanna subtype is characterized by a relatively open community of scattered or clumped (25-50 percent canopy cover; 5-50 square-feet per acre basal

Table 10: Vegetation Cover Type Reclassification

2006 Vegetation Map Cover Types	GIS Acres	Habitat Type Summary	GIS Acres
Agriculture	2,770.0	Agriculture	2,942.2
Pasture	172.3		
Jack Pine Plantation	22.0	Conifer Plantation	199.5
Red Pine Plantation	98.3		
Scotch Pine Plantation	39.4		
Spruce Plantation	24.1		
White Pine Plantation	15.7		
Developed	1,70.1	Developed	
Roads-Roadside	1,75.2		
Bulrush (Scirpus)	6.8	Emergent Marsh	1,599.3
Cattail (Typha)	409.0		
Giant Reed Grass (Phragmites)	240.2		
Reed Canary Grass (Phalaris)	144.2		
Wild Rice (Zizania)	40.0		
Rooted Floating Aquatic	456.5		
Submersed Vegetation	302.6		
Oak-Jackpine Mixed Forest	84.5	Jackpine Woodland	84.5
Lowland Broadleaf	435.3	Northern Floodplain Forest	435.3
Alder Shrub	50.8	Willow-Dogwood Shrub Swamp	2,499.9
Willow-Dogwood Shrub	2,449.2		
Northern Pin Oak-Bur Oak Forest	718.4	Oak Woodland	1,181.5
Upland Broadleaf	463.1		
Open Water	153.9	Open Water	153.9
Blue Joint Meadow	569.5	Sedge Meadow	2,640.4
Sedge Bluejoint Mixed Meadow	1,498.5		
Sedge Meadow	296.8		
Wet Meadow-Mixed Emergents	275.7		
Oak Savanna	185.1	Southern Dry Savanna	185.1
Cool Season Grasses	549.2	Prairie [a]	911.0
Warm Season Grasses (planted)	361.8		
Aspen	671.9	Oak-Aspen Woodland	671.9
		Southern Rich Conifer Swamp	0.0
		River/Stream	32 Miles

a. *The term "Prairie" refers to all prairie subtypes including: Southern Mesic Prairie, Southern Dry Prairie, and Wet Prairie.*

Figure 25: National Wetland Inventory Wetland Vegetation Classes, Crane Meadows NWR

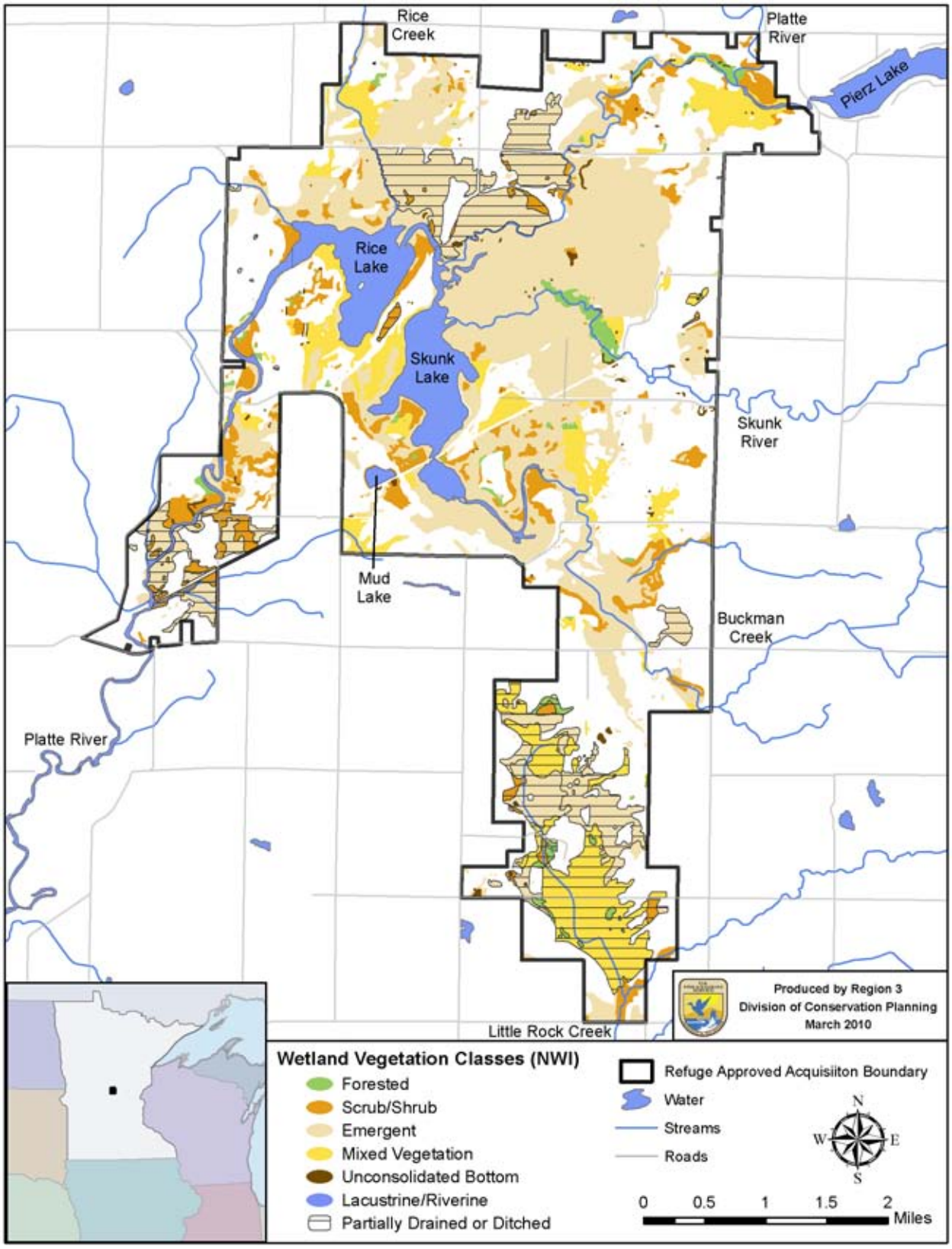
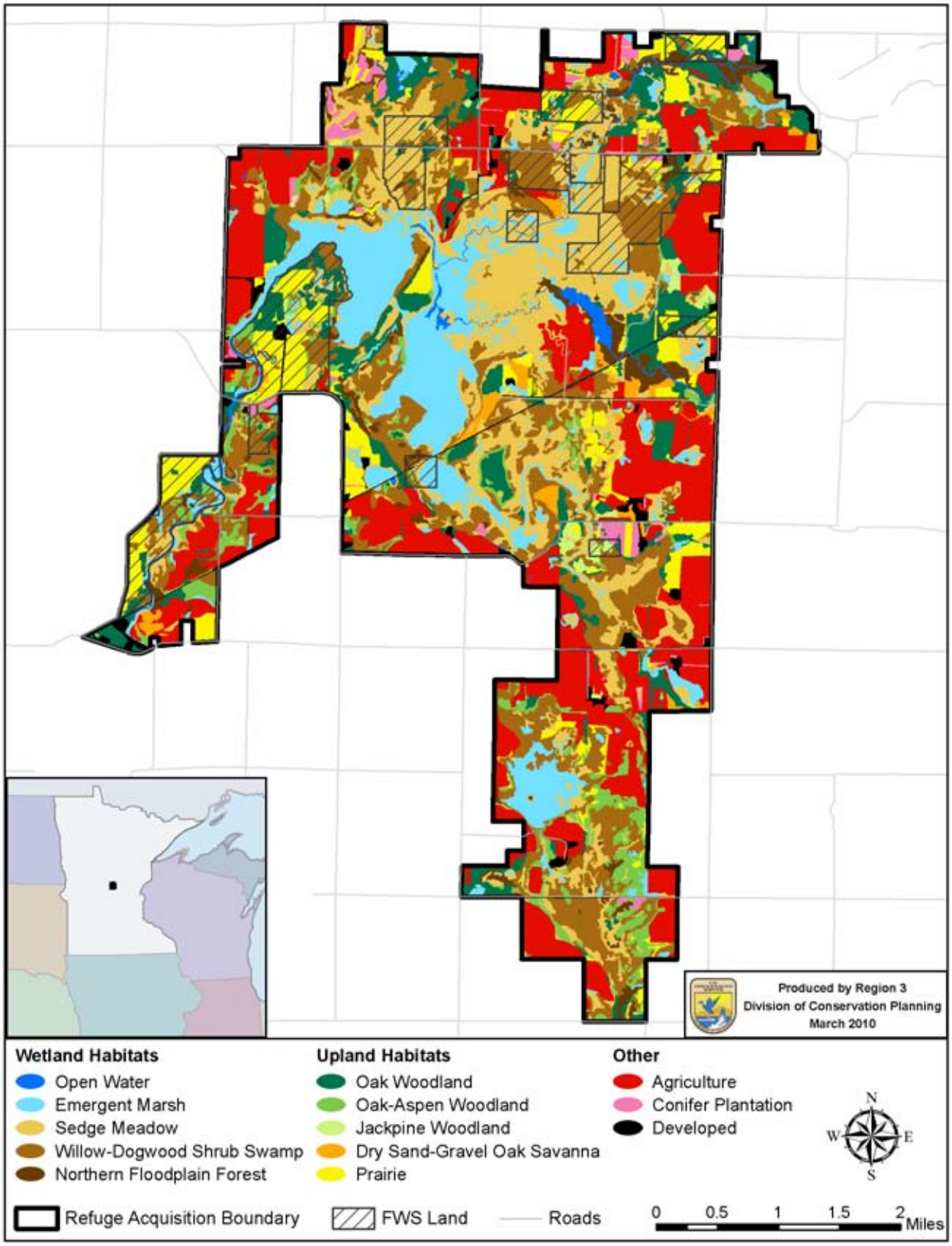


Figure 26: Refuge Vegetation Based on 2006 Imagery, Crane Meadows NWR



Grasslands at Crane Meadows NWR. Photo Credit: FWS

area), short (15-45 feet), open grown bur oak trees that are usually interspersed with northern pin oak, may have black oak and jack pine components, and with a nearly continuous cover of both prairie and forest forbs and graminoids (Wovcha et al. 1995).

Grasslands

The Refuge contains approximately 911 acres of grassland habitat including a few small remnants of native southern dry prairie (sand prairie). Other open grasslands on the Refuge include southern mesic prairie, consisting mostly of native warm season grasses and tallgrass prairie species that were planted during restoration efforts; and wet prairie characterized by both warm and cool season grasses, sedges, and forbs. (Note: the diversity of prairie types and grassland habitats were not distinguishable during the 2006 aerial cover type classification). These grasslands support a variety of grassland-dependent wildlife species. Prairie habitats throughout North America have also declined significantly due to fire suppression and conversion to agriculture.

Agriculture

Agriculture remains the leading economic activity in Morrison County. Because Crane Meadows NWR falls within the Anoka Sand Plain, the soil is porous sand and susceptible to rapid water percolation, typically undesirable for agricultural practices. However, once marginal farmland has now become profitable because of large-scale irrigation and fertilization. Incidentally, the rapid infiltration and passage of water through the sandy soils also leads to an increased transfer of fertilizers, pesticides, and other agricultural chemicals into surface and ground waters.

Many of the Refuge in-holdings are currently being used for agricultural purposes. Crop production within the proposed Refuge boundaries consists mainly of corn, small grains, and alfalfa. Other agricultural uses in the immediate vicinity include diary, pork and poultry farms. A number of pasture/grassland areas are used for grazing livestock as well. Also, some sedge meadows and wetland edges are hayed during years of normal or below average precipitation. The wetland complex is experiencing pressure from large scale farming and, to a lesser extent, residential development on adjacent lands within the acquisition boundary. Several large-scale agricultural and livestock operations have developed in recent years. Large installations have been erected to house hundreds and even thousands of animals. It will be increasingly difficult for the Service to acquire lands where costly structures have been erected. Similarly, central pivot irrigation systems continue to be constructed at an alarming rate on and adjacent to the Refuge. Many woodlots, windbreaks, and fence lines have been removed to accommodate these large irrigation structures.

Refuge Wildlife

Birds

The Refuge supports populations of many bird species and attracts more than 200 species each year with its diverse habitats. The abundance of wetland habitat attracts a variety of wetland-dependent species to the area including the Greater Sandhill Crane, a bird that was almost completely extirpated from Minnesota by the beginning of the 20th century. Historical records show cranes used Rice and Skunk Lakes in pre-settlement times. The first recorded sighting after extirpation was in 1958. Sandhill Cranes have been recorded every year since, and the area has emerged as one of the most important nesting areas for cranes in central Minnesota, with a current estimate of 40 breeding pairs in the area. The Refuge also serves as a staging ground for thousands of cranes during fall migration.

Waterfowl are generally abundant in the spring and into the fall, and include most species of ducks and geese found in the Prairie Pothole Region of Minnesota. Some waterfowl species of conservation concern use the Refuge during certain life-stages including Northern Pintail (migration), Lesser Scaup (migration), American Black Duck (migration/winter), Mallard (breeding/resident), Canvasback (migration), and Trumpeter Swan (migratrion). The most common nesting species of ducks are Mallard, Blue-winged Teal, and Wood Duck. During spring and fall migration, up to 10,000 ducks, a mixture of both divers and dabblers, and geese may be present at one time on Rice and Skunk Lakes and surrounding wetlands. High concentrations of Mallards, Ring-necked Ducks, Wood

Rose-breasted Grosbeak. Photo Credit: FWS

Ducks, Lesser Scaup, and Blue-winged Teal can be observed in the fall and thousands of Canvasbacks and Mergansers are present in early spring.

Other wetland-dependent birds found in the area include Great Blue Heron, American Bittern, Common Loon, Horned Grebe, Common Snipe, Sora (Rail), Sedge Wren, Black Tern, Foster's Tern, and Northern Harrier. Exposed mud flats that occur sporadically on the edges of Refuge wetlands attract some shorebirds including Wilson's Phalarope, Greater and Lesser Yellowlegs, Solitary Sandpiper, and Spotted Sandpiper.

More than 100 other bird species have been recorded during the breeding and migration seasons. Some of the common songbirds attracted to the woodlands and open grassland areas on the Refuge include:

- Eastern Kingbird
- Eastern Bluebird
- Northern (Baltimore) Oriole
- Rose-breasted Grosbeak
- Brown Thrasher
- Scarlet Tanager

Several songbirds of conservation concern also inhabit the Refuge woodlands and grasslands during the breeding season including:

- Golden-winged Warbler
- Black-billed Cuckoo
- Red-headed Woodpecker
- Bobolink
- Eastern Meadowlark

Year-round residents include:

- Black-capped Chickadee
- Red-breasted Nuthatch
- White-breasted Nuthatch
- Downy Woodpecker
- Hairy Woodpecker
- Pileated Woodpecker
- Red-bellied Woodpecker
- Ruffed Grouse
- Ring-necked Pheasant
- Wild Turkey

Common birds of prey that inhabit the Refuge include:

- Bald Eagle
- Red-tailed Hawk
- Northern Goshawk
- Red-shouldered Hawk
- American Kestrel
- Osprey
- Sharp-shinned Hawk
- Coopers Hawk
- Barred Owl
- Great Horned Owl

See Appendix C for a list of all bird species found on the Refuge.

Mammals

The Refuge lies within the known breeding range of 54 mammal species. Of these, 35 species have been confirmed on Refuge lands. Bison and elk were historically present on the landscape, but were extirpated in the early 1900s.

The largest mammal that inhabits and breeds on the Refuge is the white-tailed deer. Other large mammals common to the Refuge include coyote, red fox, and on occasion black bear. Gray wolves will occasionally pass through the area, but do not have established packs on the Refuge. Other predators on the Refuge include mink, river otter, short-tailed weasel, and badger. Small mammals typical of this area include:

- Short-tailed shrew
- Star-nosed mole
- White-footed mouse
- Deer mouse
- Plains pocket gopher
- Thirteen-lined ground squirrel

Observations of two state special concern species on the Refuge include plains pocket mouse and the prairie vole. Little brown bats and red bats have also been identified on the Refuge. Muskrat, beaver, raccoon, and mink are common in wetland habitat, while uplands harbor a variety of mice, voles,

shrews, and ground and tree squirrel species. See Appendix C for a list of all mammal species found on the Refuge.

Amphibians and Reptiles

Ten species of amphibians and 11 species of reptiles have been documented on the Refuge. Many of these species are dependent on Refuge wetlands, such as painted turtles, snapping turtles, and tiger salamanders while others, including eastern garter snake, brown snake, eastern and western hognose snake, and gopher (bull) snake, are associated with the upland habitats. The state-listed threatened Blanding's turtle is dependent on both upland and wetland habitats. The eastern gray tree frog, Cope's gray tree frog, wood frog, and western chorus frogs are commonly heard on the Refuge and inhabit wooded areas adjacent to sedge meadows, emergent marshes, or potholes. See Appendix C for a list of all herpetofauna found on the Refuge.

Fish

Forty fish species have been identified in lakes and rivers on the Refuge. Game fish species include:

- Northern pike
- Walleye
- Smallmouth bass
- Largemouth bass
- Bluegill
- Black crappie

A large population of carp and other roughfish also inhabit the open waters. Species that are indicators of ecosystem health within Refuge waters include redhorse suckers and shiners. Many fish in these areas experience winterkill caused by depletion of oxygen during the winter months. Much of the watershed is restocked naturally from the Mississippi River by way of the Platte River downstream from the Refuge. See Appendix C for a list of all fish species found on the Refuge.

White-tailed deer fawn. Photo credit: FWS

Threatened and Endangered Species

Animals

Gray wolves, a federally-listed endangered species, are also currently listed under a threatened status in the state of Minnesota. Wolves do not have any established packs on the Refuge but intermittently pass through the area. In 2001, a program was initiated to reintroduce an experimental nonessential population of federally listed endangered Whooping Cranes. The intent was to establish an eastern migratory flock that would summer and breed in central Wisconsin and winter in west-central Florida. On rare occasions, individuals from this experimental population have been observed in the area near Crane Meadows NWR. The mosaic of vegetation communities, mainly the wetland complex at Crane Meadows NWR, can provide essential habitat for this species if the population continues to grow and disperse. Bald Eagles were federally-listed as endangered and later as threatened, but were delisted on August 9, 2007, and moved to a protected status under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. This species is commonly observed in the area during spring and fall migration and the Refuge currently supports three nesting pairs. Peregrine Falcons were also once federally listed as endangered and were delisted in 1999 after their remarkable comeback. Currently, Peregrine Falcons are state-listed as threatened and are occasionally seen on the Refuge during spring and fall migration.

State-listed threatened or special concern birds species documented on the Refuge include Trumpeter Swan, Wilson's Phalarope, Horned Grebe, Nelson's Sharp-tailed Sparrow, Short-eared Owl, Red-shouldered Hawk, American White Pelican, and Forster's Tern. Greater Prairie Chickens were once documented using a cultivated field within the Refuge acquisition boundary. Two locally extirpated bird species, but historically present in the area and of conservation interest to the Refuge, are the Loggerhead Shrike and Upland Sandpiper. The Refuge supports a Blanding's turtle population, a state-listed threatened species, and other reptiles with special concern status including snapping turtles, western hognose snake, and gopher snake. Two species of mussel with state special concern status have also been documented on the Refuge, the creek heelsplitter and black sandshell found in the Skunk River (see Appendix C for a list of the mussel species present at Crane Meadows NWR).

Plants

Three species of rare plants have been documented on the Refuge. Small populations of blunt sedge and Hill's thistle (state-listed special concern species) were found in southern dry prairie (sand

prairie) and southern dry savanna remnants on the Refuge. The state-listed endangered tubercled rein-orchid has been documented in two locations on the Refuge in southern mesic/wet prairie and sedge meadow habitats.

Threats to Resources

Agricultural Development

Agriculture is the primary land use and leading economic activity in Morrison County. More natural areas have been converted to cropland in the county than to any other cover type, and many of these areas were already converted by the middle of the 20th century.

Threats associated with agriculture continue to pose the greatest challenges for the Refuge and its resources. This land conversion adversely impacts wildlife species by decreasing habitat availability, quality, and connectivity, and thereby increasing overall fragmentation of habitat. However, a parallel issue is the intensification of agriculture adjacent to the Refuge. Runoff from crop fields, pastureland, and feedlots creates non-point sources of pollution. Refuge resources are adversely affected by the application of pesticides, herbicides, and fertilizers on neighboring and upstream lands. These substances are not only a source of contamination but can also lead to increased erosion, sedimentation, and eutrophication in the watershed and Refuge wetlands. Many of these substances, such as organochlorines and organo-phosphates, are known to be toxic to fish and wildlife via direct exposure, bioaccumulation, and bio-magnification (Cox 1991).

There are a number of agricultural practices in the area that pose threats to the Refuge and the area's natural resources.

Animal Barns and Poultry Houses

Large animal husbandry projects occur and continue to be developed near the Refuge acquisition boundary. At the time of writing, one installation exists within the acquisition boundary and five additional installations can be found within 1 mile of the boundary. In addition to habitat loss and fragmentation, these installations may pose threats regarding undesirable nutrient levels, wastes, contaminants in surface waters, and rapid infiltration through sandy soils into local aquifers.

Public health issues for people such as E. Coli, as well as impacts on wildlife (e.g. avian influenza, salmonella, etc.) are also risk factors. The risks posed by Concentrated Animal Feeding Operations (CAFOs) include environmental contamination with nitrogen, phosphorous, pathogenic bacteria, hormones, antibiotics, and ammonia; noxious odor; habitat loss; and groundwater depletion (EPA and USDA 1999).

Center Pivot Irrigation

Center pivot irrigation systems have been erected in dryland farming areas increasing habitat loss and fragmentation. This activity also depletes groundwater sources and impact the levels of local water tables; create field scars and increase erosion, runoff, and sedimentation; impact adjacent habitats by increasing local moisture levels; degrade soils by increasing soil mineral levels and salinity if applied long-term; and these practices are typically accompanied by increased usage of pesticides, herbicides, and fertilizers – each with environmental implications (Johnson and Lewis 2007).

Tiling, Channelization, and Draining

Another serious threat to the natural function of the Rice-Skunk wetland system is tiling and channelizing waterways for agriculture.

This activity destroys wetlands and increases bottomland habitat fragmentation. In addition, the rapid removal of water from large areas leads to water volume surges in streams and wetlands, increased sediment, nutrient (especially nitrates), and agrochemical transport and deposition in waterways and Refuge wetlands, and reduces infiltration for groundwater recharge. Channelization also increases soil erosion, while tiling may help reduce surface runoff and erosion.

Invasive Species

Several invasive species occupy the Refuge, many of which are exotic. Invasives are often able to tolerate a wide range of environmental conditions and do not require the same external mechanisms for pollination and seed dispersal as natives. These species have the potential to negatively impact biodiversity and the quality of important habitat for native wildlife species. They also complicate efforts to preserve or restore natural vegetation communities.

Currently, the following invasive plants pose the greatest threat to Refuge uplands:

- Siberian elm
- Black locust
- Buckthorn
- Canada thistle
- Leafy spurge
- Common tansy
- Spotted knapweed

Proliferation of aspen may also lead to problems in upland restoration sites.

Invasive and exotic species also pose a threat to Refuge wetlands. Purple loosestrife is an exotic species, is invasive to the wetland areas near the Refuge, and merits routine monitoring due to its high level of invasiveness. Reed canary grass is also an aggressive invasive species that competes with and displaces native wetland vegetation. Phragmites requires monitoring for increases in abundance within the complex; as some subspecies are invasive and others native. These species can reduce the quality of habitat for wetland-dependent wildlife species. Routine monitoring is required to understand and prevent the spread of these and other invasive species on the Refuge.

Urban and Residential Development

The Refuge is located 7 miles southeast of the closest town, Little Falls, Minnesota, which has an estimated population of 8,200 and 545 housing units. Within the last decade, the population of Little Falls has grown by 5.5 percent.

The population of Morrison County increased by 10 percent in the last 20 years, and 3.6 percent in the last decade to reach a current count of 33,000 people. The number of housing units in Morrison County has increased 12.8 percent within the last decade, with approximately 16,000 house or condo units (U.S. Census 2009). Increased population and development may impact the Refuge resources and land acquisition by adding to habitat loss and fragmentation, changing property ownership and zoning, and increasing other human activities that may conflict with the Refuge purposes and the Refuge System mission.

Even more relevant to the Refuge than growth and development within the county and adjacent towns is development in and immediately adjacent to the Refuge. Because the Refuge is not at full acquisition within its congressionally designated acquisition boundary, private landowners are free to build and develop any areas not owned by the Fish and Wildlife Service.

To gain a sense of development levels and distribution, 2008 Farm Services Agency imagery was used to identify existing structures both within the Refuge acquisition boundary, and within a 1-mile buffer of the Refuge (see Figure 27 on page 66). More than 35 developed sites (residences, farmsteads, and agricultural installations) with approximately 100 associated structures such as houses, garages, barns, storage silos, and others were identified within the acquisition boundary. The wetland complex itself has limited the amount of development in the center of the Refuge, and the majority of these developed sites lie along the periphery of the acquisition boundary.

An additional 250 developed sites with more than 600 structures exist within 1 mile of the Refuge. The highest concentrations of developed sites follow Highway 27 along the northern boundary of the Refuge, and surround the shorelines of Pierz Lake to the northeast. Moderate or little development has occurred on the west, south, and east flanks of the acquisition boundary (Figure 27 on page 66). As the city of Little Falls grows, it is likely that development surrounding the Refuge will increase – particularly on the north and west sides.

Contaminants

An aerial survey of possible contamination sites in the area was conducted by the Service in August of 1991. No unusual sources of contaminants were found other than abandoned private waste sites.

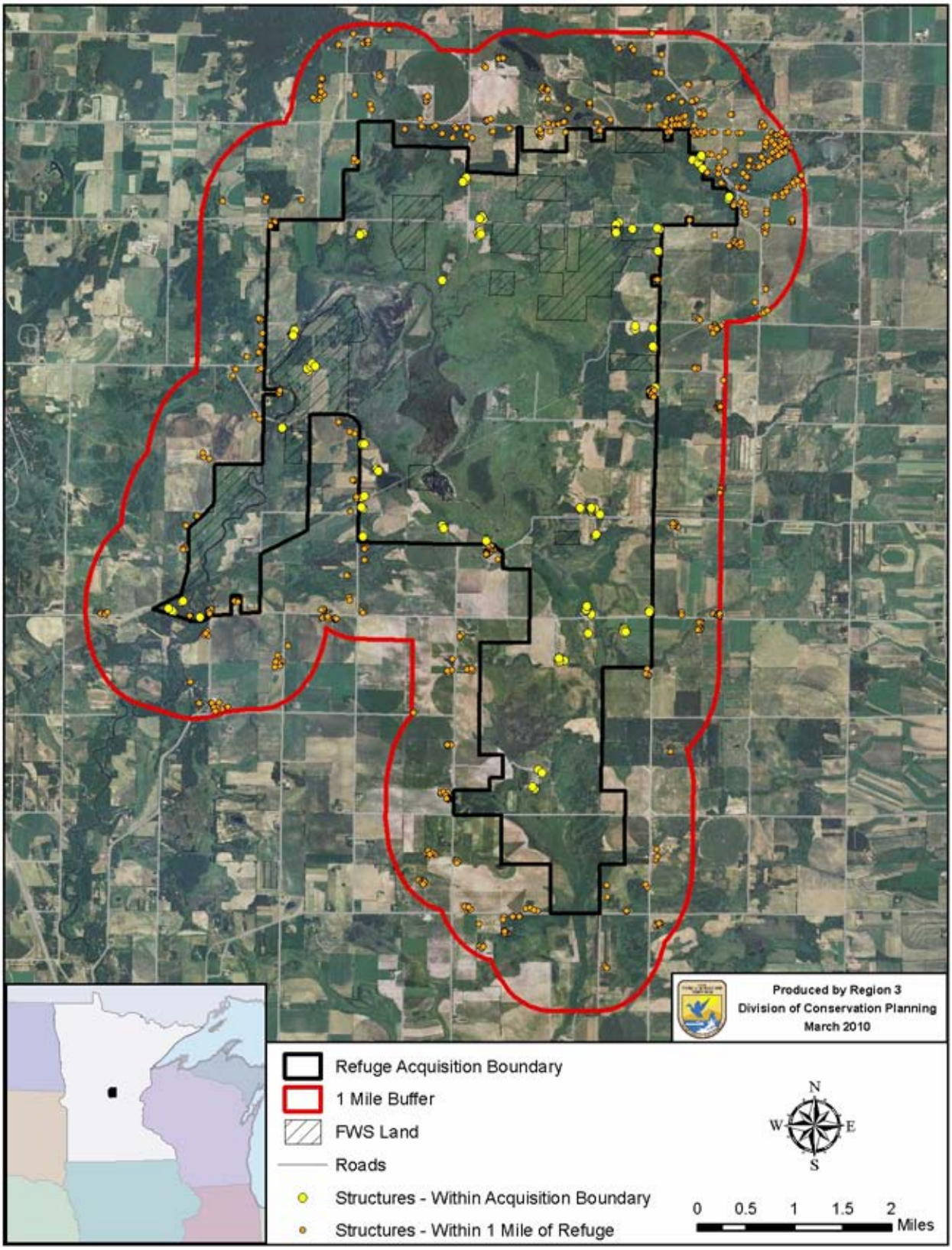
The Greater Morrison County Sanitary Landfill is located approximately 1.5 miles west of the Refuge. Surveys of the area surrounding the landfill have indicated contamination in the form of volatile organic compounds (VOCs) in the underlying groundwater. However, measured VOC levels are low (less than 300 parts per billion at the edge of the groundwater plume) and have not been detected beyond 500 feet from the landfill boundary. The general direction of the upper aquifer groundwater movement beneath the landfill heads away from the Refuge-to the southeast toward the Platte River.

Other potential sources of contamination (i.e. high concentrations of phosphorous, manure, etc.) are associated with agricultural lands currently within and adjacent to the Refuge acquisition boundary as discussed in the previous section.

Climate Change

The increase of carbon dioxide and other greenhouse gasses in the Earth's atmosphere resulting from the burning of fossil fuels has been linked to the gradual rise in surface temperature, commonly referred to as global warming. In addition to rising air and water temperatures, there are a number of other effects associated with a changing global climate including intense heat waves, shrinking permafrost zones, winter snow cover, sea ice, and glaciers, ocean acidification, changing precipitation patterns and associated effects on water availability (drought, flooding), a general decrease in open water areas and soil moisture levels, increasing fire severity – intensity, extent, and frequency, migrating plant productivity and agricultural zones, habitat shifts at all scales from ecosystems and biomes to specific sites, dislocation of species as habitat ranges experience shifts, reductions, and/or expansions, increasing issues with plant and animal pathogens and pests – both exotic and endemic, and more.

Figure 27: Development Near Crane Meadows NWR



Several examples of potential climate change impacts on wildlife have been identified. The following are just a few issues that may require further attention as climate change progresses (Green et al. 2000, Schneider and Root 2002).

- Habitat available for cold water fish such as trout and salmon in lakes and streams could be reduced.
- Forest distributions and compositions may change, with some species shifting their range northward, higher in altitude, or being replaced as other tree species move in to take their place.
- Ducks and other waterfowl could lose breeding habitat due to more severe and frequent drought events.
- Changes in the seasonality of life cycle stages such as migration and nesting could put some animals out of sync with the life cycles of their prey species.
- Herpetofauna may have trouble meeting the moisture conditions required for reproduction, and even respiration in their local habitats, and difficulty dispersing through inhospitable environments.
- Animal and plant species, including invasive or pest species, shift their ranges north in latitude as winter climatic conditions become more moderate and the warm seasons lengthen.

The resiliency of natural systems is tied to biodiversity. The diversity of organisms may be one of our greatest weapons against climate change; each organism will react and respond differently (Scott et al. 2009). Biological communities will not shift or remain intact because of the variability in each organism's sensitivity to climate change, size, mobility, lifespan, and the availability of food, shelter, and other resources it requires (Karl, Melillo, and Peterson 2009). In response, we must assess and provide for increased representation and redundancy across seasonal, geographic, and ecologic thresholds. Initial prioritization of action should be directed to those species for which climate change poses the greatest threat, namely those with limited distributions, highly specific ecological niches, and/or limited mobility. For example, plants and animals that are highly temperature sensitive or are confined to high altitudes or polar areas (Scott et al. 2009).

The U.S. Department of the Interior issued Secretarial Order Number 3226 in January 2001 requiring all federal agencies with land management responsibilities within the DOI to consider potential climate change impacts as part of long range planning efforts. This report was amended in January of 2009 to further expand and define bureau climate change, carbon sequestration, and energy conservation responsibilities.

In its 2009 strategic plan, 'Rising to the Urgent Challenges of a Changing Climate,' the Service calls for bold, aggressive, and strategic action to address climate change on three broad fronts: adaptation, mitigation, and education. Despite considerable uncertainty regarding the magnitude, extent, and timing of changes, the Service vision includes measures to "…sustain diverse, distributed, and abundant populations of fish and wildlife by conserving healthy habitats in a network of interconnected, ecologically-functioning landscapes (p. 8)."

The plan also describes six principles deemed essential to achieving this vision: priority setting, partnership, best science, landscape conservation, technical capacity, and global approach. Climate change was a key factor in the discussions and decision-making for the future management proposed in Crane Meadows NWR's CCP.

Mitigation and Adaptation

According to the 2009 report, 'Global Climate Change Impacts in the United States,' there are two broad categories of responses to global climate change: mitigation and adaptation. Mitigation refers to actions taken 'before' change occurs – efforts to reduce climate change as we move forward from the present, and curb its effects before they increase in severity or reach critical thresholds. Adaptation measures can be applied both 'before' (anticipatory) and 'after' (reactive) climate changes have occurred, and are actions aimed at avoiding or coping with harmful impacts and taking advantage of new opportunities presented by new climatic and environmental conditions (Karl, Melillo, and Peterson 2009; FWS 2009).

National wildlife refuges help mitigate the onset of climate change by increasing our ecological resiliency and reducing environmental stressors. Refuges will also play a critical role in adaptation strategies in the future. Table 11 on page 68 lists a number of examples in which refuges may contribute to climate change mitigation and adaptation.

The following paragraphs are excerpts from the 2000 report, 'Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change,' produced by the National Assessment Synthesis Team (NAST), an advisory committee chartered under the Federal Advisory Committee Act to help the U.S. Global Change Research Program fulfill its mandate under the Global Change Research Act of 1990. These excerpts are from the section of the report focused upon the eight-state Midwest Region.

Climate Trends of the Past Century

> "Over the 20th century, the northern portion of the Midwest, including the upper Great Lakes,

Table 11: Refuge Contributions to Climate Change Mitigation and Adaptation

Problems Associated with Climate Change	Refuge Mitigation Potential
Rising ambient air temperatures caused by increasing greenhouse gasses. Increased water temperatures.	Sequester carbon in vegetative biomass and serve as 'sinks' for greenhouse gasses. Set an example by moving towards agency-wide carbon neutrality. Contribute to efforts for increasing renewable energy development.
Changing precipitation frequency and intensity, including overwhelming water management systems	Provide floodplains as protection against surges, and reservoirs to buffer periods of drought. Enhance wetland and bottomland habitats for groundwater recharge and to filter waterborne pollutants (fertilizers, pesticides, excessive sediment).
Disrupted ecological processes and basic life support functionality	Tailor refuge management to protect or, if necessary, restore essential ecological processes and services such as pollination, seed dispersal, soil formation and stabilization, primary production, photosynthesis, and air, water, and nutrient cycling.
Rising sea levels and increasing tropical storm intensities	Where possible, buffer coastal areas with natural cover types thus minimizing socioeconomic losses as waters advance inland and storms pass from the oceans inland.
Modified fire frequency and intensity	Use controlled burn programs to reduce fuel loads on-refuge and serve as a source of trained fire professionals for other areas in need.
Loss of species and their required habitats	Protect lands with a diversity of habitats for declining species and spearhead efforts to protect species of concern. Protect genetic diversity and serve as a source for repopulation efforts.
Geographical shifts in biomes and species' ranges	Serve as large ecological hubs in a greater network of conservation lands allowing for species migration.
Altered species phenologies and interactions (competition, predations, parasitism, and disease)	Provide natural, minimally-altered settings for the evolutionary process and wildlife interaction.
Advancement of exotic invasives, pest species, pathogens, and contaminants	Manage to control and eradicate invasives on refuge lands, providing habitat for endemic species. Direct efforts to reduce species susceptibility to disease, pathogens, pests, and contaminants.
Limited scientific understanding of long-term climate change implications	Develop inventory and monitoring sites for ecological and climatic variables. Conduct directed research to address climate change topics. Continue to build scientific capacities and expertise in the Agency. Foster collaboration among conservation science community.
General lack of knowledge and understanding regarding climate change	Increase climate change education, training, and outreach both within the agency, and to external audiences. Tailor environmental education and interpretation programs to climate change topics. Provide conservation support to partners and other interested parties. Collaborate and share information and resources both internally and externally.
Inadequate legal, regulatory, and policy framework to address climate change	Assist in the review and revision of environmental laws, regulations, policies, guidance, and protocols to increase incentives and eliminate barriers to conservation actions addressing climate change. Revise grant programs to direct funding to projects that address climate change.

has warmed by almost 4°F (2°C), while the southern portion, along the Ohio River Valley, has cooled by about 1°F (0.5°C). Annual precipitation has increased, up to 20 percent in some areas, with much of this coming from more heavy precipitation events (NAST 2000)."

Climate Projections for the Next Century

"During the 21st century, it is highly likely that temperatures will increase throughout the region, likely at a rate faster than that observed in the 20th century, with models projecting a warming trend of 5 to 10°F (3 degrees to 6

degrees Celsius) over 100 years. Precipitation is likely to continue its upward trend, with 10 to 30 percent increases across much of the region. Increases in the frequency and intensity of heavy precipitation events are likely to continue in the 21st century. Despite the increase in precipitation, rising air temperatures and other meteorological factors are likely to lead to a substantial increase in evaporation, causing a soil moisture deficit, reduction in lake and river levels, and more drought-like conditions in many areas (NAST 2000)."

Midwest Key Issues

Water Resources

Water levels, supply, quality, and water-based transportation and recreation are all climate-sensitive issues affecting the Midwest Region. Despite the projected increase in precipitation, increased evaporation due to higher summer air temperatures is likely to lead to reduced water levels in the Great Lakes. Of 12 models used to assess the future of Great Lakes hydrology, 11 suggest significant decreases in lake levels while one suggests a small increase. The total range of the 11 models' projections ranges from a less than 1-foot increase to a more than 5-foot decrease. A 5-foot (1.5-meter) reduction would lead to a 20 to 40 percent reduction in outflow to the St. Lawrence Seaway. Lower lake levels will cause reduced hydropower generation downstream, with reductions of up to 15 percent by 2050. The projected increase in demand for water across the region while there is a simultaneous decrease in net flows is of particular concern. As demands for water increase there is a possibility for increased national and international tension related to growing pressure for water diversions from the Lakes. For smaller lakes and rivers, reduced flows are likely to make water quality issues more acute. In addition, the projected increase in very heavy precipitation events will likely lead to an increase in flash flooding, and thus worsen agricultural and other non-point source pollution as more frequent heavy rains wash pollutants into rivers and lakes. Lower water levels are likely to make water-based transportation more difficult, with increases in navigation costs from 5 to 40 percent. Some of this increase may be offset as reduced ice cover extends the navigation season and the geography of navigable waters changes. Reduced water levels may also decrease shoreline damage resulting from high lake levels by 40 to 80 percent.

Adaptations: A reduction in lake and river levels would require adaptations such as re-engineering of ship docks and locks for transportation and recreation. If flows decrease while demand increases, international commissions focusing on Great Lakes water issues will become even more important in the future. Improved forecasting of extreme precipitation events could help reduce some related impacts.

Agriculture

Agriculture is of vital importance to this region, the nation, and the world. Agricultural systems have exhibited a capacity to adapt to moderate differences in growing season climate, and it is likely that agriculture will be able to continue to adapt. With an increase in the length of the growing season, double cropping, the practice of planting a second crop in a single year after the first is harvested, is likely to become more prevalent. The fertilization effects of carbon dioxide are likely to enhance plant growth and contribute to generally higher yields. The largest increases are projected to occur in the northern areas of the region, where crop yields are currently temperature limited. However, yields are not likely to increase in all parts of the region. Consumers may pay lower prices due to increased yields, while producers are likely to suffer reduced profits because of declining prices. Increased use of pesticides and herbicides are very likely to be required, presenting additional challenges.

Adaptations: Plant breeding programs can use climate prediction models to direct research to breeding new varieties for new growing conditions. Farmers can then choose varieties better suited to the expected climate. It is likely that plant breeders will need to use all tools available in adapting to climate change, including genetic engineering. Modifying planting and harvest dates, planting densities, and using integrated pest management, conservation tillage, and new farm technologies are additional options. There may be opportunities to shift or expand the area where certain crops are grown if climate conditions become more favorable. Weather conditions during the growing season are the primary factor in year-to-year differences in corn and soybean yields. Droughts and floods result in large yield reductions. Severe droughts like the drought of 1988 cause yield reductions of over 30 percent. Reliable seasonal forecasts would help farmers adjust their practices from year-to-year to respond to such events.

Changes in Semi-natural and Natural Ecosystems

Forests: Different U.S. forest types are expected to expand (oak-hickory), contract (maple-beech-birch), or disappear altogether (spruce-fir) (Ryan et al. 2008). The Upper Midwest has a unique combination of soil and climate conditions that favor the growth of conifer forests. Higher temperatures and increased evaporation will likely reduce boreal forest acreage, and make current forestlands more susceptible to pests and diseases. It is likely that the southern transition zone of the boreal forest will be

susceptible to expansion of temperate forests, not to mention increased competition from other land use pressures. However, warmer weather (coupled with beneficial effects of increased carbon dioxide on vegetation), are likely to lead to an increase in tree growth rates on marginal forestlands that are currently temperature-limited. Most climate models indicate that higher air temperatures will cause greater evaporation and hence reduce soil moisture, a situation conducive to forest fires. Increased temperatures and longer growing seasons may also speed up decomposition rates and nutrient cycling, depending on water availability. As the 21st century progresses, there will be an increased likelihood and intensity of environmental stress on both deciduous and coniferous trees, making them susceptible to disease, pest infestation, and ultimately, mortality.

Water Habitats: As lake water temperatures increase, major changes in freshwater ecosystems will very likely occur. For example, a shift may occur from cold water fish species such as trout, to warmer water species such as bass and catfish. Warmer water is also likely to create an environment more susceptible to invasive, non-native species. Runoff of excess nutrients (such as nitrogen and phosphorus from fertilizer) into lakes and rivers is likely to increase due to an increase in heavy precipitation events. This, coupled with warmer lake temperatures, is likely to stimulate the growth of algae, depleting dissolved oxygen content in the water to the detriment of other living organisms. Reduced lake levels will likely impact the current distribution of wetlands. There is a chance that some wetlands could migrate gradually over time, but in areas where their migration is limited by the topography or anthropogenic land change, they would disappear. Changes in bird populations and other native wildlife have already been linked to increasing temperatures, and more changes are likely in the future.

Outdoor Recreation

The climate change impacts on environmental systems will have direct consequences to humans. In the context of Service management responsibilities, this may result in effects on appropriate and compatible Refuge uses. Popular winter activities such as cross-country skiing, snow-shoeing, and ice fishing may have shorter seasons, and have the potential to be compromised by thinner ice and reduced snow cover. Opportunities for warm-season activities can be expected to see similar but opposite changes. Not only may warm-weather recreation seasons lengthen, but changing life cycles and distributions of wildlife may alter opportunities for hunting, wildlife viewing, and photography. Changes in activities not only affect Refuge management, but the local and regional economy.

Administrative Facilities

Because of Crane Meadows NWR's small size and limited land in fee-title ownership, there is a small staff and minimal administration facilities. The main office (a converted private residence), four maintenance buildings, and their associated gravel parking lots comprise the administrative headquarters. The office building was renovated in 1992 when the Service began managing the first Refuge tracts, and has three offices and a small kitchen /common area.

Cultural Resources

The geology and hydrology in the area surrounding the Crane Meadows NWR have combined to produce one of the most potentially rich archaeological locations in the region. The pre-settlement habitats of oak savanna, tallgrass prairie, and sedge-meadow wetland, co-mingled with a large number of water features (Rice Lake, Skunk Lake, Mud Lake, Platte River, Skunk River, Rice Creek, Buckman Creek, and Little Rock Creek), would have provided an inviting wealth of animal and plant resources (particularly wild rice) for the prehistoric inhabitants of the region.

To date, only three prehistoric archaeological sites have been positively identified within the boundaries of the Refuge acquisition boundary. All three are habitation and mound sites containing between 2 and 10 circular burial mounds each. The largest of the mounds is reported to be between 15 and 25 feet high – likely the largest mound in Morrison County. Archaeological research conducted in the habitation areas has revealed that these locations were occupied for at least the last 3,000 years. Two of the mound sites were determined to be so significant and unique, that they were designated

Green-wing teal. Photo credit: Beau Liddell

the *Rice Lake Prehistoric District* and listed on the National Register of Historic Places (NRHP) on October 2, 1973.

The Pelkey Lake Site, which is located only 1 mile north of the Refuge, was also listed on the NRHP in 1973. Archaeological evidence there indicates that the site was used for the last 10,000 years by people of the Paleo-Indian, Archaic, and Woodland periods. In addition, dozens of local residents have collected artifacts from the area (four archaeological sites are known to exist immediately adjacent to the Refuge) that reflect a long and continuous occupation of the region beginning with the Paleo-Indian period approximately 10,000 years ago.

The use of the area historically includes ricing, gathering, and hunting (bison and large herds of elk were observed as late as 1806) by the Dakota and Ojibwe. The Platte River also served as a major canoe route between Lake Mille Lacs and the Mississippi River by Native Americans and Euro-American explorers, trappers, and traders. Dams were built on the Platte River during the mid 1800s and the first log drive occurred in 1856, the practice continued until the turn of the century. Euro-American settlement of the area began about 1850 with farmers clearing the land and building homesteads. The Minneapolis, St. Paul, and Saulte Ste. Marie (Soo Line) railroad laid new track between Mud and Skunk Lakes and plated the town of Vawter around 1908. The town contained several stores, a grain elevator, community church, and school. By 1940, the town was abandoned.

Archaeological and historic sites associated with the above events have not been previously identified or recorded, but are believed to exist within the Refuge. To date, only one archaeological investigation covering 5 acres has been conducted within the Refuge since it was established in 1992.

Section 2 – Current Management

The following section describes current and past management of Service-owned lands within the Crane Meadows Refuge acquisition boundary. To more easily facilitate management descriptions throughout this CCP, a temporary naming convention is used to reference the Service-owned properties within the Refuge acquisition boundary. A series of unit names was created as a part of the planning process to identify 12 distinct management areas (see Figure 28).

Habitat Management

Wetlands

The greatest conservation priority at Crane Meadows NWR is protecting one of Minnesota's largest remaining wetland complexes through land acquisition. Several wetlands within the proposed Refuge boundary are completely or partially drained for agricultural purposes and need to be restored. Restoration, protection, mechanical treatment of invasive species, and rotational prescribed burning are currently the only active management on Refuge-owned wetland habitat. Prescribed burning is limited due to difficult mobility in these areas and because of fragmented Service land ownership. Burns are often coordinated with adjacent private landowners.

Open Water

Open waters, including Mud, Rice, and Skunk Lakes, are under state jurisdiction and management. A weir with a water control structure was built on the Platte River where it exits Rice Lake to maintain minimum water levels in the lakes for recreational use in the fall.

River/Streams

No direct management is currently associated with river and stream areas. A spring clean-up day is conducted on many creeks and rivers throughout the Refuge acquisition boundary.

Emergent Marsh

No active management is currently associated with this habitat type other than the presence of the state-managed weir on the Platte River. Ditch plugs were used in 1996 to restore emergent marsh on the Headquarters Unit. Various methods for controlling invasive plant species, particularly purple loosestrife, have been used in these areas.

Beaver leveler used on a Private Lands project. Photo Credit: FWS

Sedge Meadow

There is currently little active management directly associated with this habitat other than protection and suppression of woody encroachment through prescribed burning and mechanical cutting.

Willow-dogwood Shrub Swamp

These areas undergo rotational prescribed burns where possible to control the spread of woody vegetation into other adjacent habitats.

Northern Floodplain Forest

No active management programs are currently associated with this habitat type. Natural flood events occur regularly and wind throw occurs over time.

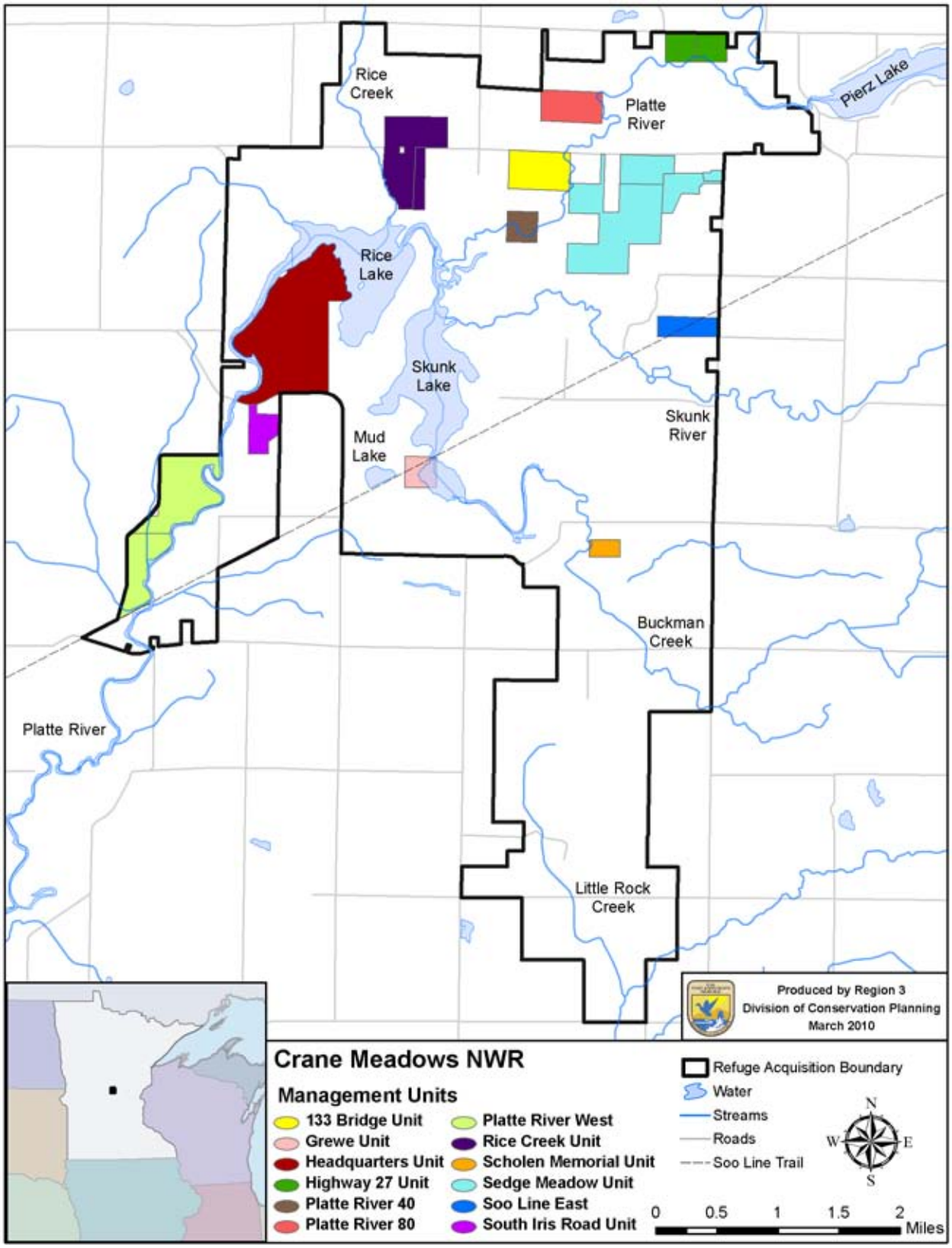
Uplands

Grasslands (Southern Dry Prairie, Southern Mesic Prairie, and Wet Prairie)

Prescribed fire is used to rejuvenate grassland and prevent woody encroachment. The Refuge has a greenhouse in which native grasses and forbs are propagated for use during restoration activities. As new properties are acquired by the Refuge, upland areas formerly in agriculture are seeded with prairie grass and forb species:

- Prior to the creation of the Refuge, several former agricultural fields on the Headquarters Unit were seeded to native warm-season grasses.
- 1994: The Platte River 80 Unit and the northern half of the Platte River West Unit were seeded with a mix of native prairie grasses from Big

Figure 28: Refuge Unit Names, Crane Meadows NWR



Stone NWR near Odessa, Minnesota. Plant species included in this mix were primarily big bluestem, little bluestem, and Indiangrass, with lesser components of switchgrass, side-oats gramma, purple prairie clover, and black-eyed susan.

- 1997: The front field of the Soo Line East Unit and some areas on the Sedge Meadow Unit were seeded with the same Big Stone mix.
- 1999: The Highway 27 Unit was seeded to a short dry grass mix, predominantly little bluestem. This area has become a seed production area for the Refuge.
- 2003: The Highway 27 Unit was inter-seeded using a local, dry, shortgrass mix purchased from Prairie Restorations, Inc.
- 2005: A home site was removed from the north half of the Platte River West Unit and the site was seeded with prairie grasses of local origin. Also, the south half of the Platte River West Unit, and a small field on the east edge of the Sedge Meadow Unit were seeded to a big bluestem/Indiangrass mix. These two sites are used as seed production areas for the Refuge. The seed is harvested at maturity each year and used to seed other areas at Crane Meadows and Sherburne NWRs.
- 2006: Forty acres on the Headquarters Unit were seeded to big bluestem/Indiangrass and now serve as a seed production area.
- 2007: The 9-acre interior field on the Soo Line East Unit was seeded to Indiangrass of local origin, and is now used as a seed production area.

Oak Savanna (Southern Dry Savanna)

Current management consists of rotational prescribed burning to restore a historical disturbance and to suppress woody encroachment on sections of the Headquarters Unit.

Woodlands (Oak, Oak-Aspen, and Jack Pine)

Management of woodlands includes rotational prescribed burning in wooded areas on the Platte River West and Sedge Meadow Units to reduce hazardous fuel loads, and the removal of conifer plantations:

- 2005-2006: A windbreak of spruce trees was removed along the periphery of the home site on the north half of the Platte River West Unit.
- 2007: Conifer plantations were removed from the Platte River 80, Highway 27, and an east portion of the Sedge Meadow Unit.

Agriculture (Cropland/Pasture)

The last 40 acres of agricultural land on the Refuge were removed from production in 2005 on the Headquarters tract, just east of the road to the Refuge office. Following the purchase of the South Iris Road Unit in 2008, the property's 4 acres of agriculture were removed from production. Staff will continue to eliminate agriculture from all newly acquired properties, restoring these areas to native upland habitats.

Fish and Wildlife Management and Monitoring

Refuge fish, wildlife, and habitat monitoring activities and surveys are conducted to provide information for management decisions, to enhance biological integrity of the Refuge, and to support statewide and national conservation efforts. Many of the surveys on the Refuge are done in collaboration with other agencies such as the Minnesota Department of Natural Resources, the International Crane Foundation, the Bluebird Recovery Team, etc. Fish, wildlife, and vegetation monitoring activities are described in the following paragraphs.

Migratory and Resident Birds

Sandhill Crane Survey: (Unison Call Survey) A unison call survey is conducted each spring (late April) at the peak of the crane nesting season. The purpose of this survey is to estimate the number of Greater Sandhill Crane breeding pairs. The survey lasts 2 hours, beginning one-half hour before sunrise and ending 1 and a half hours after sunrise. At numerous survey locations observers record the time, compass direction, and distance of unison calls heard. During the field season, general observations of known pairs in the area or nest site locations validate and supplement the unison call data.

Annual Midwest Crane Count: This survey is one of the largest citizen-based inventories in the world. It is hosted by the International Crane Foundation (ICF), and Morrison County is one of only 12 counties in Minnesota included in the survey. The purpose of this survey is to monitor the abundance, distribution, and population trends of cranes in the Upper-Midwest. One Saturday in April observers record individual birds and breeding pairs (identified by unison calls).

Waterfowl Survey: Waterfowl surveys are conducted one morning each week during early migration each spring and fall. The data are used to provide managers and the public with up-to-date information on the presence and abundance of waterfowl species using the Refuge. This survey is also used to monitor long-term trends of waterfowl populations.

Marsh Bird Surveys: A survey of secretive marsh birds was conducted between April and June from 2002 to 2004. Play-back calls were used to detect the presence of Yellow Rails, Virginia Rails, Soras, Least Bitterns, American Bitterns, and Pied-billed Grebes. Data is used to inform managers and direct habitat management objectives and strategies for wetlands on the Refuge. This data also contributes to the National Marsh Bird Monitoring Program which tracks marsh bird population trends throughout the nation.

Bald Eagle Monitoring: All Bald Eagle nests on the Refuge are monitored each spring (March to May) during the waterfowl survey and periodically throughout the year.

Songbird Point Counts: Every 3 to 5 years, point counts are performed for 2 consecutive years. This survey tracks the population trends and habitat use of breeding songbirds.

Christmas Bird Count: The Christmas Bird Count is an annual 1-day event in December hosted by the National Audubon Society and conducted by volunteers. Each species is recorded as well as the number of individuals within a species. This survey provides a basic inventory of birds observed at the Refuge during the winter.

Mourning Dove Survey: Call count surveys are conducted annually in the 48 contiguous states to monitor Mourning Dove populations and to provide managers with an annual index of population size. The data is used by wildlife administrators to set annual hunting regulations. The Refuge has participated in this survey for approximately 15 years.

Woodcock Survey: Singing ground surveys of woodcock are conducted annually to provide indices of recruitment, hunting success, changes in abundance, and annual population changes. The Refuge has participated in this survey for approximately 15 years.

Bluebird and Wood Duck Boxes: Nest boxes for Bluebirds and Wood Ducks were built and implemented on the Refuge in 2007 and 2008.

Native Resident Wildlife

Small Mammal Survey: A survey was conducted in 2004 using live traps to inventory small mammal species on the Refuge.

Frog and Toad Calling Survey: Frog/toad calling surveys were conducted in 2002-2004. The purpose of these surveys was to inventory species presence or absence, and to determine population status and diversity. Survey methods were adopted from the North American Amphibian Monitoring Program, and the data collected was shared with Minnesota Frog Watch.

Fish and Other Aquatic Resources

Fish Surveys: Several fish surveys have been completed on the Refuge in collaboration with the Minnesota DNR. These surveys use electro-shockers to document the fish species present, number of individuals caught, and their lengths. The surveys track diversity, population estimates, spawning information, and aid in the development of habitat management plans and public fishing regulations.

Habitat Monitoring and Management

Prescribed Fire Monitoring: Fire monitoring is accomplished using protocols established by the National Park Service and the U.S. Forest Service. The Refuge has seven designated burn units that are used to monitor the long-term effects of fire on vegetation composition and to determine if habitat management objectives are being met. Three are grassland plots and four are woodland plots. All plots are sampled pre-burn, immediately post-burn, and at intervals of 1, 2, 5, and 10 years following any prescribed burns.

Invasive Plant Monitoring and Management: Annual purple loosestrife monitoring occurs on the Refuge, and a biological control is used as needed to manage infestations. The presence of other invasive species such as Siberian elm, black locust, spotted knapweed, Canada thistle, leafy spurge, and buckthorn are monitored on the Refuge, and are treated where possible.

Wildlife Lake Habitat Survey: The Minnesota DNR has conducted lake habitat surveys for Rice and Skunk Lakes (1950, 1962, 1966, 2003, and 2006). These studies sample along transect lines that traverse each lake, and are used to assess the condition of the system and document wildlife diversity and plant species composition.

Wild Rice Surveys: The Minnesota DNR has monitored wild rice trends in the complex since the mid-1970s, and in more recent years has conducted wild rice surveys using aerial imagery to determine its abundance and distribution on Rice and Skunk Lakes.

Water Surveys: Water surveys occur on and around the Refuge in collaboration with various agencies and organizations, including the DNR, USGS, and Aquatech. See "Water and Hydrology" on page 48 for more information.

Wetland Health Evaluation: Beginning in 2009, Releve plots have been established to survey and inventory wetland vegetation and invertebrates.

Table 12: Refuge Visitation – Crane Meadows National Wildlife Refuge

Refuge Activity	2005	2006	2007	2008
Platte River Trail	1,960	2,098	4,508	5,388
Habitat Day	500	550	450	475
Environmental Education	615	151	396	688
General Refuge Visitation	8,171	3,925	5,380	6,317

The results are then used to develop indices of biological integrity, providing insight to the health of the wetland system.

Visitor Services

The National Wildlife Improvement Act of 1997 established six priority uses of the Refuge System:

- Hunting
- Fishing
- Wildlife observation
- Wildlife photography
- Environmental interpretation
- Environmental education.

All but hunting and fishing are a part of current management at Crane Meadows NWR. The Headquarters Unit is currently the only Refuge property with public access and accommodations for public use. The Refuge provides a number of facilities including trails, observation platforms, kiosks, and benches to facilitate wildlife-dependent recreation, and overall visitation for Refuge activities has increased in recent years (see Table 12).

Hunting

The Refuge is not currently open to hunting because Service land ownership inside the Refuge acquisition boundary is relatively small, scattered, and interspersed with privately owned land. Consistent with its establishment goals, Refuge staff are seeking ways to overcome these and other obstacles to provide safe and manageable hunting opportunities at Crane Meadows NWR.

Fishing

Fishing is permitted on all state-managed public waters, including Rice, Skunk and Mud Lakes, and the Platte River. Fishing, however, is not permitted on Crane Meadows NWR property along the banks of Refuge rivers, streams, or lakes. Public boat access to these areas is available at two sites maintained by the state. One is located above the low flow dam and affords access to Rice, Skunk, and Mud Lakes. Another site just below the dam provides access to the Platte River.

Wildlife Observation and Photography

Opportunities to observe and photograph wildlife are provided year-round on the scenic 3.7-mile Platte River Trail (see Figure 29 on page 77). The trail leads visitors along the banks of the Platte River to the edge of Rice Lake, then returns to the trailhead through oak woodland, oak savanna and prairie habitat. The trail has four loops. Two shorter, inner loops are available for visitors with limited time or mobility. Long and medium length loops are also available. The entire trail was improved and surfaced with crushed granite in June 2008. Two observation platforms are provided, one adjacent to the Platte River near the trailhead and the other overlooking Rice Lake. The Rice Lake Overlook was constructed with a permanent spotting scope and a wide middle section to accommodate larger groups and provide a space for environmental education programs. Bicycles and horses are not permitted on Refuge trails.

During the winter season, the Platte River Hiking Trail is groomed for cross country skiing as snow conditions permit. A double wide groomer is used to set a side-by-side track. Snowshoers and winter hikers are asked to be respectful of tracks set for skiers and hike to the side of the trail.

Interpretation and Programs

Habitat Day

The Refuge, the Friends of Crane Meadows NWR, and numerous other co-sponsors annually host Habitat Day for Wood Ducks and Bluebirds during March. Since 2000, this event has developed and enhanced partnerships among more than 40 natural resource agencies, conservation organizations, area schools, and local businesses. During the event, participants learn about Wood Ducks and Bluebirds and have the opportunity to assemble a free nest box to place on their own property. In addition to creating nest boxes for wildlife, this program also introduces people to conservation groups in the area and creates opportunities for future involvement.

Additional results of this event include two Bluebird trails established on the Refuge and several others created off-Refuge within the county. The

Figure 29: Existing Visitor Services Facilities, Crane Meadows NWR

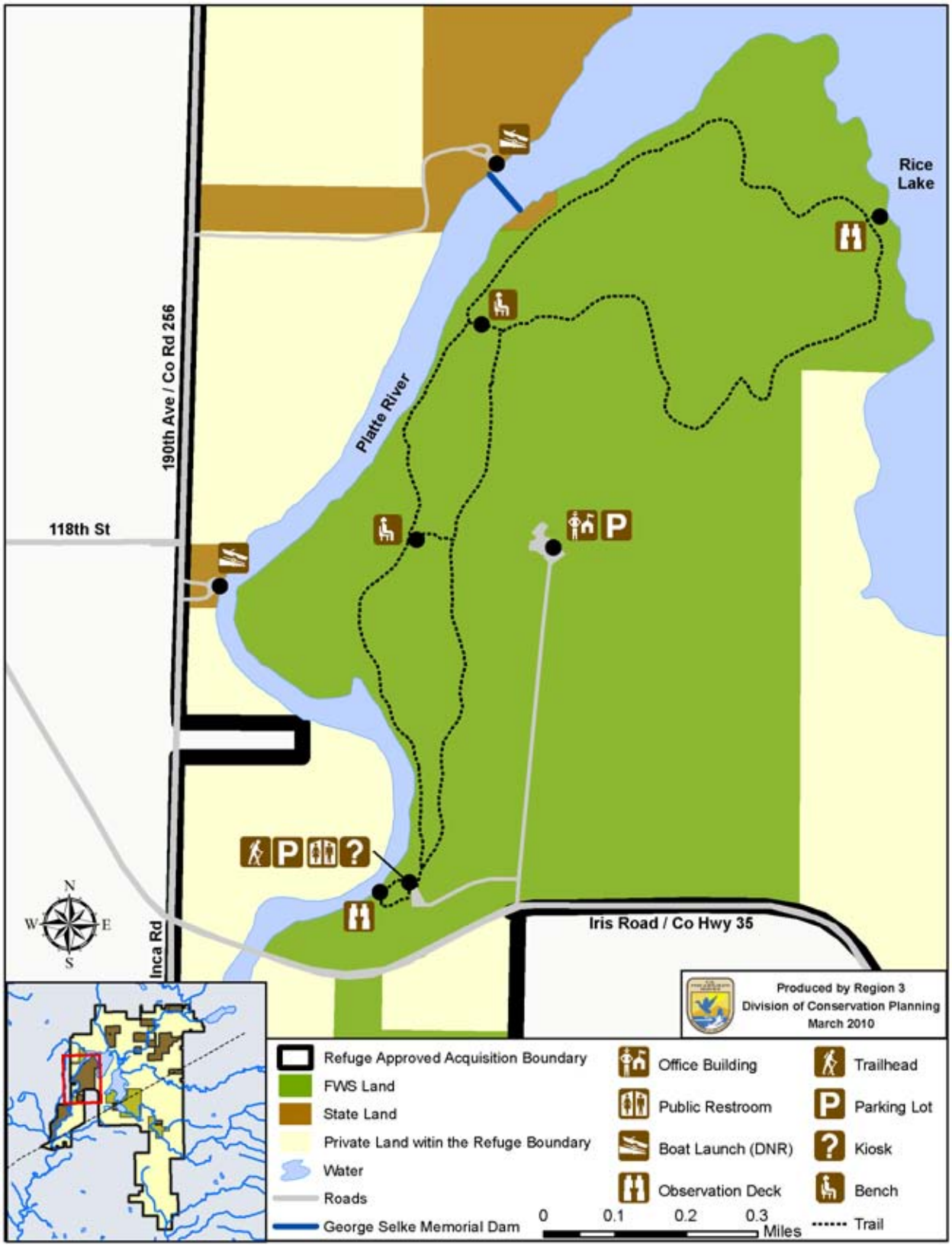


Table 13: Volunteerism at Crane Meadows National Wildlife Refuge

Volunteer Participation	2004	2005	2006	2007	2008
Total Number of Volunteers	32	37	41	63	71
Total Volunteer Hours	1,722	2,326	1,865	2,543	2,626

Refuge trails are monitored weekly by Refuge volunteers, and off-refuge trails are monitored by the local Boys and Girls Club. Results are tabulated at the end of each breeding season and submitted to the Bluebird Recovery Program. Birdhouses assembled during Habitat Day have led to the first recorded Bluebird nesting results in Morrison County.

Platte River Clean-up

The Refuge, the Friends of Crane Meadows NWR, and the Royalton Lions Club host an annual river cleanup each June. Participants clean a 26.5-mile stretch of the Platte River from Highway 27 south to the Mississippi River. The northern section of this route flows through the Refuge, and participants have the opportunity to fish and birdwatch while picking up litter.

Bat Program

The Refuge hosted a bat program in 2007 and 2008. Participants were able to built bat houses to take home, attend presentations on bats species in Minnesota, take tours to locate bats, and learn about the mechanics of echolocation.

Bird Tour

The Refuge, its Friends Group, and the Morrison Birding Club offer a guided bird tour on the Platte River Trail each spring. The Morrison County Birding Club has helped the Refuge develop a birding brochure, and lists Crane Meadows NWR on their website as an excellent birding spot in the county.

Environmental Education and Outreach

Staff and volunteers lead educational programs at the Refuge for organized groups upon request. For a number of years, Royalton Elementary School has used Crane Meadows NWR in the spring as an outdoor classroom. In 2009, the Friends of Crane Meadows NWR established an Environmental Education Committee to initiate dialog with area school superintendents, principles, and teachers to use the Refuge as an outdoor classroom for their students. The Royalton School District will be the pilot project.

Refuge staff and Friends members bring a Refuge exhibit to local business expos, the Morrison County Fair, home and garden shows, senior expos, and other off-site events as opportunities arise. Refuge staff assists with the U. S. Fish and Wildlife Service exhibit at the annual Game Fair in Anoka County in October. They also work with chapters of Pheasants Forever during their Youth Day Programs.

The Refuge participates in the Morrison County Water Festival held at Camp Ripley each year during the third week in September. Several hundred fifth-grade students from Little Falls and other area schools attend and participate in a variety of 30-minute environmental education programs conducted by staff from the Refuge, Camp Ripley, Morrison County Soil and Water Conservation District, The Nature Conservancy, and the Minnesota DNR.

Friends Group

The Friends of Crane Meadows NWR, a non-profit 501(c)(3) organization formed in September 2006, assists the Refuge with educational programs and provides financial backing for selected programs and projects through fund-raising activities. At the end of fiscal year 2008, the Friends Group had 61 members. The Friends' projects have included funding and assistance with the construction of the Rice Lake observation deck, and the development of the greenhouse program which grows native wildflowers for planting on the Refuge.

Volunteer Program

Volunteers actively participate in a wide variety of visitor services and biological programs on the Refuge. Their activities include wildlife surveys, wildflower gardening, assisting with special events, and trail maintenance. Table 13 shows an overall increase in volunteership on the Refuge over the past 5 years.

Partnerships

The staff at Crane Meadows NWR has a strong history of working with partners to implement Service policy, programs, and projects. Many initial partnerships began during the creation of Crane Meadows NWR or have been developed through the land acquisition processes. Saint Cloud State University, The Nature Conservancy, and the Minnesota DNR have been involved with the Refuge since

Pileated Woodpecker. Photo Credit: FWS

its establishment, and have been strong allies in protecting this unique and important area.

Additional partnerships have been formed through the Service's Partners for Fish and Wildlife Program. This program has strengthened working relationships with the Morrison County Soil and Water Conservation District, the Natural Resources Conservation Service, Ducks Unlimited, the Minnesota Waterfowl Association, and many private land owners in Morrison County.

In its ninth year, the Habitat Day Program has also led to the development of a number of relationships. In addition to those entities mentioned above, collaboration for this event includes many area schools, all of the sportsmen clubs in Morrison County, the Central Minnesota Audubon Society, the St. Cloud Environmental Council, the Minnesota Deer Hunters Association, Pheasants Forever, Morrison County Sentence to Serve, Boy Scout troops, 4-H clubs, Camp Ripley Environmental Office, and the Morrison County Chapter of the National Wild Turkey Federation.

Other important sources of support for the Refuge have come from the Friends of Crane Meadows NWR group. Since 2006 this group has promoted the Refuge's identity, advocated on its behalf, and increased its environmental education program. As a result, the Refuge partners list has grown to include the Little Falls Chamber of Commerce, the Visitors Bureau, Morrison County Birding Club, the Central Minnesota Audubon Society, Royalton Lions, Royalton Elementary, the Pine Grove Zoo, and the Lindbergh State Park and Historic Site.

Cultural Resources

Cultural resources (archaeological sites, historic structures, and Native American traditional cultural properties) are important parts of the nation's heritage. The Service strives to preserve evidence of these human occupations which can provide valuable information regarding not only human interactions with each other, but also with the natural environment. Protection of cultural resources is accomplished in conjunction with the Service's mandate to protect fish, wildlife, and plant resources.

The Service is charged with the responsibility, under Section 106 of the National Historic Preservation Act of 1966 (NHPA), of identifying historic properties (cultural resources that are potentially eligible for listing on the National Register of Historic Places) that may be affected by our actions. The Service is also required to coordinate these actions with the State Historic Preservation Office, Native American Tribal Governments, Local Governments, and other interested parties. Cultural resource management in the Service is the responsibility of the Regional Director and is not delegated for the Section 106 process when historic properties could be affected by Service undertakings, for issuing archaeological permits, and for Indian tribal involvement.

The Archaeological Resources Protection Act of 1979 (ARPA) Section 14 requires plans to survey lands and a schedule for surveying lands with "the most scientifically valuable archaeological resources." This Act also affords protection to all archeological and historic sites more than 100 years old (not just sites meeting the criteria for the National Register) on federal land, and requires archeological investigations on federal land be performed in the public interest by qualified persons.

The Regional Historic Preservation Officer (RHPO) advises the Regional Director about procedures, compliance, and implementation of these and other cultural resource laws. The actual determinations relating to cultural resources are to be made by the RHPO for undertakings on Service fee title lands and for undertakings funded in whole or in part under the direct or indirect jurisdiction of the Service, including those carried out by or on behalf of the Service; those carried out with federal financial assistance; and those requiring a federal permit, license, or approval.

Prescribed burn at Crane Meadows NWR. Photo Credit: FWS

The responsibility of the Refuge Manager is to identify undertakings that could affect cultural resources and coordinate the subsequent review process as early as possible with the RHPO and state, Tribal, and local officials. Also, the Refuge Manager assists the RHPO by protecting archeological sites and historic properties on Service managed and administered lands, by monitoring archaeological investigations by contractors and permittees, and by reporting ARPA violations.

Private Lands Program (Partners for Fish and Wildlife)

Outright fee-title acquisition of property by the federal government can be a difficult, costly, and lengthy process. Furthermore, to ensure the persistence of entire natural communities and ecosystems, habitat management has to be done on a much broader scale and include the private sector; an estimated 60 percent of our nation's lands are held in private ownership (Lubowski et al. 2006).

The Partners for Wildlife Program is a voluntary program that has been offered nationwide by the Service since 1987 to provide landowners with technical and financial assistance in restoring habitat and managing private property to benefit wildlife. The responsibility for the Partners Program among Minnesota's 87 counties is divided between the 15 Minnesota field stations and a State Private Lands Office in Waite Park, Minnesota. The success of this program in Minnesota is demonstrated on more than 17,000 sites with over 120,000 wetland, upland, streambank, and aquatic habitat acres restored since the program began, as well as the partnerships developed with federal, state, local, private conservation organizations, communities, schools, groups, businesses, and other private individuals.

Private lands activities for six Minnesota counties are managed out of the Crane Meadows NWR Field Office. At the Refuge level, Morrison County is assigned to Crane Meadows NWR, while Sherburne, Anoka, Isanti, Kanabec and Pine Counties are covered by Sherburne NWR. However, both private lands coordination positions are currently stationed at Crane Meadows NWR. It is also common for Service field stations to assist one another with activities due to a project's location, time constraints, required expertise, or equipment needs. As such, Crane Meadows NWR staff have also assisted restorations in Benton, Todd, and Cass Counties.

A priority for the Private Lands Program is to work on projects that have the potential to affect and improve Refuge resources. At Crane Meadows NWR, assisting landowners within and immediately adjacent to the acquisition boundary has been a primary focus of restoration. The Refuge is able to implement many of the same conservation practices on private lands as it would on Service-owned and managed land. Because water quality is a high priority for the Refuge, priority is also given to projects located in the watershed above the Refuge. In addition, the Refuge is involved with a project to restore oak savanna habitat within the Anoka Sand Plain. Priorities include lands adjacent to public natural areas or parks, those that are adjacent to larger contiguous natural areas, and conservation corridor areas that facilitate wildlife movement.

Most projects involve wetland restorations. Ditching was a common method for draining wetlands in the area, so wetlands are often restored by creating an impoundment with an earthen dam. Restoration of native upland prairie has increased in the last several years, particularly in Sherburne and Isanti Counties. Other projects include oak savanna restoration and stream bank stabilization projects. The number of wetlands and uplands restored in Morrison County since 2001 is summarized in Table 14.

In addition to numerous successful habitat restorations, this program has fostered excellent relationships between the Service and many local partners, hunt clubs, and private citizens. For larger projects, the Refuge typically seeks additional support from federal agencies, state agencies, counties, townships, non-governmental organizations such as Pheasants Forever, Minnesota Waterfowl Association, Ducks Unlimited, and private groups such as the Pinnacle Hunt Club and the Audubon Nature Center.

Landowners or administrators who benefit from this program must sign a Habitat Development Agreement (HDA) prior to any restoration work conducted on the property. The Agreement is a contract between the FWS and the cooperator, and states that the restoration must not be destroyed or damaged during the 10- or 15-year agreement

Table 14: Morrison County Private Lands Program Accomplishments

Year	Wetland Acres	Wetland Sites	Upland Acres	Upland Sites
2001	15	2	0	0
2002	128	11	60	4
2003	249	15	43	3
2004	216	10	0	0
2005	148	10	111	7
2006	241	7	102	10
2007	496	9	45	4
2008	307	6	0	0
2009	267	11	0	0
Total	2067	81	361	28

Table 15: Six-year Operations and Maintenance Budget

FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
$125,629	$152,647	$120,507	$143,325	$119,437	$119,472

period. Otherwise, the cooperator is responsible for reimbursement of the federal funds obligated toward the project. Maintenance on projects is the responsibility of the cooperator.

Law Enforcement

Certain safeguards must be in place to protect visitors, visitor use areas, cultural areas, administrative zones, residential areas, wildlife habitat, and wildlife resources from criminal or negligent actions, as well as from acts of nature. Without a staff law enforcement officer on the Refuge, Crane Meadows NWR relies on assistance from the local state DNR conservation officer, the Morrison County sheriff's office, and law enforcement officers from other refuges brought in as needed. At the time of writing, both Tamarac NWR (3 hours northwest of Crane Meadows NWR), and Litchfield Wetland Management District (2 hours south of the Refuge) provide law enforcement officers as needed.

Overall, there are few problems or violations at the Refuge. Those that do occur are predominantly natural resource related, including illegal hunting and poaching, vehicular and ATV trespass, Farm Service Agency (FSA) easement violations, and dumping. In 2007 the only incidents reported were four easement violations. In 2008 there were 24 documented offenses related to trespass (10), easement violations (6), fishing (3), hunting (2), and other resource violations (3).

Staff and Budget

Administrative and operational staff for Crane Meadows NWR has changed little since the establishment of the Refuge in 1992. Its first manager arrived in September of 1992, and remained the only staff until a maintenance position was added in June of 1993. On January 1, 1994, Crane Meadows NWR was "complexed" with Sherburne NWR. As a part of this transition, management of both units was combined and oversight of Crane Meadows NWR moved to the headquarters at Sherburne NWR. With a small, federally-owned land base at Crane Meadows NWR and similar habitats and wildlife to Sherburne NWR, complexing the Refuges has provided Crane Meadows NWR with additional support from the larger staff at Sherburne NWR. For the next 10 years a maintenance position was the only staff position at Crane Meadows NWR. In October of 2004 a second position, a combined Refuge Operations Specialist and Private Lands Biologist, was added providing on-refuge management for day-to-day operations under the supervision of the complex manager. The two-person staff has continued to the present, with seasonal intern positions to help with busy summer schedules.

Crane Meadows NWR Staff, 2009:

- Private Lands Biologist/Refuge Operations Specialist
- Maintenance

The operations and maintenance budget for the Refuge over the last 6 years has slightly decreased overall. The budget history is displayed in Table 15.

Chapter 4: Management Direction

The Environmental Assessment in Appendix A describes and analyzes three management alternatives for Crane Meadows NWR. The Service identifies one as its preferred alternative and it is described in the following chapter as the proposed future management direction that would guide activities on the Refuge for the next 15 years.

The Refuge has three management goals:

- *Goal 1: Habitat*

  Conserve a diverse mosaic of habitats both on- and off-Refuge, particularly sedge meadow, shallow lake, oak savanna, prairie, and other declining endemic habitat types, to meet the needs of native plants and wildlife with emphasis on Service Regional Conservation Priority Species. Crane Meadows NWR will remain engaged in efforts to protect and enhance water quality and natural hydrology in the watershed.

- *Goal 2: Wildlife*

  Protect, restore, and maintain native wildlife species to ensure biological diversity and abundance, with special emphasis on Service Regional Conservation Priority Species.

- *Goal 3: People*

  As an active partner in collaborative conservation, the Refuge will provide quality wildlife-dependent recreation, environmental education, and outreach to a diverse audience. These activities will preserve cultural resources and promote understanding, appreciation, and support for Crane Meadows NWR, the National Wildlife Refuge System, and natural resource conservation.

Goals, objectives, and strategies comprise the proposed future management direction. Goals are descriptive broad statements of desired future conditions that convey a purpose. There are three goals for Crane Meadows NWR. Goals are followed by objectives, which are specific statements describing management intent. Objectives provide detail and are supported by rationale statements that describe background, history, assumptions, and technical details to help clarify how the objective was formulated.

Crane Meadows NWR. Photo Credit: FWS

Finally, beneath each objective there is a list of strategies, the specific actions, tools, and techniques required to fulfill the objective. The strategies may be refined or amended as specific tasks are completed or new research and information come to light. Some strategies are linked to the duties of an employee position, which indicates that the strategy will be accomplished with the help of a new staff position. When a time in number of years is noted in an objective or strategy, it refers to the number of years from approval of this CCP. If no time is given, the objective is to be accomplished within the 15 years of the life of the plan.

Goal 1: Habitat

Conserve a diverse mosaic of habitats both on- and off-Refuge, particularly sedge meadow, shallow lake, oak savanna, prairie, and other declining endemic habitat types, to meet the needs of native plants and wildlife with emphasis on Service Regional Conservation Priority Species. Crane Meadows NWR will remain engaged in efforts to protect and enhance water quality and natural hydrology in the watershed.

Desired benchmark vegetation conditions for all future Refuge habitats are described in Table 16.

Table 16: Benchmark Conditions for Habitat Types, Crane Meadows NWR

Habitat Type	Benchmark Conditions (Minnesota DNR 2005)
Emergent Marsh	Emergent marsh has 20-60 inches of standing water present most of the year, providing favorable conditions for hydrophytic plants. Relative vegetation cover is dominated by native cattails (>50 percent), bulrushes, submergents such as common coontail, milfoil, and floating aquatic plants such as pondweeds, duckweed, broad-leaved arrowhead, and water-lilies. Open water (25-75 percent) is interspersed throughout dense stands of emergent vegetation and shrubs are absent or very sparse.
Sedge Meadow	Sedge meadow is an open wet meadow subjected to moderate inundation following spring thaw and heavy rains, but with little to no standing water during the growing season. There is sufficient saturation to inhibit shrub (<25 percent) and tree (<5 percent) establishment. Vegetation is dominated by broad-leaved graminoids including sedges and bluejoint (>50 percent), with variable forb cover (5-75 percent) including tufted loosestrife, marsh skullcap, and water smartweed.
Willow-dogwood Shrub Swamp	Willow-dogwood shrub swamps are open wetlands which contains >25 percent shrub cover, primarily willows, red-osier dogwood, speckled alder and bog birch, with abundant broad-leaved graminoids such as tussock sedge and bluejoint.
Southern Rich Conifer Swamp	Southern rich conifer swamps has a canopy cover ranging from 25-70 percent and are tamarack dominated, with < 25 percent elm, red maple, and paper birch. These canopy species are also primary components of the understory layer. Also common in the understory are forbs (25-75 percent) such as mash marigold and tufted loosestrife, some graminoids (<50 percent) including sedges and bluejoint, and a variable shrub layer that includes Virginia creeper and poison ivy.
Northern Floodplain Forest	Northern floodplain forest is a riparian community occasionally or annually flooded by natural events in the spring and is dominated by deciduous trees (50-100 percent cover) tolerant of occasional anoxic conditions. The canopy is strongly dominated by silver maple, but also has green ash, American elm, box elder, willow, river birch, basswood, and aspen. The most common sub-canopy or shrub layer has young canopy tree species in addition to choke cherry and nannyberry. Understory vegetation is variable in cover (5-100 percent) and species.
Upland Prairie	*Tallgrass prairies* are dominated by tall graminoids (75-100 percent) with sparse to patchy (5-50 percent) forb cover; shrub and tree layers absent. Wet: Typic species include prairie cordgrass, big bluestem, Indian grass, woolly sedge, and Canada goldenrod. Southern Mesic: Typic species include big bluestem, Indian grass, little bluestem, porcupine grass, stiff goldenrods, purple and white prairie clovers. *Short-grass prairies* are dominated mostly by short to mid-height graminoids and some tall-grass species (50-100 percent cover) and sparse to patchy forb cover (5-50 percent); shrub and tree layers absent. Southern Dry: Dominated by little bluestem; other common mid-height grasses include, side-oats grama, prairie dropseed, porcupine grass, and junegrass. Typical forbs include silky aster, purple coneflower, pasqueflower, and harebell.
Southern Dry Savanna	A relatively open community with scattered or clustered (10-70 percent canopy cover, but more typically 25-50 percent), with a basal area (BA) of 5-50 sq ft/acre, stunted (15-35 feet tall), open-grown bur oak and black oak trees, often interspersed with jack pine, and with grass-dominated herbaceous ground layer (Wovcha et al. 1995, Minnesota DNR 2005). The understory vegetation is sparse or patchy with both native grasses (25-100 percent) and forbs (5-50 percent) (MNDNR 2005). Northern pin oak is sometimes present as a secondary tree species in the overstory or in the shrub layer. The density of shrubs is less than 30 percent in high quality occurrences (Dunevitz 1993). As the dominant upland habitat at Crane Meadows NWR, a more detailed description of this habitat type has been developed and can be found in Appendix L.
Oak Woodland	Deciduous-dominated with an interrupted to continuous canopy (50-100 percent cover) consisting primarily of bur oak and northern pin oak. Northern red oak, white oak, red maple, basswood, American elm, and aspen are occasionally present and a minor conifer component with white pine or jack pine may be present as well. The understory and shrub layer is patchy to continuous (25-100 percent), depending on light penetration through canopy. The ground layer is a variable mix of forbs and graminoids including pointed-leaved tick trefoil, hog peanut, Pennsylvania sedge and a shrub layer of black cherry, red maple, and bur oak.

Table 17: Habitat: Current and Proposed, Crane Meadows NWR

Habitat Type	Habitat[a]	Service-owned Acres (1,800)		Total Acquisition Boundary Acres (13,540)	
		Current[b]	Approximate 15-Year Objective[c]	Current	Approximate Long-term Objective (100+ years)
Wetland	Open Water	18	18	150	150
Wetland	River/Stream	3 miles	3 miles	32 miles	32 miles
Wetland	Emergent Marsh	100	100	1,600	1,600
Wetland	Sedge Meadow	460	460	2,640	3,350
Wetland	Willow-Dogwood Shrub Swamp	410	410	2,500	2,500
Wetland	Southern Rich Conifer Swamp	0	0	0	100
Wetland	Northern Floodplain Forest	50	50	435	300
Upland	Prairie (Wet, Southern Mesic, and Southern Dry)	380	305	910	500
Upland	Southern Dry Savanna	5	210	185	4,700
Upland	Jack Pine Woodland	10	5	85	0
Upland	Oak Woodland	200	100	1,180	300
Upland	Oak-Aspen Woodland	65	33	670	0
Upland	Agriculture	10	0	2,940	0
Upland	Conifer Plantation	10	0	200	0

a. *Refuge vegetation was identified and quantified during a 2006 aerial imagery project conducted by the Service. Habitat classes were later standardized using plant communities described the Minnesota DNR's Field Guide to the Native Plant Communities; Eastern Broadleaf Forest Province (2005).*

b. *Current habitat acreages for both existing fee-title and acquisition boundary are approximate and based on GIS area calculations.*

c. *These numbers only account for land currently-owned by the Service, and will change with any new land acquisitions made by the Service over the 15-year planning period.*

Objective 1.1 Wetlands

Total Acquisition Boundary Acres: 7,329
Total Service-owned Acres: 1,041

Maintain existing wetland habitat, and restore disturbed, altered, or degraded wetland areas where feasible within 5 years of acquisition.

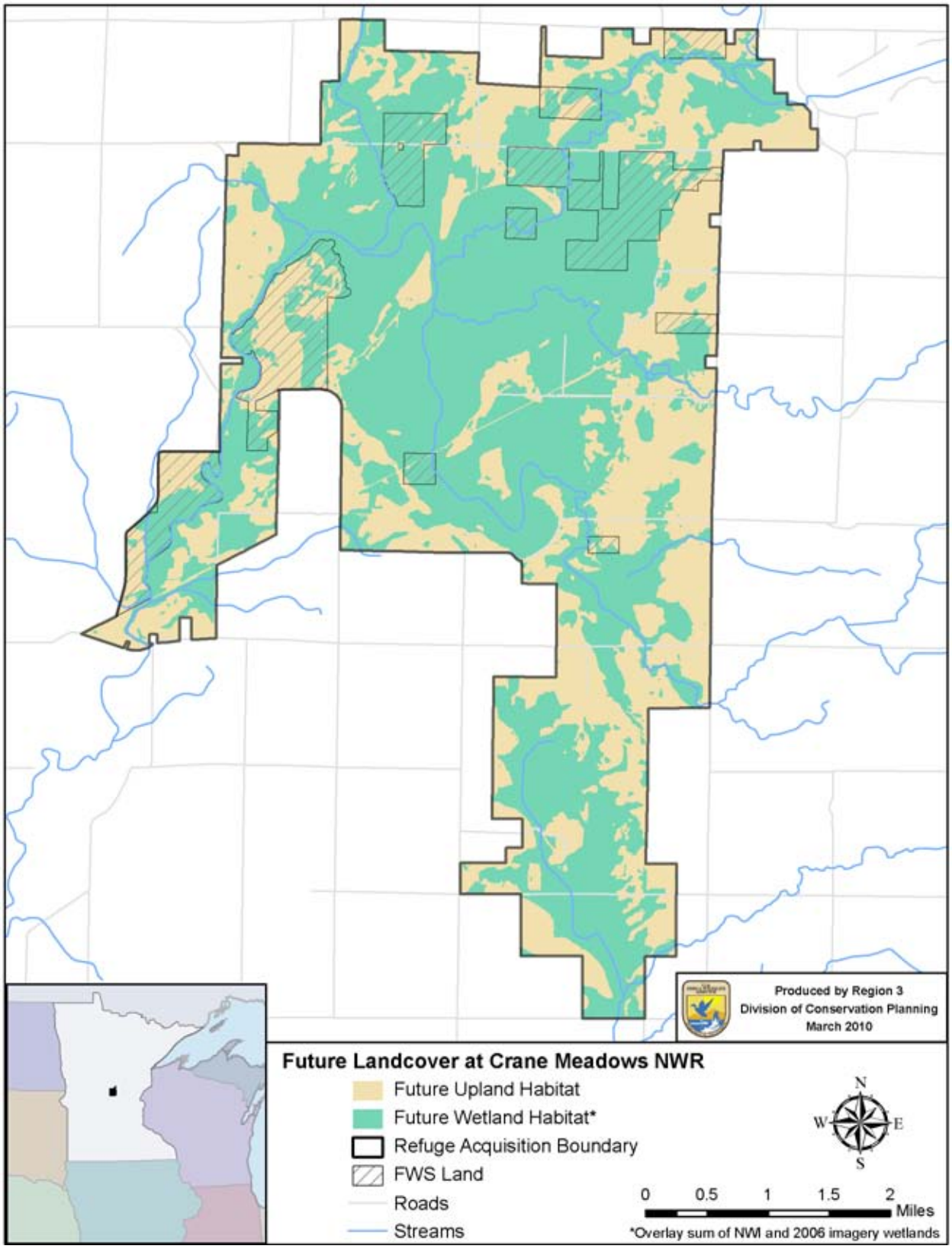
Over the long term (100-plus years) within the full Refuge acquisition boundary, maintain existing and restore drained or degraded wetland habitats in suitable areas to the desired benchmark conditions (see Table 16 on page 83) to achieve a minimum of 8,000 acres (approximately 60 percent of the Refuge) in a mosaic of wetland habitats with the approximate desired acreages targets displayed in Table 17. (See Figure 30)

Rationale: Protecting and maintaining the integrity of existing wetland habitat and restoring degraded habitats to benchmark conditions is important for numerous reasons. The following list cites some of the key reasons:

1. It is NWRS policy as mandated by the Refuge Improvement Act of 1997 to "ensure that the biological integrity, diversity, and environmental health of the System are maintained…" which provides guidance to restore and maintain "biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic (benchmark) conditions…" on refuge lands where appropriate.

2. The primary purpose of the Refuge is derived from the Emergency Wetland Resources Act of

Figure 30: Desired Future Land Cover, Crane Meadows NWR



1986, which mandates "... the conservation of the wetlands of the Nation…"

3. Approximately 9 million acres (72 percent) of Minnesota's natural wetlands have been lost since 1850 (FWS 1992).
4. There is an ongoing threat of development and expansion of agriculture in the area; nearly 1,800 acres of wetlands have already been drained or ditched within the acquisition boundary (Cowardin et al. 1979).
5. The wetland complex itself has been classified as 'regionally significant' by the Service because it is considered a "natural" ecosystem that remains healthy and relatively intact.
6. A mosaic of these habitat types on the landscape would support an abundant and diverse array of wildlife species.
7. Wetlands provide a multitude of ecosystem services that benefit both humans and wildlife - from controlling floods to improving water quality.

The short and long-term objectives described in this CCP strive to maximize acres of Refuge wetlands by protecting existing wetland habitat and restoring wetland areas that have been altered or degraded. Although a number of factors, including climate change, have the potential to affect fundamental ecosystem conditions and balances, historic records still form a benchmark by which to gauge the level of anthropogenic alteration and disturbance, and therefore lend direction and guidance regarding restoration potential.

In addition, it is important to acknowledge the natural range of variation within each habitat type, both spatially and temporally, depending on disturbance and local environmental factors. Selecting a range of targeted conditions and habitat acreages is a more accurate and less risky way to identify desired conditions than with exact numbers, however numerical ranges can obscure the precision of the existing data. Therefore, exact numbers are identified for this objective with the understanding that these are approximations based on the best available information. Furthermore, annual fluctuations in water levels make it nearly impossible to pinpoint exact desired acreages between wetland habitat types – particularly open water and emergent marsh. Nonetheless, an average of current and pre-existing conditions obtained from a variety of sources, including an analysis of aerial imagery, the National Wetlands Inventory, USDA NRCS soils data, and Marschner's pre-settlement vegetation estimates make it possible to establish target acreages – fully acknowledging the limitations of these data sources and resulting numbers.

Chapter 3 of the CCP describes in further detail the data used to acquire the numbers in this objective.

In summary, current imagery portrays over 7,300 acres of wetland habitat, the NWI shows just under 7,800 acres of wetlands, SSURGO identifies nearly 8,300 acres of suitable wetland soils in the acquisition boundary, and Marschner's generalized map of historic cover types contains over 6,600 acres of bottomlands when summarized using GIS software.

The large and relatively intact sedge meadow habitat found at Crane Meadows NWR is recognized for its high quality condition, and warrants protection and where appropriate restoration. Although sedge meadow habitat is relatively abundant in Northern Minnesota, there is an overall decrease in the quantity and quality of this once abundant habitat as you move southward in the state. There are few examples of large, high quality sedge meadows throughout the Anoka Sand Plain, and in central or southern Minnesota in general. Many sedge meadows in central and southern Minnesota have been degraded by invasive reed canary grass, herbicide use, woody encroachment resulting from reduced disturbance cycles, alteration of natural landscape hydrology, increased or contaminated run-off, and other anthropogenic factors. There are over 250 areas of sedge meadow identified in the Anoka Sand Plain by the Minnesota County Biological Survey (MCBS), but many are small and/or low quality and most are not actively managed. Unmanaged sedge meadows will eventually succeed to shrub or tree-dominated wetlands (like willow-dogwood shrub swamp) and/or will be invaded by exotic-invasive species. Therefore protecting, managing, and restoring sedge meadow habitat on the Refuge will enhance one of the only large, high quality sedge meadows that is actively managed and restored in this part of the state. Management will use sedge meadow benchmark conditions as a target for wetland habitat restoration where appropriate in order to mitigate the loss or degradation of this habitat type throughout the Anoka Sand Plain, and provide habitat for native species dependent on this declining habitat.

Southern rich conifer swamp is no longer present within the Refuge boundaries, but was extant at the time of European settlement according to GLO notes and Marschner's historic vegetation data. This habitat is also documented by the Minnesota DNR as occurring in surrounding areas in association with basins on moraines and outwash plains underlain by sandy substrates (Minnesota DNR 2005).

They are often present as small patches mixed with shrub or hardwood swamps - a reasonable form to consider re-establishing at Crane Meadows NWR. Because of its increasing rarity and the unique wildlife associated with this habitat type, including habitat-limited species of lady slipper, sundew, mosses, and sedges, there is value in restoring this habitat to the Refuge landscape.

The local benefits of various wetland habitats to bird species and other wildlife are well documented. During spring and fall migration open water, emergent marsh, and sedge meadow habitats on the Refuge are essential stopover habitats for approximately 10,000 waterfowl, a mix of both divers and dabblers, and over 100 other migratory bird species. There are notable concentrations of American Wigeon, Gadwall, Mallards and Blue-winged Teal in the fall and thousands of Canvasbacks and Mergansers in early spring. The emergent marsh and sedge meadow habitats on the Refuge support several breeding waterfowl species including Mallards, Blue-winged Teal, Green-winged Teal, Canada Geese, and Ring-necked Ducks. These wetland habitats also host one of the largest nesting populations of Greater Sandhill Cranes in central Minnesota (FWS 1992). Willow-dogwood shrub swamp provides cover for many resident wildlife species and breeding habitat for several Region 3 Resource Conservation Priority (RCP) species including American Woodcock, Willow Flycatcher, and Black-billed Cuckoo. Southern rich conifer swamp is a biologically rich and a unique wetland type that is dominated by tamarack and supports a variety of wildlife species including several RCP species such as Virginia Rail and Golden-winged Warblers. Animal species that occur in tamarack bogs are not exclusive to this habitat, but many breeding bird species reach their highest densities in conifer bogs (Sullivan 1994). Northern floodplain forest is a diverse riparian habitat that occurs along rivers and streams that provide seasonal variability correlated to natural water fluctuations. Ephemeral pools, usually devoid of fish, are temporarily available during spring thaw influx providing habitat and safe conditions for breeding and the development of natal amphibian and insect species. Other wildlife species that commonly use floodplain forest include mink, river otter, and RCP species such as American Woodcock, Bald Eagle, Red-shouldered Hawk, Loggerhead Shrike, Sedge Wren, and Black-billed Cuckoo.

Strategies:

1. Identify and restore drained wetland habitat.
2. Continue wetland health evaluation study to assess condition and productivity of emergent marshes. Document plant and wildlife species and develop an "index of biological integrity" (IBI) once every 5 years or as needed after a management activity that may affect emergent marsh habitat.
3. Within the life of the plan assess and determine the most suitable location(s) on the Refuge for southern rich conifer swamp restoration. Begin planting tamarack trees and other bog species on the site(s), and restore natural hydrology required for this habitat type over the long-term.
4. Use prescribed fire events that mimic historical burn cycles to help minimize woody encroachment.
5. Coordinate with Minnesota DNR regarding management of wetland habitats, the weir, and water levels in the wetland complex.
6. Educate landowners within acquisition boundary about their role in the health of the wetland complex.
7. Further define Refuge habitat management in a step-down plan within 5 years of CCP approval.

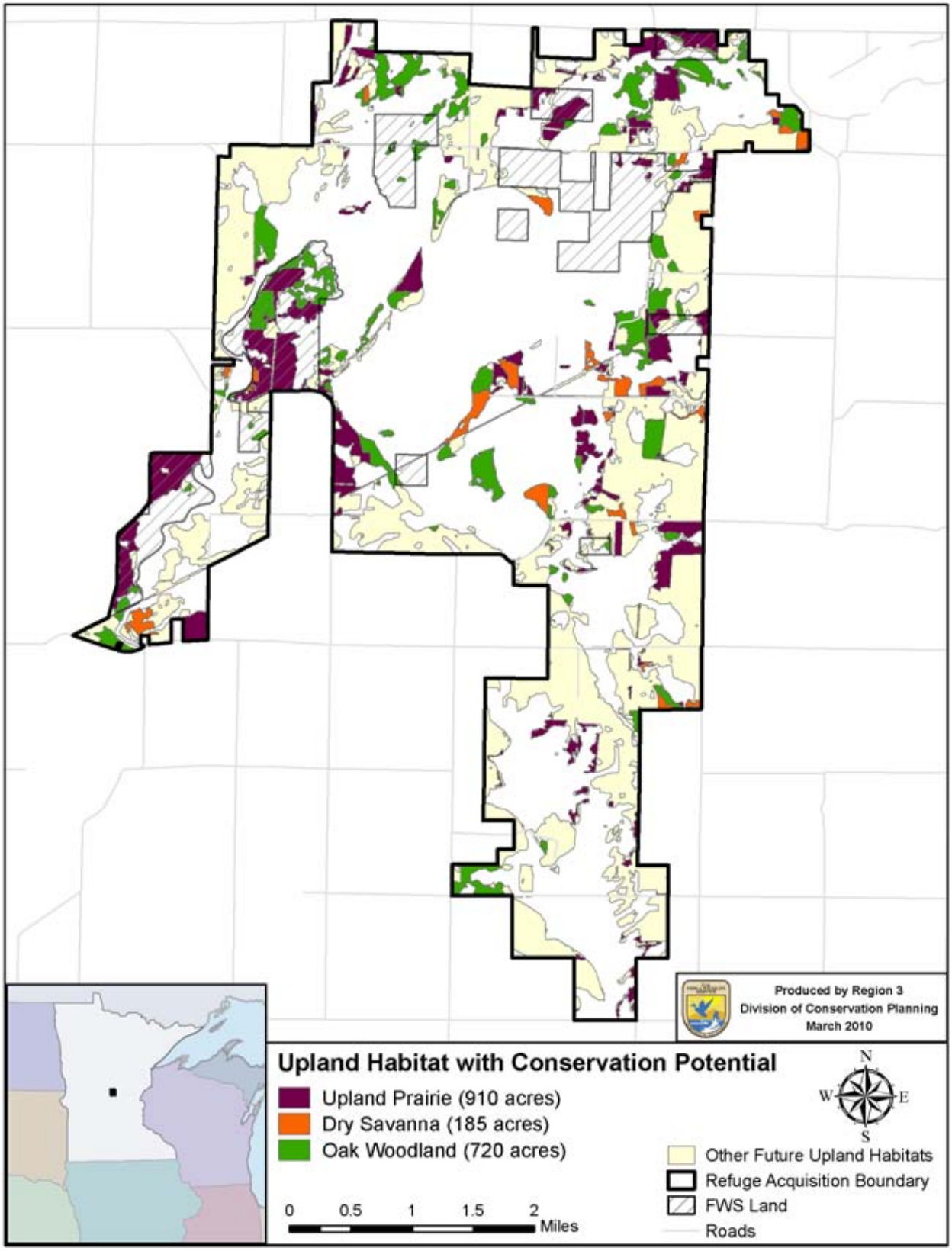
Objective 1.2 Upland Prairie

Total Acquisition Boundary Acres: 911
Total Service-owned Acres: 379

Over the life of the plan:

- Seed all newly acquired disturbed, altered, or degraded upland areas to prairie (as a transition step for southern dry savanna restoration) using local ecotype seed characteristic of savanna within 5 years of acquisition.
- Restore 20 percent (approximately 75 acres) of Service-owned upland prairie habitat to southern dry savanna.
- Within 3 years of plan approval identify the highest quality Service-owned upland prairie habitat to retain (see Figure 31 on page 88 for a map of existing upland prairies on the Refuge). Work in these areas to improve vegetation structure and composition to desired benchmark habitat conditions (see Table 16 on page 83) and develop quality prairie seed source areas.
- Over the long term (100-plus years) within the full Refuge acquisition boundary, maintain a minimum of 4 percent (approximately 500 acres) upland prairie habitat at desired benchmark habitat conditions (see Table 16 on page 83), transitioning the remaining 3

Figure 31: Existing Upland Habitat Source Areas, Crane Meadows NWR



percent (approximately 400 acres) to southern dry savanna. (see Figure 31 on page 88)

Rationale: As mandated by the Refuge Improvement Act of 1997, it is Service policy to "ensure that the biological integrity, diversity, and environmental health of the System are maintained…" Service policy provides guidance to restore habitat to historical benchmark conditions on Refuge lands where it's appropriate. Much of the Refuge uplands were once prairie or savanna, but were converted to agricultural fields over the last 100 years. Newly acquired Refuge lands containing farm fields should be converted to prairie with native, local ecotype seed as a step toward pre-settlement conditions and transitional step to oak savanna restoration. Historical records indicate that only approximately 500 acres of uplands were considered tallgrass prairie and that most of the upland landscape of the Refuge was predominately oak and jack pine savanna (Marschner 1930). In addition, information from the SSURGO database indicating potential vegetation based on soils does not account for any coverage of an uninterrupted open prairie, but instead accounts for wetland, forest, and savanna (USDA 2009). Retaining approximately 500 acres as upland prairie over the long-term has the benefit of not only providing stepping stone for savanna restoration but also providing a more diverse mosaic of habitat types extending from prairie to savanna to woodland, thereby allowing for the potential to enhance overall flora and fauna diversity.

Finally, despite a lack of large-scale historical coverage in this area, prairie is considered one of the most endangered ecosystems in the country. Less than 1 percent of the original prairie habitat in Minnesota is still in existence (DOI 2004). The majority of this loss can be attributed to conversion to agriculture. As a result, many of the grassland birds and other wildlife associated with this habitat are also declining. By restoring prairies, the Refuge would provide critical habitat for declining grassland birds and other wildlife and plant species associated with grasslands.

Strategies:

1. Identify and map the highest quality upland prairie habitat in the Refuge acquisition boundary to retain.
2. Research historical vegetation records to assist in refining benchmark conditions.
3. Prepare native grasses and forbs in the greenhouse for transfer to prairie restoration sites.
4. Expand vegetation monitoring to include periodic field-based species richness surveys and GIS-based land cover analysis.
5. Further define Refuge habitat management in a step-down plan within 5 years of CCP approval.

Objective 1.3 Southern Dry Savanna

Total Acquisition Bouncary Acres: 185
Total Service-owned Acres: 5

Over the life of the plan, begin restoring southern dry savanna habitat to desired benchmark conditions (see Table 16 on page 83) on 30 percent (approximately 210 acres) of the total Service-owned land. This acreage will come from suitable existing upland prairie (approximately 75 acres) and oak woodland (approximately 135 acres) habitats.

Over the long term (100-plus years) within the full Refuge acquisition boundary, establish and maintain a minimum of 35 percent (approximately 4,700 acres) southern dry savanna habitat (see Table 16 on page 83 for desired benchmark conditions). Existing savanna will be retained (~200 acres), and restoration will occur on existing upland prairies (~400 acres), oak woodlands (~1,550 acres), conifer forests and plantations (~300 acres), and agricultural areas (~2,250 acres). (Figure 31 on page 88)

Rationale: The distribution of oak savanna throughout the Midwest was widespread before European settlement. This habitat type once occupied as much as 50 percent of Midwestern landscape covering 11 to 13 million hectares (Nuzzo 1986). Most oak savanna habitat has been lost due to timber harvest, fire suppression, land conversion to agriculture, and development, with only about 0.02 percent of pre-European oak savannas of the Midwest remaining today in small fragments and scattered remnants. The Nature Conservancy has identified savanna as a globally imperiled habitat. The uplands of the Refuge were predominantly oak savanna according to all historical accounts, yet only a few small remnants remain within the acquisition boundary today totaling less than 200 acres. This landscape naturally lent itself to the establishment of savanna habitat in the past due to the nature of the sandy soils and historic disturbance regimes. While these conditions prohibited the establishment of mature woodlands, the abundance of water features supported limited growth of woody vegetation. Marschner's pre-settlement vegetation data depict almost 6,000 acres of savanna habitat within the Refuge acquisition boundary, and SSURGO nearly 2,000, clearly demonstrating the historic abundance of this habitat in the upland areas of the Refuge

(Marschner 1930, USDA 2009). Protecting any existing oak savanna habitat is of critical importance, and restoring 35 percent of the Refuge acreage back to oak savanna would be consistent with the Refuge Improvement Act (1997) and Service policy for restoring habitat to historical (benchmark) conditions where appropriate. This restoration would also provide critical habitat for many declining species associated with grasslands and savannas. Restoration efforts will focus on thinning existing oak woodlands while restoring the savanna understory layer, or oppositely transitioning agricultural lands through upland prairie to savanna. Upland habitats may prove to be the most challenging habitats to protect due to the value and use of this land for agriculture.

Strategies:

1. Determine and map the most suitable sites for restoration to southern dry savanna.
2. Research historic vegetation records to assist with refining benchmark conditions.
3. Plant appropriate areas of existing upland prairie with oak seedlings at a rate of 335 seedlings per acre, with an expected long-term (10 years) mortality rate of 70 percent (Ly et al. 2009, unpublished).
4. Support reestablishment of jack pine in selected areas.
5. Seed degraded savanna restoration units with local ecotype seed as needed.
6. Research additional methods of oak reintroduction to prairie habitat (i.e. tree spading)
7. Harvest timber on appropriate wooded sites to achieve the desired tree density of 10-70 percent (mainly 25-50 percent) canopy cover.
8. Manage regeneration sites to protect seedlings from tree disease, white-tailed deer browsing, and gopher damage.
9. Work to improve the prairie/savanna grass and forb species composition (description reference).
10. Use prescribed fire to suppress woody encroachment and maintain fire-dependent savanna species.
11. Work with private landowners within the Refuge acquisition boundary to protect and restore southern dry savanna habitat.
12. Further define Refuge habitat management in a step-down plan within 5 years of CCP approval.

Objective 1.4 Oak Woodland

Total Acquisition Boundary Acres: 1,854
Total Service-owned Acres: 268

Within 3 years of plan approval identify the highest quality Service-owned oak woodland habitat to retain (see Table 16 on page 83 for desired benchmark conditions and Figure 31 on page 88 for a map of existing oak woodlands). Begin thinning 50 percent of those stands outside the highest quality oak woodlands selected to be retained to the desired basal area (ranging from 5 to 50 square feet/acre) and species composition for southern dry savanna habitat.

Over the long term (100-plus years) within the full Refuge acquisition boundary, reduce coverage of oak woodland to 2 percent (approximately 300 acres), transitioning approximately 1,550 acres to southern dry savanna. (see Figure 31 on page 88)

Rationale: At Crane Meadows NWR, the geographic extent of oak woodland habitat during pre-settlement was minimal or completely absent according to both Marschner's pre-settlement data and SSURGO's potential vegetation data (Marschner 1930, USDA 2009). The increasing proliferation of oak and other woodlands on the Refuge over the past century is a direct result of fire suppression and a lack of other natural disturbance mechanisms responsible for maintaining savanna conditions in the landscape.

Because this habitat exists today, but was not present to any great extent according to historic documentation and research, it can be argued that this cover type is most appropriately managed or maintained in only limited quantities. Nonetheless, oak woodland is important to maintain as a seral stage along a common ecological continuum that includes both upland prairie and oak savanna. These habitat types are dynamic plant communities that have always varied through space and time depending on disturbance frequency and magnitude, and natural climate variability.

Maintaining a full spectrum of upland habitat also promotes resiliency in the ecosystem as the effects of climate change become more pronounced. Drier future conditions would favor less woody growth, and wetter conditions would favor expansion of woodland cover types. Retaining oak woodland communities provide a number of additional benefits such as providing source populations and/or refugia for oak savanna plant and animal species depending on their resource requirements (i.e. cover, shade, forage, etc.); providing a niche to species of animals and plants that do not occur in open prairies or savannas; and even benefits associated with carbon

sequestration and nutrient retention. Much of the existing forest habitat would serve as a transition stage for oak savanna restoration and will ultimately be restored to more open historic conditions.

Strategies:

1. Identify and map the highest quality stands of oak woodland to retain.
2. Use prescribed burning as a tool to mimic historical mild surface fires every 20-30 years.
3. Expand vegetation monitoring to include periodic field-based species richness surveys and GIS-based land cover analysis.
4. Further define Refuge habitat management in a step-down plan within 5 years of CCP approval.

Objective 1.5 Water Resource Monitoring, Management, and Watershed Conservation

Within 5 years of plan approval, begin regular monitoring of the five major streams passing through the Refuge acquisition boundary. Work with partners to improve water quality with the long-term goal of removing all Refuge waters from state impaired waters lists.

Rationale: Water is a driving component of any ecosystem, and its importance is further accentuated in a wetland system like that found at Crane Meadows NWR. The Refuge Improvement Act (1997) requires the maintenance of "environmental health," and by definition, environmental health includes abiotic factors such as water. Furthermore, protecting the health of the wetland system is the primary establishing purpose of the Refuge, making water an important consideration in Refuge management and the allocation of Service resources. Water is not strictly an 'on-Refuge' issue. The health of the aquatic ecosystem starts at the drainage divides of the watershed and can be affected along its course by many variable before entering the Refuge. Maintaining water quality and quantity on the Refuge can only be effectively addressed by working with land owners and partner agencies in the larger geographic area affecting the Refuge's water resources.

Many wetland-dependent species, both plants and animals, are sensitive to water quality, sediment, and contaminants. The need to address water resources as part of management at Crane Meadows NWR is further exacerbated by issues related to ensuring continued water availability for both wildlife and humans, maintaining overall water quality in the system, and a general lack of data necessary to fully understand the hydrology of the upland-wetland sand plain complex. It is important to be an active participant in efforts to monitor and manage water resources affecting the Refuge. Fostering additional partnerships and collaborative management approaches will benefit all stakeholders affected by the watershed. Because the streams and lakes on the Refuge are public waters, working with state partners will be essential. More specifically, management will work with the Minnesota DNR which has managerial jurisdiction to waters on the Refuge, and the Minnesota Pollution Control Agency (MPCA), which is responsible for meeting state water quality standards. According to the MPCA's Electronic Data Access database only four of the five streams that flow onto the Refuge are monitored, and three of those four are on the state's impaired waters lists (MPCA 2009b).

In addition to upstream considerations, the Platte-Spunk Watershed (Minnesota HUC 7010201) in which Crane Meadows NWR is located (see Figure 21 on page 49) also straddles the Mississippi River. Much of the land area north and west of the Refuge drains through Crane Meadows NWR's wetland complex before reaching the Mississippi River, giving the Refuge an important role in the health of the larger Mississippi River ecosystem.

Strategies:

1. Work with the Minnesota DNR, MPCA, local groups and other partners to conduct routine monitoring of rivers and streams entering and exiting the Refuge.
2. Quantify existing sediment and contaminant loads in Refuge streams as they enter the Refuge and work to establish acceptable threshold values.
3. Over the life of the plan, work to reduce the amount of sediment and contaminants from the baseline quantities encountered in the initial years of monitoring.
4. Increase the local understanding of water quality and watershed issues through public outreach and education.
5. Partner with the Minnesota DNR, MPCA, SWCD, NRCS, FSA, Ducks Unlimited, TPL, The Nature Conservancy, other partners, and private landowners to implement land conservation projects in and adjacent to areas with key aquatic resources (i.e. streams, lakes, and wetlands) upstream of the Refuge.

Objective 1.6 Prescribed Fire

Implement and monitor a rotational prescribed burn program over the life of the plan that supports the fire dependent vegetation communities on the Refuge and reduces hazardous fuel

Table 18: Burn Cycles for Crane Meadows NWR Habitat Types

Habitat Type	Historic Burn Cycle
Wetlands	2-4 years
Upland Prairie	<3 years
Southern Dry Savanna	3-6 years
Oak Woodland	20-30 years

loads according to historic guidelines (see Table 18).

Rationale: Nearly all of the Refuge habitats are fire-dependent communities, and the frequency and magnitude of burns have a profound impact on their successional state and the transition from one habitat type to another. After Euro-American settlement wildfires were suppressed, disrupting the natural disturbance cycle, and resulting in habitat succession into seral stages or into different habitat types altogether. Prescribed burning is an effective tool in restoring these fire-dependent plant communities to historic, benchmark conditions, suppressing woody encroachment, and maintaining desired habitat conditions. The Refuge Improvement Act (1997) states that the Service must ensure that "biological diversity", "biological integrity", and "environmental health" is maintained and, by definition, these include, "…the natural biological processes that shape genomes, organisms, and communities…" such as fire.

Strategies:

1. Complete an adaptive fire management step-down plan within 1 year of CCP approval to better implement, evaluate, and improve the burn program on the Refuge.
2. Continue upland vegetation monitoring activities as part of the Fire Monitoring Program.
3. Adapt timing, seasonality, and frequency of burns in response to monitoring.
4. Partner with state and private landowners to burn larger tracts within and immediately adjacent to the Refuge acquisition boundary.

Objective 1.7 Land Acquisition

Within 3 years of plan approval, update the land acquisition priority map created for the environmental assessment that established the Refuge (see Figure 32 on page 93); over the life of the plan, increase efforts to make land acquisitions from willing landowners in high priority areas.

Rationale: Land acquisition is a key component in permanently protecting wildlife habitat. The National Wildlife Refuge System identifies land protection priorities, then designates formal boundaries within which acquisitions can be made at fair market value from willing landowners. As a part of the Refuge System mission statement, extending permanent protection to important natural resources of the nation such as the Rice-Skunk wetland complex, the Refuge System is sustaining wildlife and habitats, "for the benefit of present and future generations of Americans." Protection emphasis at Crane Meadows NWR is focused on the large intact sedge meadow wetland complex, but extends to protect adjacent upland habitats required by wildlife during various life cycle stages. Protection also extends to other important aquatic resources, wildlife, and habitat such as those associated with the Platte River below the lakes and Little Rock Creek in the southern spur of the Refuge.

Land acquisition has become more difficult and more costly over time, and while land remains unprotected additional damage may be done to the area's natural resources. For example, in recent years large scale animal husbandry structures with unforeseen effects on adjacent wildlife and habitat have been erected directly within the acquisition boundary. According to Service land status records, there are currently 54 national wildlife refuges in the Midwest Region. Of the 48 refuges with boundaries that are proposed for complete acquisition, Crane Meadows NWR owns the smallest percent of its proposed acquisition boundary at only 13 percent. In order to adequately protect the proposed boundary of the Refuge, additional steps and alternative methods will be required to prioritize acquisitions and acquire targeted lands. By first reassessing the highest priority areas, then directing limited acquisition resources to those lands, the Refuge can have the greatest conservation impact.

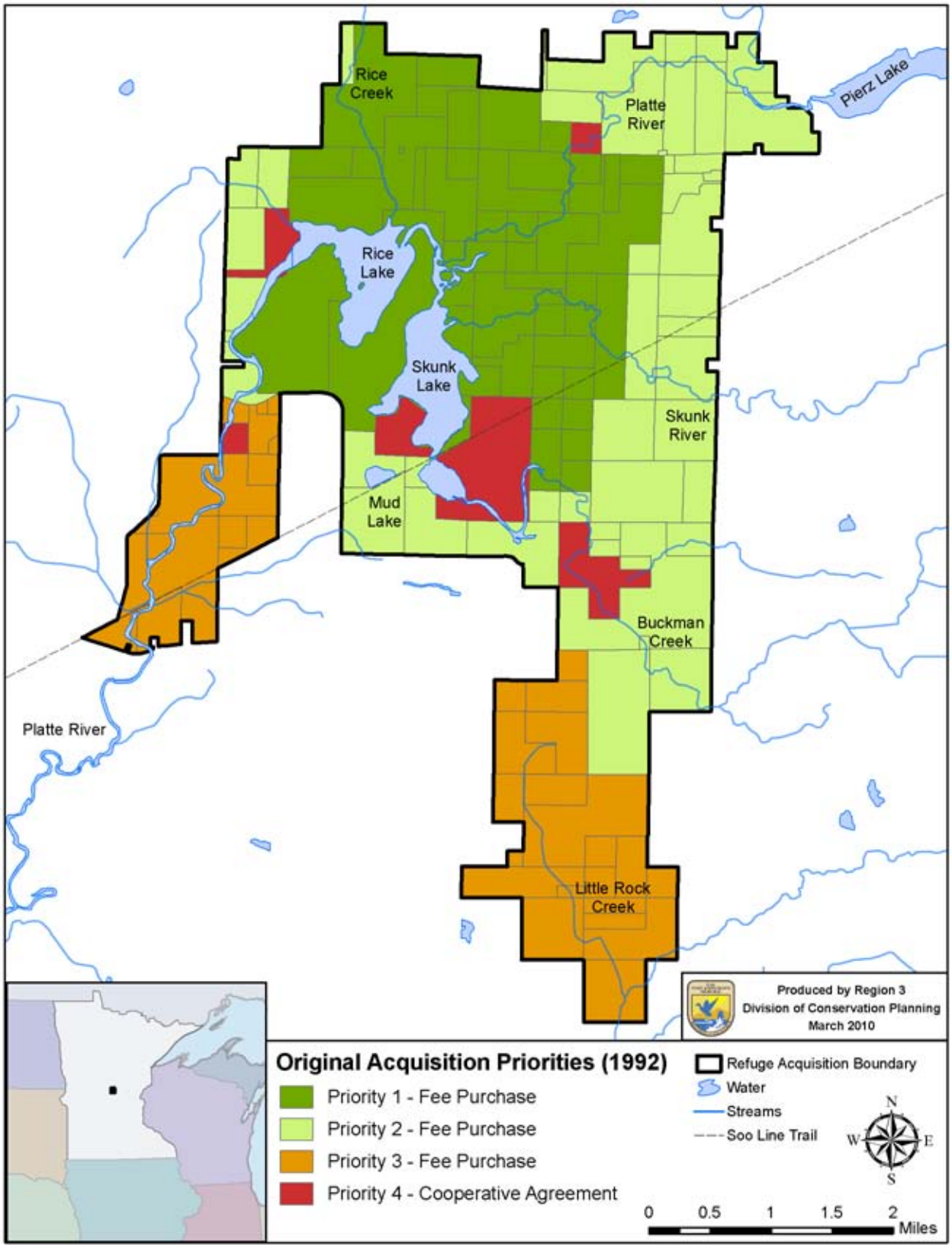
Strategies:

1. Actively work with partners to secure lands via grant opportunities, donations, bequeaths, and purchases.
2. Provide accurate and up-to-date land acquisition information to landowners within the Refuge acquisition boundary.
3. Where land acquisition is not practical within the Refuge acquisition boundary, work to obtain conservation easements.

Objective 1.8 Partners Program and FSA Easements

Over the life of the plan, conduct a minimum of 100 habitat improvement projects through the Partners program within Morrison County,

Figure 32: Original Acquisition Priorities (1992), Crane Meadows NWR



specifically targeting areas within, and upwatershed of the Refuge acquisition boundary. Ensure compliance of all properties with FSA easements (annual monitoring) and Partners program volunteer agreements (5-year monitoring cycle).

Rationale: Management emphasis is first and foremost on the lands owned by the Service. However, targeting land protection within the acquisition boundary of the Refuge is only one step in caring for our natural resources. The need is only increasing for all entities with conservation interests – federal, state, county, NGO, and private – to look outside traditional boundaries at the larger picture and work together to conserve and better manage wildlife habitat.

The Partners for Fish and Wildlife Program is set up to work with the other agencies, organizations, and the public to restore degraded habitats across the landscape. For Crane Meadows NWR, focusing on land use and activities in the watershed above the Refuge can have the greatest impact on the Refuge.

The health of the watershed above the Refuge has direct implications and impacts on the quality of Refuge habitats and wildlife. By working to protect and enhance lands and waters in the watershed upstream of the Refuge, it is possible to improve habitat quality and other variables that flow through the wetland complex. The complexity of environmental concerns and threats has forced land managers to address issues at a regional scale, obviating the value-added nature of work done on private lands in the larger landscape.

Strategies:

1. Work with interested landowners to assess and improve habitat for fish and wildlife conservation.
2. Distribute information regarding the Private Lands program to landowners in the Refuge acquisition boundary, watershed, and at all Refuge events.
3. Provide assistance to other agencies doing habitat improvement and wildlife conservation on private lands in the vicinity of the Refuge.
4. Collaborate with the Service's Office of Law Enforcement to develop an annual, systematic, and safe compliance evaluation and enforcement program for the 21 FSA easements. Methods of review include direct contact with landowners, on-site inspections, and aerial imagery surveillance.

Goal 2: Wildlife

Protect, restore, and maintain native wildlife species to ensure biological diversity and abundance, with special emphasis on Service Regional Conservation Priority Species.

Objective 2.1 Federal and State Threatened and Endangered Species and/or Regional Species of Conservation Priority

Participate in larger state and federal wildlife population monitoring efforts for species of conservation concern. Within 5 years of plan approval, develop and implement monitoring programs for the Bald Eagle and Blanding's turtle.

Rationale: As Trust Resources of the FWS and a goal of the NWRS, it is a priority for the Refuge to monitor and protect rare, threatened, and endangered species. It is also required by The Endangered Species Act (1973), "that all Federal departments and agencies shall seek to conserve endangered and threatened species…". All living things are part of a complex, often delicately balanced network within an ecosystem comprised of plants, animals, and their physical environments. No one knows how the extinction of organisms will affect the other members of its ecosystem, but the removal of a single species can set off a chain reaction affecting many others (FWS 2005). Therefore, it is important as an agency and a Refuge within the NWRS to attend to these rare species. Currently there are no federally-listed endangered species inhabiting Crane Meadows NWR, but the Refuge supports several state-listed threatened species and many regional Resources of conservation Priority (RCP) species as well. Bald Eagles were once listed as a federally threatened species. They were delisted on August 9, 2007, and moved to a protected status, and remain an RCP species in Region 3. Bald Eagles are commonly observed in the area during spring and fall migration and the Refuge currently supports three nesting pairs. Because of its recent delisting and a priority status in Region 3, Bald Eagles should be monitored and considered during management activities. Blanding's turtles have been observed on the Refuge and are currently threatened in the state of Minnesota. This species is highly dependent on the wetland complex during most of the year and savannas and prairies during the breeding season. Monitoring Blanding's turtles is important because of the species' rare status throughout their original range, and because they are valuable biological indicators of environmental health due to an inherent sensitivity to changes in the quality of their surroundings (Congdon and Keinath 2006). Over time, and as additional research is done, species may be added or removed from state and federal lists. Thus, it is necessary for the

Refuge to maintain an adaptive management approach regarding individual species protection and monitoring.

Strategies:

1. Monitor Bald Eagle nesting activities and actively protect species during prescribed burns.
2. Opportunistic mark-recapture study of Blanding's turtles.
3. Conduct surveys of rare/declining species to determine presence/absence within Refuge boundaries.
4. Design and implement a monitoring program to track abundance, population trends, and habitat associations of selected Trust species.
5. Increase collaborative research and monitoring with Central Lakes College, St. Cloud State University, and other academic institutions.
6. Further define Refuge wildlife inventory and monitoring in a step-down plan within 5 years of CCP approval.

Objective 2.2 Migratory Birds

Participate in larger state and federal wildlife population monitoring efforts (see Table 19).

Over the life of the plan, conduct periodic monitoring of marsh birds, songbirds, and other migratory bird species.

Rationale: Migratory birds are Trust Resource for the Fish and Wildlife Service and are protected by the Migratory Bird Treaty Act. It is also a goal of the Refuge System to perpetuate migratory bird populations. The Refuge attracts over 100 birds during migration with notable concentrations of waterfowl. However, reliable surveys and monitoring of migratory birds have been limited since Refuge establishment, and thus the Refuge would benefit from baseline inventories and trend analyses of migratory song birds to help inform management and partners. Cooperative efforts are essential because migratory species are dependent on multiple locations and large geographic extents, and are affected by habitat changes in their breeding range, wintering range, and migratory flyways.

Strategies:

1. Maintain existing and establish new partnerships with government agencies, non-government organizations, and private interests for bird monitoring and education efforts.

Table 19: Wildlife Monitoring at Crane Meadows NWR

Monitoring Effort	Periodicity
Crane Unison Call Surveys	Annually
Midwest Crane Counts	Annually
Waterfowl Surveys	Weekly/ Biweekly
Bald Eagle Surveys	Weekly
Mourning Dove Surveys	Annually
Woodcock Surveys	Annually
Nest Boxes (Bluebird, Wood Duck, and Purple Martin)	Annually

2. Document and share all monitoring results, particularly following any management changes.
3. Further define Refuge wildlife inventory and monitoring in a step-down plan within 5 years of CCP approval.

Objective 2.3 Native Plant Species

Within 5 years of plan approval, collaborate with the Minnesota DNR and other partners to conduct baseline inventories of plant species on the Refuge.

Rationale: The Refuge Improvement Act of 1997 states that the Service shall "ensure that the biological integrity, diversity, and environmental health of the System are maintained…" Biological integrity is defined as "biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions…" Thus, it is important to complete a more thorough inventory of the plant species currently inhabiting the Refuge, investigate which native species were on the Refuge historically, and take the necessary steps to restore the biological communities where possible and appropriate. Crane Meadows NWR is acknowledged by many sources as a relatively intact wetland system, despite a century and a half of land conversion in the surrounding landscape. More thorough examination of the vegetation in the area may yield additional insights to the local ecology and natural history.

Strategies:

1. Work with the DNR to establish new relevé plots on the Refuge.
2. Review historic vegetation records to determine if the current plant community is missing species present in the historic landscape.

Determine the need for translocation or seeding actions to replace missing species.

3. Work with partners to generate and harvest a supply of local ecotype seed. Increase seed production efforts on Refuge seed plots and in the greenhouse.

Objective 2.4 Invasive and Exotic Plant Species

Within 5 years of plan approval, conduct a comprehensive survey to assess the extent of invasive plant species on Service-owned Refuge lands. Within 10 years no more than 10 percent of acquired Refuge lands will be affected by invasive plant species.

Rationale: Invasive species can be native or exotic, and are typically early successional pioneer species that quickly establish themselves in ecologically disturbed communities.

Potential concerns at the time of writing include the following species:

Wetland

- Purple loosestrife
- Cattail
- Phragmites
- Eurasian water milfoil

Upland

- Buckthorn
- Siberian elm
- Box elder
- Black locust
- Spotted knapweed
- Common tansy
- Leafy spurge
- Japanese knotweed
- Aspen
- Hairy vetch
- Crown vetch
- Canada thistle

Exotic species occur in areas outside their native range, are often introduced by human activities, and are sometimes invasive in nature.

Invasives, particularly invasive exotics, are difficult to control because of their (typically) prolific reproductive capabilities, faster growth rates, efficient modes of dispersal, heightened environmental tolerance, and lack of natural predators and diseases which control populations in their native environments. If uncontrolled, they can displace native flora and interfere with a community's natural ecological processes, thereby reducing its biological potential and benefit to native wildlife.

Fortunately, to date many of the species listed above are not established on the Refuge, but are regional issues and pose potential future threats to native plant communities on the Refuge. It is necessary for Refuge staff to be engaged in proactive monitoring and management efforts to help prevent these invasive species from establishment. It is also important to monitor and control certain native species such as aspen that have an aggressive nature, and can become invasive to areas where they were historically absent as ecosystem processes and balances are interrupted.

Strategies:

1. Actively communicate with state and federal natural resource agencies and other partners regarding new and existing exotic/invasive threats and effective management techniques.
2. Coordinate Refuge inventories, monitoring, management, reduction, and prevention activities of invasive species with the Minnesota DNR and other landowners inside the acquisition boundary.
3. Maintain up-to-date records of invasive control efforts and results.
4. Control invasive species through appropriate mechanical, chemical, and biological treatments, including herbicides, biological control agents, mowing, flooding, prescribed burns, cutting, hand pulling, and others.
5. Educate the public about invasive species and how they can help.
6. Further define Refuge habitat management in a step-down plan within 5 years of CCP approval.

Objective 2.5 Wild Rice

Keep informed of the wild rice trends in the wetland complex and assist with monitoring and documenting wild rice trends through routine Service aerial imagery vegetation surveys.

Rationale: For many wildlife species, wild rice is an essential food resource and it is especially important forage for migrating waterfowl. A large wild rice crop can attract and sustain waterfowl in the area as they rest during migration, which may also benefit local hunters during waterfowl hunting season. The abundance of wild rice can also lend insight to local hydrology dynamics due to its specific water requirements for establishment and growth. Wild

Table 20: Future Visitor Services Facilities

Unit	Additional Facilities	Timeframe
Headquarters	Kiosk (near office), outdoor classroom	5 years
Highway 27	Directional signage, kiosk, parking area	10 years
Soo Line East[a]	Kiosk	15 years
Platte River West[a]	Kiosk	15 years
Sedge Meadow	Kiosk, observation platform, trail/boardwalk, parking area, restroom	15 years

a. The facilities at these locations will require partnerships with Morrison County Trail Association, Minnesota DNR, and private landowners.

rice has been an important part of the Rice-Skunk wetland complex for as long as written records have been kept in the area, including General Land Office descriptions from 1852 (U.S. OSG 1852).

The Minnesota DNR has monitored wild rice in the complex since the 1970s, and increased efforts to understand the dynamics of this species in recent years to include aerial surveys. The wetland complex is a very dynamic system, and wild rice monitoring will need to be conducted over the long term to gain a better understanding of its dynamics and the effects of management.

Strategies:

1. Review monitoring activities conducted by the Minnesota DNR and others.
2. Share Refuge vegetation imagery with state partners monitoring wild rice trends.
3. Work cooperatively with local universities, colleges, and other agencies to promote wild rice research within the wetland complex.

Goal 3: People

As an active partner in collaborative conservation, the Refuge will provide quality wildlife-dependent recreation, environmental education, and outreach to a diverse audience. These activities will preserve cultural resources and promote understanding, appreciation, and support for Crane Meadows National Wildlife Refuge, the National Wildlife Refuge System, and natural resource conservation.

Objective 3.1 Welcoming and Orienting Visitors

Bring all Refuge literature, web resources, kiosks, and directional signage into compliance with Service standards within 10 years of plan approval, and expand welcoming and orienting at the locations described in Table 20 (illustrated in Figure 33 on page 98).

Rationale: Welcoming and orienting Refuge visitors contributes to the criteria that defines a quality wildlife-dependent recreation program as identified in the National Wildlife Refuge System Improvement Act of 1997 and defined in Service Manual (605 FW 1). The number of visitors and amount of visitor services has increased steadily since the Refuge was established in 1992.

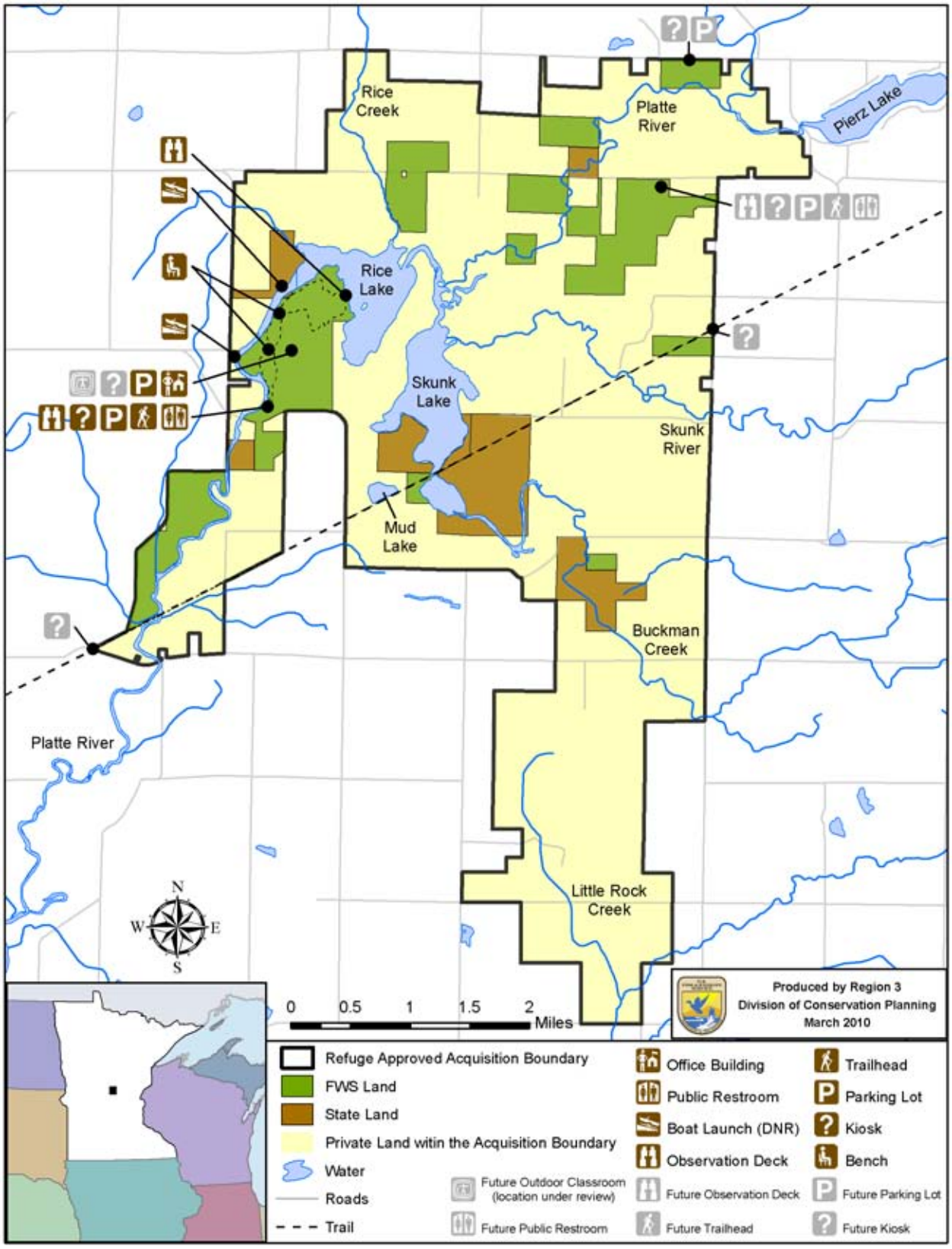
With approximately 87 percent of the land within the Refuge boundary not yet acquired, and Refuge lands intermingled with other types of ownership, clear signage and adequate visitor information is essential. The ease with which the public can navigate to visitor use areas on the Refuge, understand guidelines for appropriate conduct and safety, have basic needs met (i.e. parking, restrooms, maps, etc.), and fully engage in wildlife-related activities directly translates to a quality recreational experience, a positive impression of the Service, and an identification with the mission and goals of the Agency.

Proper signage and other welcoming and orienting materials can also reduce the need for direct interaction with Refuge staff, particularly on the headquarters unit which has the greatest concentration of visitor use. Direct contact can be difficult to offer at all times with current staffing levels, but a strategy has been included to increase staffing to greatly enhance the Refuge's ability to better accommodate visitor needs.

The two main transportation corridors in the area are Highway 10 west of the Refuge (which currently has directional signage) and Highway 27 on the northern border. Adding directional signage to Highway 27 will increase awareness of the Refuge, and has the potential to increase visitation. The county maintains the Soo Line Recreational Trail that bisects the Refuge. This trail is an additional underutilized opportunity to inform the public about the Refuge, the values of the Service, and interpretation of local natural history.

Finally, the Sedge Meadow Unit is one of the largest contiguous tracts of land owned by the Refuge within the acquisition boundary, contains ade-

Figure 33: Future Visitor Services Facilities, Crane Meadows NWR



quate access and existing structures that could be modified for visitor use, and provides a wide-sweeping view of a large, natural sedge meadow landscape, making it an ideal location to offer additional wildlife-dependent recreation opportunities.

Strategies:

1. Within 2 years of CCP approval complete a visitor services step-down plan to further evaluate and define additional Refuge facilities and programs.
2. Within 10 years, establish way-finding signage on Highway 27 and on intermediate roads between Highway 27 and the Headquarters.
3. Provide adequate signage to direct and instruct visitor recreation according to established rules and safety standards.
4. Inspect Refuge signs annually, updating and rehabilitating where necessary.
5. Develop and install an accurate system for tracking visitation to the headquarters site.
6. Within 5 years, design and produce a full color general Refuge information brochure according to Service standards.
7. Annually review and update visitor services section of Refuge website.
8. Within 2 years, add an annual accomplishments summary to the Refuge website.
9. Renovate the headquarters office building to include an area for welcoming guests, additional offices, and a meeting area.
10. Provide visitors access to staff during normal hours of operation, by hiring an administrative technician/visitor services specialist.
11. Expand the west side of the maintenance shop to include an oil room, restroom, and office space.
12. Provide clean, maintained, and accessible visitor facilities.
13. Routinely inspect and maintain existing maintenance facilities, visitor service structures, and transportation infrastructure on the Headquarters Unit (office, maintenance shop, greenhouse, three storage barns, two observation decks, kiosk, spotting scope, one-half-mile of road, two parking lots, 3.7-miles of trail), and the Sedge Meadow Unit (residence, garage, and storage building.)

Objective 3.2 Hunting

Within 5 years of plan approval, work with partners to open managed white-tailed deer and turkey hunts on specified Refuge units for hunters with disabilities and for youth hunters.

Rationale: Hunting is one of the six priority wildlife-dependent recreational uses identified in the National Wildlife Refuge System Improvement Act of 1997. Service policy directs us to provide hunting opportunities when compatible with Refuge management, and offering this use was a long-term goal of the Refuge when it was established in 1992. Managed hunting programs help promote an understanding and appreciation of natural resources and their management. Additionally, managed hunts on the Refuge provide a traditional recreational activity with no definable adverse impacts to the biological integrity or habitat sustainability of Refuge resources.

The limited size and distribution of current Service land ownership at the Refuge continues to limit our ability to offer quality hunting experience opportunities, but management has long understood the demand for, and importance of providing this activity on the Refuge. By beginning with short-duration, assisted, managed hunts, Refuge staff can provide hunting opportunities in a controlled fashion, direct these activities to specific audiences, and adaptively evaluate the hunting program for expansion or reduction based on demand and program success.

Strategies:

1. Prepare and submit all materials required to open hunting as a use on the Refuge.
2. Partner with Minnesota DNR, Wheelin' Sportsmen, National Wild Turkey Foundation, Capable Partners, Minnesota Deer Hunters Association, Pheasants Forever, Camp Ripley, Minnesota State Archery Association, local sportsmen's clubs, and others to conduct managed hunts.
3. Prepare the Headquarters, Sedge Meadow, and Platte River West Units for managed hunts.
4. Provide adequate boundary signage on all hunting areas.
5. As additional land is acquired, re-evaluate the areas that are available and safe for hunting with the ultimate goal of opening additional areas of the Refuge to hunting.
6. Increase law enforcement as the hunting program expands.

7. Manage hunts to minimize conflicts with other uses and resources.
8. Assist with hunter education.
9. Survey participants in specialized hunts.
10. Adhere to state regulations for hunting activities.
11. Further define Refuge management of the hunting program as a part of the visitor services step-down plan and complete it within 2 years of CCP approval.

Objective 3.3 Fishing

Within 3 years, evaluate the potential to establish seasonal bank fishing opportunities on the Platte River West Unit; over the life of the plan evaluate the potential for new bank fishing opportunities as additional properties are acquired.

Rationale: Fishing is one of the six priority wildlife-dependent recreational uses identified in the National Wildlife Refuge System Improvement Act of 1997. Fishing would provide a traditional recreational activity on the Refuge, if no definable adverse impacts to the biological integrity or habitat sustainability of Refuge resources are found and it is determined that a quality fishing experience is possible and sustainable. Fishing programs help promote understanding and appreciation of natural resources and their management on lands and waters in the Refuge System. Fishing is also a way to engage visitors in activities related to water resources and water-associated habitats, which relates to the primary purpose of the Refuge under the Emergency Wetlands Resources Act of 1986, "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide…".

Because of the great abundance of other quality fishing opportunities in the area, the additional management responsibilities associated with offering this activity, and a limited understanding of the fisheries adjacent to Refuge properties, Refuge staff feel it is important to further investigate the demand for this activity and the ability of the Refuge to meet the demand before opening the Refuge to fishing. It is a goal of the Refuge System to provide the most appropriate and compatible, highest quality, and most sustainable wildlife-dependent recreation opportunities for the public.

Strategies:

1. Conduct site evaluations for quality fishing opportunities.

Crane Meadows NWR by water. Photo Credit: FWS

2. Review potential fishing sites and evaluate the potential for disturbance to eagle nests.
3. Evaluate potential for bank erosion and vegetation disturbance when considering new fishing access sites.
4. Provide appropriate directional and informational signage when establishing any fishing access sites.

Objective 3.4 Wildlife Observation and Photography

Over the life of the plan, maintain existing wildlife observation and photography infrastructure and opportunities, and expand and promote opportunities along the Soo Line Trail corridor and on the Sedge Meadow Unit to correspond to a 20 percent increase in Refuge visitation from 2009 levels (see welcoming and orienting objective 3.1 for additional information).

Rationale: Wildlife observation and photography are priority wildlife-dependent recreation activities listed in the National Wildlife Refuge System Improvement Act of 1997. They are important and valuable activities that promote understanding and appreciation of natural resources and their management.

If properly managed, these uses provide invaluable opportunities for interaction between people and the natural environment with little or no detrimental effects to wildlife or habitat. By developing trails, boardwalks, observation decks, and other infrastructure it is possible to enhance mobility and access to locations that offer premium wildlife viewing opportunities. The various modes of travel permitted on the Refuge also help facilitate year-round access to these opportunities. The objectives and strategies proposed in this CCP were conceived and further developed during a visitor services planning

session held by Refuge staff, members of the Refuge Friends group, and other natural resource professionals in March 2009 in preparation for the writing of the CCP.

Strategies:

1. As the Refuge grows in size and visitor use increases, develop a public use site on the Sedge Meadow Unit (see welcoming and orienting objective 3.1 for additional information).
2. Consider accessible wildlife observation and photography facilities at selected sites as new lands are acquired for the Refuge, and as visitation and demand increase; facilities may include blinds, observation platforms, trails, and other provisions.
3. Continue to offer wildlife observation and photography opportunities for portable blinds by special use permit.
4. Work with partners to establish Crane Meadows NWR as an Audubon Important Bird Area (IBA).

Objective 3.5 Environmental Education and Interpretation

Increase Refuge environmental education and interpretation provision from 2009 levels, specifically:

- Increasing participation in programs (see rationale) by 20 percent within 15 years.
- Establishing new interpretive displays that convey key habitat, wildlife, and other natural resource messages to visitors on the following Refuge units: Headquarters, Highway 27, Sedge Meadow, Platte River West, and Soo Line East (see welcoming and orienting objective 3.1 for additional information).

Rationale: Environmental education and interpretation are priority wildlife-dependent recreational uses listed in the National Wildlife Refuge System Improvement Act of 1997. Well-designed environmental education and interpretive programs can be effective management tools and provide the opportunity to influence visitor attitudes about natural resources, refuges, the Refuge System, and the Service. They can help develop a citizenry that has the awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively towards the conservation of our nation's environmental resources. They can also influence visitor behavior when visiting units of the Refuge System. One aspect of future management efforts will be directed toward on-Refuge programs with a goal of increasing the knowledge of, and appreciation for the Refuge and its resources. Another emphasis will be directed towards a growing need to connect the nation's youth with the natural world and engage children in the outdoors. Richard Louv's 2005 book, 'Last Child in the Woods,' motivated a growing interest in, and acknowledgement of the disconnect between modern youth and nature (Louv 2005). By working with local schools and increasing provision of environmental education and interpretation, the Refuge hopes to begin addressing some of these issues at the local level.

Current programs and activities include:

- Habitat Day
- Platte River Cleanup Day
- Winter Backyard Bird Feeding
- Spring and Fall Birding Tours
- Morrison County Water Festival
- Pheasant Forever Youth Days (Sherburne and Anoka Counties)

Strategies:

1. Identify priority natural resource messages and relevant Refuge audiences to develop interpretive themes that will guide interpretive programs and products.
2. Work with local educators, regional Service environmental education staff, and others to identify target audiences and topics for environmental education programs.
3. Encourage self-directed learning on the Refuge, in addition to providing programs, activities, talks, publications, audio-visual media, signs, and exhibits.
4. Begin coordinating environmental education programs with the five local schools (Royalton, Little Falls, Pierz, Upsala, and Swanville.)
5. Serve as a local resource for environmental education and interpretation related to area wildlife, habitats, water resources, and cultural history by providing curricula, workshops, outdoor classrooms, and teaching materials.
6. Work with local educators to develop environmental education curricula and teach workshops.
7. Develop operational measures of success for the environmental education program.
8. On the Headquarters unit, design and develop the plan for an outdoor classroom with electricity, running water, and flush toilets, and

an indoor visitor information area (see welcoming and orienting objective 3.1 for additional information).

9. Work with local scout groups on merit badges and conservation projects.

10. Update existing kiosk at the Platte River Trailhead.

Objective 3.6 Outreach and Partnerships

Maintain relationships with current partners(see rationale) and existing outreach activities (see rationale), and identify and participate in at least 10 new outreach opportunities or community activities over the life of the plan to increase collaboration, improve the public understanding of Crane Meadows NWR and the Refuge System, and reinforce the importance of natural resource conservation.

Rationale: It is critical to the mission of the Refuge System, and to Crane Meadows NWR, that the neighbors, citizens, organizations, and agencies in the surrounding landscape know about the Refuge and support it as a valuable and contributing part of the community. The Refuge is an asset to the local community and has received strong support since its establishment in 1992. Continued support is essential for the success of the Refuge and its long-term viability. Developing relationships with other conservation agencies and organizations is mutually beneficial in conducting efficient and effective natural resource work. Also, building support for land and water conservation among Refuge neighbors is essential in protecting the natural resources in the area over the long term. It is important that the Refuge continue efforts to build and maintain open communication, informing partners and the public about the successes, opportunities, and challenges involved in conservation and wildlife-dependent recreation.

Current partners include:

- Morrison County Sportsmen Clubs
- Ducks Unlimited
- Minnesota Waterfowl Association
- Central Minnesota Audubon Society
- Delta Waterfowl
- Central Minnesota Environmental Council
- Minnesota Department of Natural Resources
- Camp Ripley Environmental Office
- National Wild Turkey Federation
- Minnesota Deer Hunters Association
- Morrison County Pheasants Forever
- Soil and Water Conservation District
- Natural Resource Conservation Service
- Morrison County Government (Commissioners, Planning and Zoning, Roads and Transportation)
- Local snowmobile and ATV clubs
- Royalton Lions Club
- Morrison County Master Gardeners

Current outreach activities include:

- Habitat Day
- Platte River Cleanup Day
- Winter Backyard Bird Feeding
- Spring and Fall Birding Tours
- Morrison County Water Festival
- Anoka County Game Fair
- Pheasant Forever Youth Days (Sherburne and Anoka Counties)
- Camp Ripley hunts
- Local Expos (business and others)
- Anoka Game Fair
- Morrison County Fair

Strategies:

1. Work with the state to establish a Memorandum of Understanding (MOU) for managing land and water within the acquisition boundary.

2. Increase interaction with public media outlets to promote Refuge activities, amenities, accomplishments, and management.

3. Maintain regular contact with community leaders, schools, agencies, and partner organizations.

4. Continue to develop good relations with landowners in, and immediately adjacent to the Refuge acquisition boundary.

5. Contact at least one new potential partner each year.

6. Work cooperatively with local universities, colleges, and other agencies to promote research within the Refuge.

7. Develop periodic news articles and radio programs on Refuge-related topics.

Objective 3.7: Cultural Resource Management

Over the life of the plan, work to protect all cultural, historic, and archaeological resources on the Refuge.

Rationale: Cultural resources are an important part of the nation's heritage, and historic/pre-his-

toric artifacts on the Refuge are limited and irreplaceable national treasures. Crane Meadows NWR remains committed to preserving archeological and historic sites against degradation, looting, and other adverse impacts. The guiding principle for management derives from the National Historic Preservation Act of 1966 as amended, 16 U.S.C.470 et seq., and the Archeological Resources Protection Act of 1970 as amended, 16 U.S.C. 47011-mm. There are a number of documented archaeological sites in the area of the Rice-Skunk wetland complex.

The abundance of wildlife that has been attracted to this area for thousands of years has, in turn, drawn early native peoples to this wetland system. Although none of the known archaeological sites are currently owned by the Refuge, there may be undiscovered sites that will need to be properly attended as more research is done on Refuge lands. In addition, full acquisition would place a number of historic resources under the care of the Service, and it is important for Refuge and Regional Office staff to be aware of these resources.

Strategies:

1. Ensure archaeological and cultural resources are identified, described, and taken into consideration prior to implementing management actions.
2. Conduct site-specific surveys prior to any ground disturbance activities.
3. Conduct consultations with Minnesota State Historic Preservation Officer (SHPO) and Service Regional Historic Preservation Officer (RHPO) to ensure compliance with Section 106 of the National Historic Preservation Act.
4. In the event of inadvertent discoveries of ancient human remains, follow instructions and procedures indicated by the SHPO and RHPO, including tribal notification and consultation where appropriate.

Objective 3.8: Volunteers and Friends Group

Over the life of the plan, increase Friends group membership by 10 percent, increase the 3-year moving average of annual service hours contributed by volunteers an average of 1 percent per year, and increase volunteer opportunities related to resource monitoring, environmental education, partnership development, land protection, and visitor services.

Rationale: The human resource hours required to effectively manage a national wildlife refuge often exceeds that which can be provided by staff alone. The accomplishments of any refuge, especially the exemplary work above and beyond the day-to-day management needs are often the result of joint public and private teamwork and the collective interests and enthusiasm of the multitude of individuals that benefit from the Refuge. As public servants, Service staff manage a public resource owned by the citizens of this nation. The greater the involvement of the public, the more successfully the mission of the Fish and Wildlife Service is met, "…working with others…for the continuing benefit of the American people."

Crane Meadows NWR staff sees the opportunity to work with private individuals as critical to their effective management, and are grateful to those who have become engaged with the conservation, research, and education activities conducted by the Refuge. As an extension of Refuge volunteerism, a Refuge Friends Group is a grassroots organization formed by citizens who have a shared desire and vision to support their local National Wildlife Refuge. They join with Service personnel in a partnership that seeks to accomplish mutually defined goals.

Establishing a Friends group helps build a constituency of support for the Refuge, provides people with opportunities to assist in the accomplishment of the Service mission, and enhances Refuge performance through the creativity, innovations, labor, and expertise contributed by its members. The Refuge will continue to work diligently to increase opportunities to support Crane Meadows NWR, and to enhance the experience of its volunteers.

Strategies:

1. Actively recruit new volunteers in areas within and adjacent to the Refuge acquisition boundary, and throughout the watershed.
2. Use off-site outreach and education events as opportunities to recruit new volunteers and promote the Friends group.
3. Work with volunteer agencies and service groups to increase volunteerism at the Refuge.
4. Support the Refuge Friends Group in Refuge advocacy, education, and resource management.

Objective 3.9 Law Enforcement

Work with local police authorities, state conservation officers, and law enforcement officers from other national wildlife refuges to ensure visitor safety and resource protection. Work to minimize the potential for incidents, violations, and other illegal activities on the Refuge.

Table 21: Additional Staffing Needs at Crane Meadows NWR

Position Title	Priority	Issues Addressed by New Position
Wildlife Refuge Specialist	1	General Refuge management; replace existing position provided by Sherburne NWR.
Biologist	2	Land acquisition efforts; habitat restoration; research and monitoring (i.e. water resources, invasive species, wildlife surveys).
Administrative Assistant	3	Hospitality, communications, information provision, filing, outreach, volunteer program administration, and local visitor services oversight.

Rationale: The Refuge is responsible for protecting the resources within its boundaries and for providing a safe environment for visitors and employees. The Refuge law enforcement program is a critical tool in protecting trust resources, wildlife habitat, public facilities, employees, and the visiting public. To provide this essential service, the Refuge will share regional resources and cooperate with other law enforcement authorities to meet its responsibilities.

Strategies:

1. Actively maintain partnerships with local, state, and Service law enforcement officers that support the Refuge.
2. Promote surveillance of the Refuge by local landowners, visitors, and partner agency personnel.
3. Report and document all incidents and violations on the Refuge.
4. Maintain all facilities and infrastructure in compliance with OSHA and other regulations.
5. Increase boundary signage where necessary to prevent illegal trespass.

Objective 3.10 Staffing

Increase staffing from the existing two positions to the levels projected by the 2008 Region 3 staffing model [2] (see Table 21) in order to accomplish the work set forth by the CCP.

Rationale: With a strong Private Lands program, increasing visitation trends, endless research interests, and incomplete land acquisition, the Refuge will require additional human resources to meet future management needs.

Current staffing at Crane Meadows NWR includes two positions:

- Private Lands Biologist/Refuge Operations Specialist (provided by Sherburne NWR)
- Maintenance

The commitments described in this CCP will be greatly influenced by the availability of human resources. In addition to a healthy volunteer program, the Refuge needs professional FWS staff to effectively manage the expansion of biological and visitor service programs at the Refuge.

2. *The 2008 staffing model does not account for personnel associated with fire, the Partners Program, or law enforcement.*

Chapter 5: Plan Implementation

Introduction

The efficacy of any management plan is dependent on a multitude of factors that change over time. This chapter describes a number of these factors in further detail, including the funding, projects, human resources, coordination, monitoring, and additional planning associated with CCP implementation. Adaptive management will also be necessary to meet new, unforeseen challenges, and to take advantage of new opportunities.

As noted in the inside cover of this document, this plan does not constitute a commitment for additional staffing or increases in operational and maintenance resources. These decisions are at the discretion of Congress in overall appropriations, and in budget allocation decisions made at the national and regional levels of the Service.

Crane Meadows NWR. Photo credit: Arthur Groinus

Funding

In the preceding chapters, the Crane Meadows NWR CCP has outlined a vision for the future management of the Refuge and included the objectives and strategies needed to realize that vision. Current financial resources available to the Refuge will not adequately provide the means to protect habitat and wildlife, and improve the condition of visitor services through the life of the plan. In fact, the operating and maintenance budget for the Refuge over the past 6 years has slightly decreased overall (see Table 15 on page 81.) Similarly, pre-plan staff levels do not allow adequate interactions with the public for welcoming, education, interpretation, information, safety, or enforcement purposes; nor are the habitat management strategies described in this plan achievable at minimum staffing levels.

The rate at which each refuge achieves its full potential of contributing to local, regional, and national conservation goals depends on the resources provided for those purposes. Increased funding and staffing will result in long-lasting protection, maintenance, and enhancements to Refuge habitats, visitor facilities, and programs.

The operations and maintenance budget provide funds for routine, day-to-day costs on the Refuge. These costs include utilities, upkeep of offices and structures, required safety inspections, and the maintenance of Refuge facilities including parking lots, restrooms, informational kiosks, and trails. Currently, the operations and maintenance costs for the Refuge are fairly moderate because of the Refuge's small size, and because habitat in many acquisition areas is still relatively intact. However, land acquisition funds and other options to protect identified lands occur outside the normal operations and maintenance funding process for refuges. On a national level, Crane Meadows NWR ranks low in the Service's objective based Land Acquisition Priority System (LAPS), which requires considerable collaborative efforts with local landowners, conservation organizations, and political interests to coordinate land protection on the Refuge.

In fact, of the 48 refuges in the Midwest Region with boundaries that are proposed for complete acquisition, Crane Meadows NWR owns the small-

Table 22: New Project List, Crane Meadows NWR

Project Number	Rank	Project Description	Estimated Cost (First Year)
FY08-4200	1	Protect one of the largest unaltered wetlands in Minnesota	$141,984
FY08-4201	2	Conduct Strategic Habitat Planning	$97,911
FY08-4202	3	Provide administrataive support for critical Refuge programs	$80,046
FY08-6880	4	Connecting Kids With Nature	$75,901
FY08-6886	5	Protect and enhance Crane Meadows wetland complex	$110,901
FY08-6888	6	Collect biological information	$85,901
FY08-6890	7	Restore upland and wetland habitats	$4,000

est percent of its proposed acquisition boundary at only 13 percent. Refuge staff remain committed to seeking new opportunities for acquisition support and options for land protection – both from within the Service and from external sources.

New and Existing Projects

This CCP outlines an ambitious course of action for the future management of Crane Meadows NWR. The Refuge will need appropriate and consistent operational and maintenance funding to implement the objectives and strategies outlined in this plan. A full listing of unfunded Refuge projects and operational needs predating this plan can be found in Table 22. Included are land protection efforts, habitat restoration projects, research and planning initiatives, youth education programs, general maintenance and rehabilitation of existing buildings, and the resurfacing of roads, parking lots, and trails.

Staffing

Current staffing at Crane Meadows NWR includes two positions:

- Private Land Biologist/Refuge Operations specialist (provided by Sherburne NWR)
- Maintenance

Full implementation of the vision set forth in this CCP will require changes in the work force of the Refuge. Existing staff will direct their time and energy in new directions, and new staff members will be needed to assist in management and operations.

In March of 2008 a national team of Refuge System professionals developed a staffing model to estimate the personnel required to effectively operate and manage the 589 existing field stations of the Refuge System. Fifteen factors were used in the evaluation, covering the following topics:

- total acres, acres actively managed, and number of easement contracts
- endangered and invasive species populations
- biological management and monitoring, threats and conflicts
- wilderness management
- visitor services: visitation, education programs, volunteers, Friends
- maintenance needs and existing assets

The model attempts to project staffing levels in a systematic, qualitative manner. Although a model provides only an estimate or theoretical measure and may not depict staffing needs with 100 percent accuracy, this modeling application is useful for supporting personnel actions and making consistent staffing decisions. The 2008 model projects the total maximum number of full-time equivalent (FTE) positions needed at each station, but does not determine the individual disciplines or specialties. Law enforcement, fire, and private lands positions were not included in the assessment. To implement the staffing model, the final report recommends that each Region adjust the final personnel numbers as necessary and identify the most appropriate position descriptions for each station.

The 2008 staffing model results for Crane Meadows NWR included a total of five FTE positions, with a subsequent adjustment at the regional level to four. Using a 2008 baseline staffing of one FTE position, the Refuge was asked to identify three additional positions and rank them from greatest to least priority (see Table 23 on page 107). These are the same three positions covered in objective 3.10 of

Table 23: Current and Proposed Staffing as Indicated by the 2008 NWRS Staffing Model

Position Title	Status	Priority
Maintenance	Existing	n/a
Wildlife Refuge Specialist	Currently provided by Sherburne NWR, but proposed for Crane Meadows NWR	1
Biologist	Proposed	2
Administrative Assistant	Proposed	3

Chapter 4. The three additional positions would replace the existing wildlife refuge specialist that is currently provided by Sherburne NWR for general management of the Refuge; to augment the biological program; to increase research and monitoring activities, habitat restoration, and land protection efforts; and to address Refuge needs related to hospitality, outreach, volunteerism, and visitor services oversight.

The results of the staffing model illustrate full staffing at Crane Meadows NWR under optimum conditions. Due to the reality of financial constraints and operating budgets within the Service, it may not be possible to reach full staffing levels immediately. However, the amount and quality of management on a Refuge is highly dependent on the personnel resources available to implement the CCP.

Partnerships

Partnerships are an essential element for the successful accomplishment of goals, objectives, and strategies at Crane Meadows NWR. The objectives outlined in this CCP need the support and the partnerships of federal, state, and local agencies, nongovernmental organizations, and individual citizens. Refuge staff will continue to seek creative partnership opportunities to achieve the vision of the Refuge.

The importance of cooperation, collaboration, and partnerships in the successful implementation of this CCP is heavily emphasized throughout this document, including the current management section (Chapter 3, see "Partnerships" on page 107) and in Chapter 4 (see "Objective 3.6 Outreach and Partnerships" on page 102). With only 13 percent of the acquirable Refuge lands in Service ownership, Refuge staff spend a great deal of time and effort communicating with and supporting adjacent landowners in their stewardship of the land. State partners own just under 7 percent of the land within Refuge acquisition boundary and manage all of its open waters, making them a valuable ally for local conservation. Furthermore, local hunters and anglers – both private individuals and organized groups, control a substantial amount of land within the boundary. With a shared vision for conservation these individuals and groups can play an important role in keeping natural habitat on the landscape. Only through the combined efforts of a multitude of agencies, organizations, groups, and individuals with complementary conservation values can a healthy local ecosystem be retained over the long-term. Crane Meadows NWR will continue to be an engaged and committed partner in the community of support for this important vision.

Step-Down Management Plans

The CCP is a plan that provides general direction for Refuge management over short- and long-term timeframes. It also begins to describe specific wildlife, habitat, and people related objectives and strategies. Step-down management plans build on the over-arching framework provided by the CCP and develop management concepts in greater detail. This process provides managers and employees the opportunity to identify the specific implementation actions that will be carried to meet the requirement of the CCP. The Refuge staff will revise or develop the following step-down plans within the established timeframes:

- Fire Management Plan (1 year)
- Visitor Services Plan (2 years)
- Habitat Management Plan (5 years)
- Inventory and Monitoring Plan (5 years)

Monitoring and Evaluation

The direction set forth in this CCP and specifically identified strategies and projects will be monitored throughout the life of this plan. On a periodic basis, the Regional Office will assemble a station review team whose purpose will be to visit Crane Meadows NWR and evaluate current activities in light of this plan. The team will review all aspects of Refuge management, including direction, accomplishments and funding. The goals and objectives presented in this CCP will provide the baseline for evaluation of this field station.

Plan Review and Revision

While comprehensive conservation plans are designed to provide guidance for Refuge management over a 15-year period, they are also dynamic and flexible documents that are reviewed regularly and modified when plan review or other Refuge monitoring and evaluation determines that it is necessary.

Service policy calls for an annual review of these plans and revision when significant events or new information necessitate change in order to achieve the refuge purposes, vision, and goals. The policy calls for revision, "…when significant new information becomes available, ecological conditions change, major refuge expansion occurs, or when we identify the need to do so during plan review" [602 FW 3]. Plan revisions follow the same procedures and processes used to develop the original CCP. As with a standard CCP planning effort, revisions must follow NEPA requirements and include opportunities for public review and comment. Minor plan revisions that meet the criteria for a categorical exclusion in an EAS may be made in accordance with 550 FW 3.3C.

Appendix A: Finding of No Significant Impact

Finding of No Significant Impact

Environmental Assessment and Comprehensive Conservation Plan for Crane Meadows National Wildlife Refuge, Minnesota

An Environmental Assessment (EA) has been prepared to identify management strategies to meet the conservation goals of Crane Meadows National Wildlife Refuge (NWR). The EA examined the environmental consequences that each management alternative could have on the quality of the physical, biological, and human environment, as required by the National Environmental Policy Act of 1969 (NEPA). The EA evaluated three alternatives for the future management of Crane Meadows NWR.

The alternative selected for implementation on the refuge is *Alternative B*. This preferred alternative portrays a long-term vision for habitat restoration to near-historic benchmark conditions and increases recreation opportunities for visitors over the 15-year planning horizon. A diversity of wetland and savanna habitats are favored reinforcing historic conditions, while prairie and woodland are reduced over the long-term. This alternative includes active participation in monitoring and improving upstream water resources, calls for adherence to a well-developed prescribed fire plan, increases land acquisition and work on private lands in high priority areas, augments the existing biological inventory and monitoring program, and offers visitor services in a greater number of locations. Specific, managed hunts are offered, and opportunities for quality fishing experiences will be evaluated as new lands are acquired.

For reasons presented above and below, and based on an evaluation of the information contained in the Environmental Assessment, we have determined that the action of adopting Alternative B as the management alternative for Crane Meadows NWR is not a major Federal action which would significantly affect the quality of the human environment, within the meaning of Section 102 (2)(c) of the National Environmental Policy Act of 1969.

Additional Reasons:

- Future management actions will have a neutral or positive impact on the local economy.
- This action will not have an adverse impact on threatened or endangered species.

Supporting References:

- Environmental Assessment
- Comprehensive Conservation Plan

ACTING Regional Director _____ Date 9/14/10

Appendix B: Glossary

Alternative

A set of objectives and strategies needed to achieve refuge goals and the desired future condition.

Biological Diversity

The variety of life forms and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Compatible Use

A wildlife-dependent recreational use, or any other use on a refuge that will not materially interfere with or detract from the fulfillment of the mission of the Service or the purposes of the refuge.

Comprehensive Conservation Plan

A document that describes the desired future conditions of the refuge, and specifies management actions to achieve refuge goals and the mission of the National Wildlife Refuge System.

Cultural Resources

"Those parts of the physical environment -- natural and built -- that have cultural value to some kind of sociocultural group ... [and] those nonmaterial human social institutions...." Cultural resources include historic sites, archeological sites and associated artifacts, sacred sites, traditional cultural properties, cultural items (human remains, funerary objects, sacred objects, and objects of cultural patrimony), and buildings and structures.

Ecosystem

A dynamic and interrelated complex of plant and animal communities and their associated non-living environment.

Ecosystem Approach

A strategy or plan to protect and restore the natural function, structure, and species composition of an ecosystem, recognizing that all components are interrelated.

Ecosystem Management

Management of an ecosystem that includes all ecological, social and economic components that make up the whole of the system.

Endangered Species

Any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.

Environmental Assessment

A systematic analysis to determine if proposed actions would result in a significant effect on the quality of the environment.

Extirpation

The local extinction of a species that is no longer found in a locality or country, but exists elsewhere in the world.

Goals

Descriptive statements of desired future conditions.

Interjurisdictional Fish

Fish that occur in waters under the jurisdiction of one or more states, for which there is an interstate fishery management plan or which migrates between the waters under the jurisdiction of two or more states bordering on the Great Lakes.

Issue

Any unsettled matter that requires a management decision. For example, a resource management problem, concern, a threat to natural resources, a conflict in uses, or in the presence of an undesirable resource condition.

National Wildlife Refuge System

All lands, waters, and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish, wildlife and plant resources.

Objectives

A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies.

Preferred Alternative

The Service's selected alternative identified in the Draft Comprehensive Conservation Plan.

Scoping

A process for determining the scope of issues to be addressed by a comprehensive conservation plan and for identifying the significant issues. Involved in the scoping process are federal, state and local agencies; private organizations; and individuals.

Species

A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.

Strategies

A general approach or specific actions to achieve objectives.

Threatened Species

Those plant or animal species likely to become endangered species throughout all of or a significant portion of their range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Undertaking:

"A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license or approval...," i.e., all federal actions.

Vegetation

Plants in general, or the sum total of the plant life in an area.

Vegetation Type

A category of land based on potential or existing dominant plan species of a particular area.

Watershed

The entire land area that collects and drains water into a stream or stream system.

Wetland

Areas such as lakes, marshes, and streams that are inundated by surface or ground water for a long enough period of time each year to support, and that do support under natural conditions, plants and animals that require saturated or seasonally saturated soils.

Wildlife-dependent Recreational Use

A use of refuge that involves hunting, fishing, wildlife observation and photography, or environmental education and interpretation, as identified in the National Wildlife Refuge System Improvement Act of 1997.

Wildlife Diversity

A measure of the number of wildlife species in an area and their relative abundance.

Water Birds

This general category includes all birds that inhabit lakes, marshes, streams and other wetlands at some point during the year. The group includes all waterfowl, such as ducks, geese, and swans, and other birds such as loons, rails, cranes, herons, egrets, ibis, cormorants, pelicans, shorebirds and passerines that nest and rely on wetland vegetation.

Appendix C: Lists of Species Occurring on Crane Meadows NWR

List of Bird Species 116
List of Fish Species..... 126
List of Herpetofauna Species..... 128
List of Mammal Species..... 129
List of Mussel Species 131
List of Plant Species 132

Bird List, Crane Meadows NWR

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Common Loon	Gaviidae	*Gavia*	*immer*	breeding	On-site
Red-necked Grebe	Podicipedidae	*Podiceps*	*grisegena*	migrant	On-site
Horned Grebe	Podicipedidae	*Podiceps*	*auritus*	migrant	On-site
Eared Grebe	Podicipedidae	*Podiceps*	*nigricollis*	migrant	On-site
Pied-billed Grebe	Podicipedidae	*Podilymbus*	*podiceps*	breeding	On-site
American White Pelican	Pelecanidae	*Pelecanus*	*erythrorhynchos*	summer visitor	On-site
Double-crested Cormorant	Phalacrocoracidae	*Phalacrocorax*	*auritus*	summer visitor	On-site
American Bittern	Ardeidae	*Botarus*	*lentiginosus*	breeding	On-site
Least Bittern	Ardeidae	*Ixobrychus*	*flavicollis*	breeding	On-site
Black-crowned Night Heron	Ardeidae	*Nycticorax*	*nycticorax*	summer visitor	On-site
Green Heron	Ardeidae	*Butorides*	*virescens*	breeding	On-site
Great Blue Heron	Ardeidae	*Ardea*	*herodias*	summer visitor	On-site
Great Egret	Ardeidae	*Ardea*	*alba*	summer visitor	On-site
Tundra Swan	Anatidae	*Cygnus*	*columbianus*	migrant	On-site
Trumpeter Swan	Anatidae	*Cygnus*	*buccinator*	summer visitor	On-site
Canada Goose	Anatidae	*Branta*	*canadensis*	breeding	On-site
Snow Goose	Anatidae	*Chen*	*caerulescens*	migrant	On-site
Wood Duck	Anatidae	*Aix*	*sponsa*	breeding	On-site
Mallard	Anatidae	*Anas*	*platyrhynchos*	breeding	On-site
American Black Duck	Anatidae	*Anas*	*rubreedingipes*	migrant	On-site
Gadwall	Anatidae	*Anas*	*strepera*	migrant	On-site
Northern Pintail	Anatidae	*Anas*	*acuta*	migrant	On-site
Green-winged Teal	Anatidae	*Anas*	*crecca*	breeding	On-site
Blue-winged Teal	Anatidae	*Anas*	*discors*	breeding	On-site
American Wigeon	Anatidae	*Anas*	*americana*	migrant	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Northern Shoveler	Anatidae	*Anas*	*clypeata*	migrant	On-site
Redhead	Anatidae	*Aythya*	*americana*	migrant	On-site
Ring-necked Duck	Anatidae	*Aythya*	*collaris*	breeding	On-site
Canvasback	Anatidae	*Aythya*	*valisineria*	migrant	On-site
Lesser Scaup	Anatidae	*Aythya*	*affinis*	migrant	On-site
Common Goldeneye	Anatidae	*Bucephala*	*clangula*	migrant	On-site
Bufflehead	Anatidae	*Bucephala*	*albeola*	migrant	On-site
Hooded Merganser	Anatidae	*Lophodytes*	*cucullatus*	breeding	On-site
Common Merganser	Anatidae	*Mergus*	*merganser*	migrant	On-site
Red-breasted Merganser	Anatidae	*Mergus*	*serrator*	migrant	On-site
Ruddy Duck	Anatidae	*Oxyura*	*jamaicensis*	migrant	On-site
Turkey Vulture	Cathartidae	*Cathartes*	*aura*	summer visitor	On-site
Osprey	Accipitridae	*Pandion*	*haliaetus*	migrant	On-site
Northern Harrier	Accipitridae	*Circus*	*cyaneus*	breeding	On-site
Golden Eagle	Accipitridae	*Aquila*	*chrysaetos*	migrant	On-site
Bald Eagle	Accipitridae	*Haliaeetus*	*leucocephalus*	breeding, winter migrant	On-site
Sharp-shinned Hawk	Accipitridae	*Accipiter*	*striatus*	breeding	On-site
Cooper's Hawk	Accipitridae	*Accipiter*	*cooperii*	breeding	On-site
Northern Goshawk	Accipitridae	*Accipiter*	*gentilis*	migrant, winter	On-site
Red-tailed Hawk	Accipitridae	*Buteo*	*jamaicensis*	breeding	On-site
Red-shouldered Hawk	Accipitridae	*Buteo*	*lineatus*	breeding	On-site
Broad-winged Hawk	Accipitridae	*Buteo*	*platypterus*	breeding	On-site
Rough-legged Hawk	Accipitridae	*Buteo*	*lagopus*	winter visitor	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Peregrine Falcon	Falconidae	*Falco*	*peregrinus*	summer visitor, migrant	On-site
Merlin	Falconidae	*Falco*	*columbarius*	migrant	On-site
American Kestrel	Falconidae	*Falco*	*sparverius*	breeding	On-site
Ring-necked Pheasant	Phasianidae	*Phasianus*	*colchicus*	breeding	On-site
Wild Turkey	Phasianidae	*Meleagris*	*gallopavo*	breeding	On-site
Ruffed Grouse	Phasianidae	*Bonasa*	*umbellus*	breeding	On-site
Greater Prairie-chicken	Phasianidae	*Tympanuchus*	*cupido*	-	Historical
Sharp-tailed Grouse	Phasianidae	*Tympanuchus*	*phasianellus*	-	Historical
Virginia Rail	Rallidae	*Rallus*	*limigrantcola*	breeding	On-site
Sora	Rallidae	*Parzana*	*carolina*	breeding	On-site
Yellow Rail	Rallidae	*Coturnicops*	*noveboracensis*	migrant, breeding?	In County
American Coot	Rallidae	*Fulica*	*americana*	breeding	On-site
Sandhill Crane	Gruidae	*Grus*	*canadensis*	breeding	On-site
Whooping Crane	Gruidae	*Grus*	*americana*	rare migrant, summer visitor	On-site
American Golden Plover	Charadriidae	*Pluvialis*	*apricaria*	migrant	County-wide Range
Black-bellied Plover	Charadriidae	*Pluvialis*	*squatarola*	migrant	County-wide Range
Semipalmated Plover	Charadriidae	*Charadrius*	*semipalmatus*	migrant	On-site
Killdeer	Charadriidae	*Charadrius*	*vociferus*	breeding	On-site
American Avocet	Recurvirostridae	*Recurvirostra*	*americana*	migrant	County-wide Range
Willet	Scolopacidae	*Catoptrophorus*	*semipalmatus*	migrant	County-wide Range
Greater Yellowlegs	Scolopacidae	*Tringa*	*melanoleuca*	migrant	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Lesser Yellowlegs	Scolopacidae	*Tringa*	*flavipes*	migrant	On-site
Solitary Sandpiper	Scolopacidae	*Tringa*	*solitaria*	migrant	On-site
Spotted Sandpiper	Scolopacidae	*Actitis*	*macularia*	breeding	On-site
Baird's Sandpiper	Scolopacidae	*Calidris*	*bairdii*	migrant	County-wide Range
Pectoral Sandpiper	Scolopacidae	*Calidris*	*melanotos*	migrant	County-wide Range
White-rumped Sandpiper	Scolopacidae	*Calidris*	*fuscicollis*	migrant	County-wide Range
Least Sandpiper	Scolopacidae	*Calidris*	*minutilla*	migrant	County-wide Range
Dunlin	Scolopacidae	*Calidris*	*alpina*	migrant	On-site
Semipalmated Sandpiper	Scolopacidae	*Calidris*	*pusilla*	migrant	County-wide Range
Upland Sandpiper	Scolopacidae	*Bartramia*	*longicauda*	breeding	Historical, breeds in county
Long-billed Dowitcher	Scolopacidae	*Limnodromus*	*scolopaceus*	migrant	County-wide Range
Short-billed Dowitcher	Scolopacidae	*Limnodromus*	*griseus*	migrant	County-wide Range
American Woodcock	Scolopacidae	*Scolopax*	*minor*	breeding	On-site
Wilson's Snipe	Scolopacidae	*Gallinago*	*delicata*	breeding	On-site
Wilson's Phalarope	Scolopacidae	*Phalaropus*	*tricolor*	migrant	On-site
Ring-billed Gull	Laridae	*Larus*	*delawarensis*	migrant	On-site
Bonaparte's Gull	Laridae	*Larus*	*philadelphia*	migrant	On-site
Herring Gull	Laridae	*Larus*	*argentatus*	migrant	On-site
Foster's Tern	Laridae	*Sterna*	*forsteri*	migrant	On-site
Caspian Tern	Laridae	*Sterna*	*caspia*	migrant	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Black Tern	Laridae	*Chlidonias*	*niger*	breeding	On-site
Rock Dove	Columbidae	*Columba*	*livia*	breeding	On-site
Mourning Dove	Columbidae	*Zenaida*	*macroura*	breeding	On-site
Yellow-billed Cuckoo	Cuculidae	*Coccyzus*	*americanus*	breeding	On-site
Black-billed Cuckoo	Cuculidae	*Coccyzus*	*erythropthalmus*	breeding	On-site
Long-eared Owl	Strigidae	*Asio*	*otus*	breeding	On-site
Short-eared Owl	Strigidae	*Asio*	*flammeus*	migrant	On-site
Great horned Owl	Strigidae	*Bubo*	*virginianus*	breeding	On-site
Barred Owl	Strigidae	*Strix*	*varia*	breeding	On-site
Snowy Owl	Strigidae	*Nyctea*	*scandica*	winter visitor	On-site
Eastern screech Owl	Strigidae	*Otus*	*asio*	breeding	On-site
Common Nighthawk	Caprimulgidae	*Chordeiles*	*minor*	breeding	On-site
Whip-poor-will	Caprimulgidae	*Caprimulgus*	*vociferus*	breeding	County-wide Range
Chimney Swift	Apodidae	*Chaetura*	*pelagica*	migrant	On-site
Ruby-throated Hummingbird	Trochilidae	*Archilochus*	*colubreedingis*	breeding	On-site
Belted Kingfisher	Alcedinidae	*Ceryle*	*alcyon*	breeding	On-site
Red-bellied Woodpecker	Picidae	*Melanerpus*	*carolinus*	breeding	On-site
Red-headed Woodpecker	Picidae	*Melanerpus*	*erythocephalus*	breeding	On-site
Northern Flicker	Picidae	*Colaptes*	*auratus*	breeding	On-site
Yellow-bellied Sapsucker	Picidae	*Sphyrapicus*	*varius*	breeding	On-site
Downy Woodpecker	Picidae	*Picoides*	*pubescens*	breeding	On-site
Hairy Woodpecker	Picidae	*Picoides*	*villosus*	breeding	On-site
Pileated Woodpecker	Picidae	*Dryocopus*	*pileatus*	breeding	On-site
Eastern Wood-pewee	Tyrannidae	*Contopus*	*virens*	breeding	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Alder Flycatcher	Tyrannidae	*Empidonax*	*alnorum*	breeding	On-site
Least Flycatcher	Tyrannidae	*Empidonax*	*minimus*	breeding	On-site
Willow Flycatcher	Tyrannidae	*Empidonax*	*traillii*	breeding	On-site
Eastern Phoebe	Tyrannidae	*Sayornis*	*phoebe*	breeding	On-site
Great Crested Flycatcher	Tyrannidae	*Myiarchus*	*crinitus*	breeding	On-site
Eastern Kingbird	Tyrannidae	*Tyrannus*	*tyrannus*	breeding	On-site
Western Kingbird	Tyrannidae	*Tyrannus*	*verticalis*	migrant, breeding	On-site
Loggerhead Shrike	Laniidae	*Lanius*	*ludovicianus*	breeding	On-site
Northern Shrike	Laniidae	*Lanius*	*excubitor*	winter visitor	On-site
Philadelphia Vireo	Vireonidae	*Vireo*	*philadelphicus*	migrant	On-site
Red-eyed Vireo	Vireonidae	*Vireo*	*olivaceus*	breeding	On-site
Solitary Vireo	Vireonidae	*Vireo*	*solitarius*	migrant	On-site
Warbling Vireo	Vireonidae	*Vireo*	*gilvus*	breeding	On-site
Yellow-throated Vireo	Vireonidae	*Vireo*	*flavifrons*	breeding	On-site
Blue Jay	Corvidae	*Cyanocitta*	*cristata*	breeding	On-site
American Crow	Corvidae	*Corvus*	*brachyrynchos*	breeding	On-site
Common Raven	Corvidae	*Corvus*	*corax*	winter visitor	On-site
Horned Lark	Alaudidae	*Eremophila*	*alpestris*	breeding	On-site
Tree Swallow	Hirundinidae	*Tachycineta*	*bicolor*	breeding	On-site
Purple Martin	Hirundinidae	*Progne*	*subis*	breeding	On-site
Barn Swallow	Hirundinidae	*Hirundo*	*rustica*	breeding	On-site
Cliff Swallow	Hirundinidae	*Petrochelidon*	*pyrrhonota*	breeding	On-site
Bank Swallow	Hirundinidae	*Riparia*	*riparia*	breeding	On-site
N. Rough-winged Swallow	Hirundinidae	*Stelgidopteryx*	*serripennis*	breeding	On-site
Black-capped Chickadee	Paridae	*Poecile*	*atricapillus*	breeding	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Brown Creeper	Certhiidae	*Certhia*	*americana*	migrant	On-site
Red-breasted Nuthatch	Sittidae	*Sitta*	*canadensis*	winter visitor, migrant	Partial Co. Range
White-breasted Nuthatch	Sittidae	*Sitta*	*carolinensis*	breeding	On-site
House Wren	Troglodytidae	*Troglodytes*	*aedon*	breeding	On-site
Marsh Wren	Troglodytidae	*Cistothorus*	*palustris*	breeding	On-site
Sedge Wren	Troglodytidae	*Cistothorus*	*platensis*	breeding	On-site
Golden-crowned Kinglet	Regulidae	*Regulus*	*satrapa*	migrant	On-site
Ruby-crowned Kinglet	Regulidae	*Regulus*	*calendula*	migrant	On-site
Blue-gray Gnatcatcher	Sylviidae	*Polioptila*	*caerulea*	breeding	On-site
Eastern Bluebird	Turdidae	*Sialia*	*sialis*	breeding	On-site
Wood Thrush	Turdidae	*Hylocichla*	*mustelina*	migrant	On-site
Gray-cheeked Thrush	Turdidae	*Catharus*	*migrantnimus*	migrant	On-site
Hermit Thrush	Turdidae	*Catharus*	*guttatus*	migrant	On-site
Swainson's Thrush	Turdidae	*Catharus*	*ustulatus*	migrant	On-site
Veery	Turdidae	*Catharus*	*fuscescens*	breeding	On-site
American Robin	Turdidae	*Turdus*	*migratorius*	breeding	On-site
Gray Catbird	Mimidae	*Dumetella*	*carolinensis*	breeding	On-site
Brown Thrasher	Mimidae	*Toxostoma*	*rufum*	breeding	On-site
European Starling	Sturnidae	*Sturnus*	*vulgaris*	breeding	On-site
Cedar Waxwing	Bombycillidae	*Bombycilla*	*garrulus*	breeding	On-site
Golden-winged Warbler	Parulidae	*Vervora*	*chrysoptera*	breeding	On-site
Nashville Warbler	Parulidae	*Vermivora*	*ruficapilla*	migrant	On-site
Orange-crowned Warbler	Parulidae	*Vermivora*	*celata*	migrant	On-site
Tennessee Warbler	Parulidae	*Vermivora*	*peregrina*	migrant	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Bay-breasted Warbler	Parulidae	*Dendroica*	*castanea*	migrant	On-site
Black-throated Green Warbler	Parulidae	*Dendroica*	*virens*	migrant	On-site
Blackburnian Warbler	Parulidae	*Dendroica*	*fusca*	migrant	On-site
Blackpoll Warbler	Parulidae	*Dendroica*	*striata*	migrant	On-site
Chestnut-sided Warbler	Parulidae	*Dendroica*	*pensylvanica*	breeding	On-site
Magnolia Warbler	Parulidae	*Dendroica*	*magnolia*	migrant	On-site
Palm Warbler	Parulidae	*Dendroica*	*palmarum*	migrant	On-site
Prairie Warbler	Parulidae	*Dendroica*	*discolor*	accidental	On-site
Pine Warbler	Parulidae	*Dendroica*	*pinus*	migrant	On-site
Yellow Warbler	Parulidae	*Dendroica*	*petechia*	breeding	On-site
Yellow-rumped Warbler	Parulidae	*Dendroica*	*coronata*	migrant	On-site
Black-and-white Warbler	Parulidae	*Mniotilta*	*varia*	breeding	On-site
Canada Warbler	Parulidae	*Wilsonia*	*canadensis*	migrant	On-site
Hooded Warbler	Parulidae	*Wilsonia*	*citrina*	accidental	On-site
Wilson's Warbler	Parulidae	*Wilsonia*	*pusilla*	migrant	On-site
Northern Waterthrush	Parulidae	*Seiurus*	*noveboracensis*	migrant	On-site
Ovenbird	Parulidae	*Seiurus*	*aurocapillus*	breeding	On-site
Common Yellowthroat	Parulidae	*Geothlypis*	*trichas*	breeding	On-site
American Redstart	Parulidae	*Setophaga*	*ruticilla*	breeding	On-site
Scarlet Tanager	Thraupidae	*Piranga*	*olivacea*	breeding	On-site
Eastern Towhee	Emberizidae	*Pipilo*	*erythrophthalmus*	breeding	County-wide Range
Clay-colored Sparrow	Emberizidae	*Spizella*	*pallida*	breeding	On-site
Chipping Sparrow	Emberizidae	*Spizella*	*passerina*	breeding	On-site
Field Sparrow	Emberizidae	*Spizella*	*pusilla*	breeding	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
American Tree Sparrow	Emberizidae	*Spizella*	*arborea*	winter visitor	On-site
Lark Sparrow	Emberizidae	*Chondestes*	*grammacus*	breeding	On-site
Grasshopper Sparrow	Emberizidae	*Ammodramus*	*savannarum*	breeding	On-site
Nelsons Sharp-tailed Sparrow	Emberizidae	*Ammodramus*	*nelsoni*	migrant, breeding?	In County
LeConte's Sparrow	Emberizidae	*Ammodramus*	*leconteii*	breeding	On-site
Savannah Sparrow	Emberizidae	*Passerculus*	*sandwichensis*	breeding	On-site
Fox Sparrow	Emberizidae	*Passerella*	*iliaca*	migrant	On-site
Lincoln's Sparrow	Emberizidae	*Melospiza*	*lincolnii*	migrant	On-site
Song Sparrow	Emberizidae	*Melospiza*	*melodia*	breeding	On-site
Swamp Sparrow	Emberizidae	*Melospiza*	*georgiana*	breeding	On-site
Vesper Sparrow	Emberizidae	*Pooecetes*	*gramineus*	breeding	On-site
Harris' Sparrow	Emberizidae	*Zonotrichia*	*querula*	migrant	On-site
White-crowned Sparrow	Emberizidae	*Zonotrichia*	*leucophrys*	migrant	County-wide Range
White-thoated Sparrow	Emberizidae	*Zonotrichia*	*albicollis*	breeding, migrant	On-site
Dark-eyed Junco	Emberizidae	*Junco*	*hyemalis*	winter visitor	On-site
Lapland Longspur	Emberizidae	*Calcarius*	*lapponicus*	migrant	On-site
Snow Bunting	Emberizidae	*Plectrophenax*	*nivalis*	winter visitor	On-site
Dickcissel	Cardinalidae	*Spiza*	*americana*	breeding	On-site
Rose-breasted Grosbeak	Cardinalidae	*Pheucticus*	*ludovicianus*	breeding	On-site
Northern Cardinal	Cardinalidae	*Cardinalis*	*cardinalis*	breeding	On-site
Indigo Bunting	Cardinalidae	*Passerina*	*cyanea*	breeding	On-site
Bobolink	Icteridae	*Dolichonynx*	*oryzivorus*	breeding	On-site
Eastern Meadowlark	Icteridae	*Sturnella*	*magna*	breeding	On-site
Western Meadowlark	Icteridae	*Sturnella*	*neglecta*	breeding	On-site

Bird List, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Lifestage	Confirmed?
Red-winged Blackbird	Icteridae	*Agelaius*	*phoeniceus*	breeding	On-site
Brewer's Blackbird	Icteridae	*Euphagus*	*cyanocephalus*	breeding	On-site
Rusty Blackbird	Icteridae	*Euphagus*	*carolinus*	migrant	On-site
Yellow-headed Blackbird	Icteridae	*Xanthocephalus*	*xanthocephalus*	breeding	On-site
Brown-headed Cowbird	Icteridae	*Molothrus*	*ater*	breeding	On-site
Common Grackle	Icteridae	*Quiscalus*	*quiscula*	breeding	On-site
Baltimore Oriole	Icteridae	*Icterus*	*galbula*	breeding	On-site
House Finch	Fringillidae	*Carpodacus*	*mexicanus*	breeding	On-site
Purple Finch	Fringillidae	*Carpodacus*	*purpureus*	migrant, breeding	On-site
Red Crossbill	Fringillidae	*Loxia*	*curvirostra*	winter visitor, migrant	County-wide Range
White-winged Crossbill	Fringillidae	*Loxia*	*leucoptera*	winter visitor, migrant	County-wide Range
American Goldfinch	Fringillidae	*Carduelis*	*tristis*	breeding, winter	On-site
Common Redpoll	Fringillidae	*Carduelis*	*flammea*	-	On-site
Pine Siskin	Fringillidae	*Carduelis*	*pinus*	migrant, breeding, winter	On-site
House Sparrow	Passeridae	*Passer*	*domesticus*	breeding	On-site

Fish Species, Crane Meadows NWR

Common Name	Family	Genus	Species	Native?	Confirmed?
Bigmouth shiner	Cyprinidae	*Notropis*	*dorsalis*	✔	On-site
Golden shiner	Cyprinidae	*Notemigonus*	*crysoleucas*	✔	Platte River; Off-site
Bowfin	Amiidae	*Amia*	*calva*	✔	On-site
Shorthead redhorse	Catostomidae	*Moxostoma*	*macrolepidotum*	✔	On-site
Silver redhorse	Catostomidae	*Moxostoma*	*anisurum*	✔	Platte River; Off-site
White sucker	Catostomidae	*Catostomus*	*commersoni*	✔	On-site
Black crappie	Centrarchidae	*Poxomis*	*nigromaculatus*	✔	On-site
Bluegill	Centrarchidae	*Lepomis*	*macrochirus*	✔	On-site
Largemouth bass	Centrarchidae	*Micropterus*	*salmoides*	✔	On-site
Pumpkinseed	Centrarchidae	*Lepomis*	*gibbosus*	✔	On-site
Rock bass	Centrarchidae	*Ambloplites*	*rupestris*	✔	On-site
Smallmouth bass	Centrarchidae	*Micropterus*	*dolomieu*	✔	On-site
Mottled sculpin	Cottidae	*Cottus*	*bairdi*	✔	Historical
Blacknose dace	Cyprinidae	*Rhinicthys*	*atratulus*	✔	On-site
Blacknose shiner	Cyprinidae	*Notropis*	*heterolepis*	✔	On-site
Bluntnose minnow	Cyprinidae	*Pimephales*	*notatus*	✔	On-site
Brassy minnow	Cyprinidae	*Hybognathus*	*hankinsoni*	✔	L.Rock; Benton Co
Central stoneroller	Cyprinidae	*Campostoma*	*anomalum*	✔	On-site
Common carp	Cyprinidae	*Cyprinus*	*carpio*		On-site
Common shiner	Cyprinidae	*Notropis*	*cornutus*	✔	On-site
Creek chub	Cyprinidae	*Semotilus*	*atromaculatus*	✔	On-site
Fathead minnow	Cyprinidae	*Pimephales*	*promelas*	✔	On-site
Goldfish	Cyprinidae	*Carassius*	*auratus*		On-site

Fish Species, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Native?	Confirmed?
Hornyhead chub	Cyprinidae	*Nocomis*	*biguttatus*	✔	On-site
Longnose dace	Cyprinidae	*Rhinicthys*	*cataractae*	✔	On-site
Mimic shiner	Cyprinidae	*Notropis*	*volucellus*	✔	On-site
Redfin shiner	Cyprinidae	*Notropis*	*umbratilis*	✔	Platte River; Off-site
Sand shiner	Cyprinidae	*Notropis*	*stramineus*	✔	On-site
Spotfin shiner	Cyprinidae	*Notropis*	*spiloptera*	✔	On-site
Spottail shiner	Cyprinidae	*Notropis*	*hudsonius*	✔	On-site
Northern pike	Esocidae	*Esox*	*lucius*	✔	On-site
Burbot	Gadidae	*Lota*	*lota*	✔	On-site
Brook stickleback	Gasterosteidae	*Culaea*	*inconstans*	✔	On-site
Black bullhead	Ictaluridae	*Ictalurus*	*melas*	✔	On-site
Brown bullhead	Ictaluridae	*Ictalurus*	*nebulosus*	✔	On-site
Channel catfish	Ictaluridae	*Ictalurus*	*punctatus*	✔	On-site
Tadpole madtom	Ictaluridae	*Noturus*	*gyrinus*	✔	On-site
Yellow bullhead	Ictaluridae	*Ictalurus*	*natalis*	✔	On-site
Iowa darter	Percidae	*Etheostoma*	*exile*	✔	On-site
Johnny darter	Percidae	*Etheostoma*	*nigrum*	✔	On-site
Logperch	Percidae	*Percina*	*caprodes*	✔	On-site
Walleye	Percidae	*Stizostedion*	*vitreum*	✔	On-site
Yellow perch	Percidae	*Perca*	*flavescens*	✔	On-site
Brown trout	Salmonidae	*Salmo*	*trutta*		On-site
Central mudminnow	Umbridae	*Umbra*	*limi*	✔	On-site

Herpetofauna, Crane Meadows NWR

Common Name	Family	Genus	Species	Class	Confirmed?
Blue-spotted salamander	Ambystomatidae	*Ambystoma*	*laterlae*	Amphibian	In County
Tiger salamander	Ambystomatidae	*Ambystoma*	*tigrinum*	Amphibian	On-Site
American toad	Bufonidae	*Bufo*	*americanus*	Amphibian	On-Site
Cope's gray tree frog	Hylidae	*Hyla*	*chrysoscelis*	Amphibian	On-Site
Gray tree frog	Hylidae	*Hyla*	*versicolor*	Amphibian	On-Site
Spring peeper	Hylidae	*Pseudacris*	*crucifer*	Amphibian	On-Site
Western chorus frog	Hylidae	*Pseudacris*	*triseriata*	Amphibian	On-Site
Green frog	Ranidae	*Rana*	*clamitans*	Amphibian	On-Site
Mink frog	Ranidae	*Rana*	*septentrionalis*	Amphibian	On-Site
Northern leopard frog	Ranidae	*Rana*	*pipiens*	Amphibian	On-Site
Wood frog	Ranidae	*Rana*	*sylvatica*	Amphibian	On-Site
Eastern newt	Salamandridae	*Notophthalmus*	*viridescens*	Amphibian	In County
Snapping turtle	Chelydridae	*Chelydra*	*serpentina*	Reptile	On-Site
Brown snake	Colubridae	*Storeria*	*dekayii*	Reptile	On-Site
Eastern garter snake	Colubridae	*Thamnophis*	*sirtalis*	Reptile	On-Site
Eastern hognose snake	Colubridae	*Heterodon*	*platyrhinos*	Reptile	On-Site
Gopher snake	Colubridae	*Pituophis*	*catenifer*	Reptile	On-Site
Plains garter snake	Colubridae	*Thamnophis*	*radix*	Reptile	In County
Red-bellied snake	Colubridae	*Storeria*	*occipitomaculata*	Reptile	On-Site
Smooth green snake	Colubridae	*Opheodrys*	*vernalis*	Reptile	On-Site
Western hognose snake	Colubridae	*Heterodon*	*nasicus*	Reptile	On-Site
Blanding's turtle	Emydidae	*Emydoidea*	*blandingii*	Reptile	On-Site
Common map turtle	Emydidae	*Graptemys*	*geopgraphica*	Reptile	In County
Painted turtle	Emydidae	*Cheysemys*	*picta*	Reptile	On-Site
Northern prairie skink	Scincidae	*Eumeces*	*septentrionalis*	Reptile	On-Site
Spiny softshell turtle	Trionychidae	*Apalone*	*spinifera*	Reptile	In County

Mammals, Crane Meadows NWR

Common Name	Family	Genus	Species	Confirmed?
Bison	Bovidae	*Bison*	*bison*	Extirpated
Coyote	Canidae	*Canis*	*latrans*	On-site
Gray fox	Canidae	*Urocyon*	*cinereoargenteus*	On-site
Gray wolf	Canidae	*Canis*	*lupus*	On-site (transient)
Red fox	Canidae	*Vulpes*	*vulpes*	On-site
Beaver	Castoridae	*Castor*	*canadensis*	On-site
Elk	Cervidae	*Cervus*	*elaphus*	extirpated
Moose	Cervidae	*Alces*	*alces*	On-site (accidental)
Mule deer	Cervidae	*Odocoileus*	*hemionus*	In County (accidental)
White-tailed deer	Cervidae	*Odocoileus*	*virginianus*	On-site
Meadow vole	Cricetidae	*Microtus*	*pennsylvanicus*	On-site
Muskrat	Cricetidae	*Ondatra*	*zibethicus*	On-site
Prairie deer mouse	Cricetidae	*Peromyscus*	*maniculatus*	On-site
Prairie vole	Cricetidae	*Microtus*	*ochrogaster*	In County
Southern bog lemming	Cricetidae	*Synaptomys*	*cooperi*	In County
Southern red-backed vole	Cricetidae	*Clethrionomys*	*gapperi*	On-site
Western harvest mouse	Cricetidae	*Reithrodontomys*	*megalotis*	In County
White-footed (wood) mouse	Cricetidae	*Peromyscus*	*leucopus*	In County
Woodland deer mouse	Cricetidae	*Peromyscus*	*maniculatus*	In County
Virginia opossum	Didelphidae	*Didelphis*	*virginiana*	On-site
Porcupine	Erethizontidae	*Erethizon*	*dorsatum*	In County
Bobcat	Felidae	*Lynx*	*rufus*	In County
Plains pocket gopher	Geomyidae	*Geomys*	*bursarius*	On-site
Plains pocket mouse	Heteromyidae	*Perognathus*	*flavenscens*	In County
Eastern cottontail	Leporidae	*Sylvilagus*	*floridanus*	On-site
Snowshoe hare	Leporidae	*Lepus*	*americanus*	On-site
White-tailed jackrabbit	Leporidae	*Lepus*	*townsendii*	In County
House mouse	Muridae	*Mus*	*musculus*	On-site
Norway rat	Muridae	*Rattus*	*norvegicus*	On-site
Badger	Mustelidae	*Taxidea*	*taxus*	On-site
Least weasel	Mustelidae	*Mustela*	*nivalis*	In nearby counties

Mammals, Crane Meadows NWR (Continued)

Common Name	Family	Genus	Species	Confirmed?
Longtail weasel	Mustelidae	*Mustela*	*frenata*	In County
Fisher	Mustelidae	*Martes*	*pennani*	On-site
Mink	Mustelidae	*Mustela*	*vison*	On-site
River otter	Mustelidae	*Lutra*	*canadensis*	On-site
Shorttail weasel (ermine)	Mustelidae	*Mustela*	*erminea*	On-site
Striped skunk	Mustelidae	*Mephitis*	*mephitis*	On-site
Eastern spotted skunk	Mustelidea	*Spilogale*	*putorius*	In County
Raccoon	Procyonidae	*Procyon*	*lotor*	On-site
13-lined ground squirrel	Sciuridae	*Citellus*	*tridecemlineatus*	On-site
Eastern chipmunk	Sciuridae	*Tamias*	*striatus*	On-site
Eastern fox squirrel	Sciuridae	*Sciurus*	*niger*	On-site
Eastern gray squirrel	Sciuridae	*Sciurus*	*carolinensis*	On-site
Franklin's ground squirrel	Sciuridae	*Citellus*	*franklinii*	In County
Red squirrel	Sciuridae	*Tamiasciurus*	*hudsonicus*	On-site
Northern flying squirrel	Sciuridae	*Glaucomys*	*sabrinus*	In nearby counties
Woodchuck	Sciuridae	*Marmota*	*monax*	On-site
Arctic shrew	Soricidae	*Sorex*	*arcticus*	In County
Masked shrew	Soricidae	*Sorex*	*cinereus*	In County
Pygmy shrew	Soricidae	*Microsorex*	*hoyi*	On-site
Short-tailed shrew	Soricidae	*Blarina*	*brevicauda*	On-site
Water shrew	Soricidae	*Sorex*	*palustris*	In County
Eastern mole	Talpidae	*Scalopus*	*aquaticus*	In nearby counties
Star-nosed mole	Talpidae	*Condylura*	*christata*	On-site
Black bear	Ursidae	*Ursus*	*americanus*	On-site
Big brown bat	Vespertilionidae	*Eptesicus*	*fuscus*	In nearby counties
Hoary bat	Vespertilionidae	*Lasiurus*	*cinereus*	In nearby counties
Keen's myotis	Vespertilionidae	*Myotis*	*keenii*	In nearby counties
Little brown myotis	Vespertilionidae	*Myotis*	*lucifugus*	On-site
Red bat	Vespertilionidae	*Lasiurus*	*borealis*	On-site
Silver-haired bat	Vespertilionidae	*Lasionycteris*	*noctivagans*	In nearby counties
Meadow jumping mouse	Zapodidae	*Zapus*	*hudsonius*	On-site

Mussel Species, Crane Meadow NWR

Common Name	Genus	Species	Reference
Floater	*Pyganodon*	*grandis*	unknown
Fat mucket	*Lampsilis*	*siliquoidea*	unknown
Fragile papershell	*Leptodea*	*fragilis*	unknown
Cyliner	*Anodontoides*	*ferruscianous*	unknown
Fingernail clams	*Sphaeridae*	*sp.*	unknown
Black sandshell mussel	*Ligumia*	*recta*	MCBS
Creek heelsplitter mussel	*Lasmigona*	*compressa*	MCBS

List of Plant Species Found on Crane Meadows NWR

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Common yarrow	Forb	Asteraceae	*Achillea millefolium*	✔	✔	✔
Blue giant hyssop	Forb	Lamiaceae	*Agastache foeniculum*	✔	✔	✔
Leadplant	Shrub	Fabaceae	*Amorpha canescens*	✔	✔	✔
Hog-peanut	Vine	Fabaceae	*Amphicarpaea bracteata*	✔	✔	✔
Big bluestem	Grass	Poaceae	*Andropogon gerardii*	✔	✔	✔
Canada anemone	Forb	Ranunculaceae	*Anemone canadensis*	✔	✔	✔
Field pussytoes	Forb	Asteraceae	*Antennaria neglecta*	✔	✔	✔
White sage (western mugwort)	Forb	Asteraceae	*Artemisia ludoviciana*	✔	✔	✔
Swamp milkweed	Forb	Asclepiadaceae	*Asclepias incarnata*	✔	✔	✔
Oval-leaved milkweed	Forb	Asclepiadaceae	*Asclepias ovalifolia*	✔	✔	✔
Common milkweed	Forb	Asclepiadaceae	*Asclepias syriaca*	✔	✔	✔
Panicled aster	Forb	Asteraceae	*Aster lanceolatus*	✔	✔	✔
Sky-blue aster	Forb	Asteraceae	*Aster oolentangiensis*	✔	✔	✔
Bluejoint	Grass	Poaceae	*Calamagrostis canadensis*	✔	✔	✔
Harebell	Forb	Campanulaceae	*Campanula rotundifolia*	✔	✔	✔
Field chickweed	Forb	Caryophyllaceae	*Cerastium arvense*	✔	✔	✔
Horseweed	Forb	Asteraceae	*Conyza canadensis*	✔	✔	✔
American hazelnut	Shrub	Betulaceae	*Corylus americana*	✔	✔	✔
Great plains flatsedge	Sedge	Cyperaceae	*Cyperus lupulinus*	✔	✔	✔
Smooth scouring-rush	Grasslike	Equisetaceae	*Equisetum laevigatum*	✔	✔	✔
Purple love grass	Grass	Poaceae	*Eragrostis spectabilis*	✔	✔	✔
Lesser daisy fleabane	Forb	Asteraceae	*Erigeron strigosus*	✔	✔	✔
Common strawberry	Forb	Rosaceae	*Fragaria virginiana*	✔	✔	✔
Northern bedstraw	Forb	Rubiaceae	*Galium boreale ssp. septentrionale*	✔	✔	✔
Fowl manna grass	Grass	Poaceae	*Glyceria striata*	✔	✔	✔
Alumroot	Forb	Saxifragaceae	*Heuchera richardsonii*	✔	✔	✔
Spotted touch-me-not, jewel-weed	Forb	Balsaminaceae	*Impatiens capensis*	✔	✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Wild veiny pea	Vine	Fabaceae	*Lathyrus venosus var. intonsus*	✔	✔	✔
Michigan lily	Forb	Liliaceae	*Lilium michiganense*	✔	✔	✔
Cut-leaved water hoarhound (bugleweed)	Forb	Lamiaceae	*Lycopus americanus*	✔	✔	✔
Wild bergamot	Forb	Lamiaceae	*Monarda fistulosa*	✔	✔	✔
Sensitive fern (bead fern)	Fern	Dryopteridaceae	*Onoclea sensibilis*	✔	✔	✔
Virginia creeper	Vine	Vitaceae	*Parthenocissus quinquefolia*	✔	✔	✔
Downy phlox (praire phlox)	Forb	Polemoniaceae	*Phlox pilosa ssp. fulgida*	✔	✔	✔
Virginia ground cherry	Forb	Solanaceae	*Physalis virginiana*	✔	✔	✔
Kentucky blue-grass	Grass	Poaceae	*Poa pratensis var. pratensis*	✔	✔	
Quaking aspen	Tree	Salicaceae	*Populus tremuloides*	✔	✔	✔
Rough cinquefoil	Forb	Rosaceae	*Potentilla norvegica*	✔	✔	✔
Smooth rattlesnake-root	Forb	Asteraceae	*Prenanthes racemosa*	✔	✔	✔
Bur oak	Tree	Fagaceae	*Quercus macrocarpa*	✔	✔	✔
Northern red oak	Tree	Fagaceae	*Quercus rubra*	✔	✔	✔
Little bluestem	Grass	Poaceae	*Schizachyrium scoparium var. frequens*	✔	✔	✔
Marsh skullcap	Forb	Lamiaceae	*Scutellaria galericulata*	✔	✔	✔
Canada goldenrod	Forb	Asteraceae	*Solidago canadensis var. canadensis*	✔	✔	✔
Giant goldenrod	Forb	Asteraceae	*Solidago gigantea var. gigantea*	✔	✔	✔
Hard-leaved goldenrod (stiff goldenrod)	Forb	Asteraceae	*Solidago ridiga var. rigida*	✔	✔	✔
Field sow thistle	Forb	Asteraceae	*Sonchus arvensis*	✔	✔	
Indian grass	Grass	Poaceae	*Sorghastrum nutans*	✔	✔	✔
Woundwort (hedge-nettle)	Forb	Lamiaceae	*Stachys palustris ssp. palustris*	✔	✔	✔
Alsike clover	Forb	Fabaceae	*Trifolium hybridum*	✔	✔	
Red clover	Forb	Fabaceae	*Trifolium pratense*	✔	✔	
Late low blueberry	Shrub	Ericaceae	*Vaccinium angustifolium*	✔	✔	✔
Blue vervain	Forb	Verbenaceae	*Verbena hastata*	✔	✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Culver's-root	Forb	Scrophulariaceae	*Veronicastrum virginicum*	✔	✔	✔
Purple vetch (American vetch)	Forb	Fabaceae	*Vicia americana*	✔	✔	✔
Prairie bird-floot violet	Forb	Violaceae	*Viola pedatifida*	✔	✔	✔
Quack grass	Grass	Poaceae	*Agropyron repens var. repens*		✔	
Wheatgrass	Grass	Poaceae	*Agropyron trachycaulum*		✔	✔
Rough bent-grass	Grass	Poaceae	*Agrostis scabra*		✔	✔
Redtop	Grass	Poaceae	*Agrostis stolonifera*		✔	
Speckled alder	Shrub/Tree	Betulaceae	*Alnus incana ssp. rugosa*		✔	✔
Western ragweed	Forb	Asteraceae	*Ambrosia coronopifolia*		✔	✔
Juneberry; serviceberry; saska	Shrub/Tree	Rosaceae	*Amelanchier sp.*		✔	✔
Thimbleweed	Forb	Ranunculaceae	*Anemone cylindrica*		✔	✔
Two-leaf anemone	Forb	Ranunculaceae	*Anemone quinquefolia var. bifolia*		✔	✔
Plantain-leaved pussytoes	Forb	Asteraceae	*Antennaria plantaginifolia*		✔	✔
Spreading dogbane	Forb	Apocynaceae	*Apocynum androsaemifolium*		✔	✔
Hairy rock-cress	Forb	Brassicaceae	*Arabis hirsuta var. adpressipilis*		✔	✔
Wild sarsaparilla	Forb	Araliaceae	*Aralia nudicaulis*		✔	✔
Bog aster	Forb	Asteraceae	*Aster borealis*		✔	✔
Heath aster	Forb	Asteraceae	*Aster ericoides ssp. ericoides*		✔	✔
Red-stemmed aster	Forb	Asteraceae	*Aster puniceus*		✔	✔
Flat-topped aster	Forb	Asteraceae	*Aster umbellatus*		✔	✔
Nodding bur-marigold	Forb	Asteraceae	*Bidens cernua*		✔	✔
Common beggar-ticks	Forb	Asteraceae	*Bidens vulgata*		✔	✔
Blue grama	Grass	Poaceae	*Bouteloua gracilis*		✔	✔
Fringed brome	Grass	Poaceae	*Bromus ciliatus*		✔	✔
Kalm's brome	Grass	Poaceae	*Bromus kalmii*		✔	✔
Slim-stem reed grass	Grass	Poaceae	*Calamagrostis neglecta*		✔	✔
Sand reedgrass	Grass	Poaceae	*Calamovil falongifolia*		✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Wild calla	Forb	Araceae	*Calla palustris*		✔	✔
Marsh marigold	Forb	Ranunculaceae	*Caltha palustris*		✔	✔
Marsh bellflower	Forb	Campanulaceae	*Campanula aparinoides var. aparinoides*		✔	✔
Bebb's sedge	Grass	Cyperaceae	*Carex bebbii*		✔	✔
Buxbaum's sedge	Grass	Cyperaceae	*Carex buxbaumii*		✔	✔
Creeping sedge	Grass	Cyperaceae	*Carex chordorrhiza*		✔	✔
Openfield sedge	Grass	Cyperaceae	*Carex conoidea*		✔	✔
Lesser panicled sedge	Grass	Cyperaceae	*Carex diandra*		✔	✔
Dryspike sedge	Grass	Cyperaceae	*Carex foenea*		✔	✔
Hayden's sedge	Grass	Cyperaceae	*Carex haydenii*		✔	✔
Inland sedge	Grass	Cyperaceae	*Carex interior*		✔	✔
Hairy sedge	Grass	Cyperaceae	*Carex lacustris*		✔	✔
Woolly sedge	Grass	Cyperaceae	*Carex lanuginosa*		✔	✔
Woolyfruit sedge	Grass	Cyperaceae	*Carex lasiocarpa var. americana*		✔	✔
Obtuse sedge	Grass	Cyperaceae	*Carex obtusata*		✔	✔
Pennsylvania sedge	Grass	Cyperaceae	*Carex pensylvanica*		✔	✔
Prairie sedge	Grass	Cyperaceae	*Carex prairea*		✔	✔
Sartwell's sedge	Grass	Cyperaceae	*Carex sartwellii*		✔	✔
Broom sedge	Grass	Cyperaceae	*Carex scoparia*		✔	✔
Upright sedge	Grass	Cyperaceae	*Carex stricta*		✔	✔
Rigid sedge	Grass	Cyperaceae	*Carex tetanica*		✔	✔
Indian paint-brush	Forb	Scrophulariaceae	*Castilleja coccinea*		✔	✔
Turtlehead	Forb	Scrophulariaceae	*Chelone glabra*		✔	✔
Narrow-leaved lamb's quarters	Forb	Chenopodiaceae	*Chenopodium desiccatum*		✔	✔
Bulb-bearing water-hemlock	Forb	Apiaceae	*Cicuta bulbifera*		✔	✔
Water-hemlock	Forb	Apiaceae	*Cicuta maculata*		✔	✔
Hill's thistle	Forb	Asteraceae	*Cirsium hillii*		✔	✔
Swamp thistle	Forb	Asteraceae	*Cirsium muticum*		✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Bastard toad-flax	Forb	Santalaceae	*Comandra umbellata*		✔	✔
Stiff tickseed	Forb	Asteraceae	*Coreopsis palmata*		✔	✔
Red-osier dogwood	Shrub/Tree	Cornaceae	*Cornus stolonifera*		✔	✔
Tick-trefoil	Forb	Fabaceae	*Desmodium canadense*		✔	✔
Crested fern	Forb	Dryopteridaceae	*Dryopteris cristata*		✔	✔
Marginal shield fern	Forb	Dryopteridaceae	*Dryopteris marginalis*		✔	✔
Fringed willowherb	Forb	Onagraceae	*Epilobium glandulosum*		✔	✔
Linear-leaved willow-herb	Forb	Onagraceae	*Epilobium leptophyllum*		✔	✔
Field horsetail	Forb	Equisetaceae	*Equisetum arvense*		✔	✔
Cotton-grass	Grass	Cyperaceae	*Eriophorum angustifolium*		✔	✔
Spotted joe-pye weed	Forb	Asteraceae	*Eupatorium maculatum*		✔	✔
Common boneset	Forb	Asteraceae	*Eupatorium perfoliatum*		✔	✔
Grass-leaved goldenrod	Forb	Asteraceae	*Euthamia graminifolia*		✔	✔
Marsh bedstraw	Forb	Rubiaceae	*Galium labradoricum*		✔	✔
Stiff marsh bedstraw	Forb	Rubiaceae	*Galium tinctorium*		✔	✔
Small bedstraw	Forb	Rubiaceae	*Galium trifidum*		✔	✔
Closed gentian	Forb	Gentianaceae	*Gentiana andrewsii var. andrewsii*		✔	✔
Smaller fringed gentian	Forb	Gentianaceae	*Gentianopsis procera*		✔	✔
Wild geranium	Forb	Geraniaceae	*Geranium maculatum*		✔	✔
Yellow avens	Forb	Rosaceae	*Geum aleppicum var. strictum*		✔	✔
Prairie smoke	Forb	Rosaceae	*Geum triflorum var. triflorum*		✔	✔
Creeping charlie	Forb	Lamiaceae	*Glechoma hederacea*		✔	
Sneezeweed	Forb	Asteraceae	*Helenium autumnale*		✔	✔
Hoary frostweed	Forb	Cistaceae	*Helianthemum bicknellii*		✔	✔
Giant sunflower	Forb	Asteraceae	*Helianthus giganteus*		✔	✔
Stiff sunflower	Forb	Asteraceae	*Helianthus rigidus ssp. rigidus*		✔	✔
Ox-eye	Forb	Asteraceae	*Heliopsis helianthoides ssp. occidentalis*		✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Hawkweed	Forb	Asteraceae	*Hieracium kalmii*		✔	✔
Sweet grass, vanilla grass	Grass	Poaceae	*Hierochloe odorata ssp. hirta*		✔	✔
Blue flag	Forb	Iridaceae	*Iris versicolor*		✔	✔
Path rush	Grass	Juncaceae	*Juncus tenuis*		✔	✔
Vasey's rush	Grass	Juncaceae	*Juncus vaseyi*		✔	✔
June grass	Grass	Poaceae	*Koeleria macrantha*		✔	✔
Two-flowered cynthia	Forb	Asteraceae	*Krigia biflora*		✔	✔
Pale vetchling	Forb	Fabaceae	*Lathyrus ochroleucus*		✔	✔
Marsh vetchling	Forb	Fabaceae	*Lathyrus palustris var. palustris*		✔	✔
Prairie pinweed	Forb	Cistaceae	*Lechea stricta*		✔	✔
Rice cut grass	Grass	Poaceae	*Leersia oryzoides*		✔	✔
Lesser duckweed	Forb	Lemnaceae	*Lemna minor*		✔	✔
Round-headed bush-clover	Forb	Fabaceae	*Lespedeza capitata*		✔	✔
Rough blazing star	Forb	Asteraceae	*Liatris aspera*		✔	✔
Gay-feather	Forb	Asteraceae	*Liatris pycnostachya*		✔	✔
Loesel's twayblade	Forb	Orchidaceae	*Liparis loeselii*		✔	✔
Hoary puccoon	Forb	Boraginaceae	*Lithospermum canescens*		✔	✔
Rough-spiked lobelia	Forb	Campanulaceae	*Lobelia spicata*		✔	✔
Woodrush	Grass	Cyperaceae	*Luzula multiflora*		✔	✔
Northern bugleweed	Forb	Lamiaceae	*Lycopus uniflorus*		✔	✔
Fringed loosestrife	Forb	Primulaceae	*Lysimachia ciliata*		✔	✔
Yellow loosestrife	Forb	Primulaceae	*Lysimachia terrestris*		✔	✔
Tufted loosestrife	Forb	Primulaceae	*Lysimachia thyrsiflora*		✔	✔
Canada mayflower	Forb	Liliaceae	*Maianthemum canadense*		✔	✔
Spiked muhly	Grass	Poaceae	*Muhlenbergia glomerata*		✔	✔
Common evening-primrose	Forb	Onagraceae	*Oenothera biennis*		✔	✔
Adder's-tongue	Forb	Ophioglossaceae	*Ophioglossum pusillum*		✔	✔
Northern panic grass	Grass	Poaceae	*Panicum boreale*		✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Early panic grass	Grass	Poaceae	*Panicum lanuginosum var. praecocius*		✔	✔
Leiberg's panic grass	Grass	Poaceae	*Panicum leibergii*		✔	✔
Long-leaved panic grass	Grass	Poaceae	*Panicum perlongum*		✔	✔
Wood-betony	Forb	Scrophulariaceae	*Pedicularis canadensis*		✔	✔
Swamp lousewort	Forb	Scrophulariaceae	*Pedicularis lanceolata*		✔	✔
Slender beard-tongue	Forb	Scrophulariaceae	*Penstemon gracilis*		✔	✔
White prairie-clover	Forb	Fabaceae	*Petalostemon candidum*		✔	✔
Purple prairie-clover	Forb	Fabaceae	*Petalostemon purpureum*		✔	✔
Timothy	Grass	Poaceae	*Phleum pratense*		✔	
Jack pine	Tree	Pinaceae	*Pinus banksiana*		✔	✔
Tubercled rein-orchid	Forb	Orchidaceae	*Platanthera flava var. herbiola*		✔	✔
Tall northern orchid	Forb	Orchidaceae	*Platanthera hyperborea*		✔	✔
Ragged fringed orchid	Forb	Orchidaceae	*Platanthera lacera*		✔	✔
Purple fringed orchid	Forb	Orchidaceae	*Platanthera psycodes*		✔	✔
Fowl meadow grass	Grass	Poaceae	*Poa palustris*		✔	✔
Purple milkwort	Forb	Polygalaceae	*Polygala sanguinea*		✔	✔
Water smartweed	Forb	Polygonaceae	*Polygonum amphibium var. stipulaceum*		✔	✔
Nodding smartweed	Forb	Polygonaceae	*Polygonum lapathifolium*		✔	✔
Dotted smartweed	Forb	Polygonaceae	*Polygonum punctatum*		✔	✔
Arrow-leaved tearthumb	Forb	Polygonaceae	*Polygonum sagittatum*		✔	✔
Tall cinquefoil	Forb	Rosaceae	*Potentilla arguta*		✔	✔
Marsh cinquefoil	Forb	Rosaceae	*Potentilla palustris var. villosa*		✔	✔
Choke cherry	Shrub/Tree	Rosaceae	*Prunus virginiana*		✔	✔
Virginia mountain-mint	Forb	Lamiaceae	*Pycnanthemum virginianum*		✔	✔
Northern pin oak	Tree	Fagaceae	*Quercus ellipsoidalis*		✔	✔
Smooth sumac	Shrub/Tree	Anacardiaceae	*Rhus glabra*		✔	✔
Poison ivy	Shrub/Forb/ Vine	Anacardiaceae	*Rhus radicans*		✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Prairie rose	Shrub	Rosaceae	*Rosa arkansana var. arkansana*		✔	✔
Northern dewberry	Shrub	Rosaceae	*Rubus flagellaris*		✔	✔
Dwarf blackberry	Forb/Shrub	Rosaceae	*Rubus pubescens*		✔	✔
Red raspberry	Shrub	Rosaceae	*Rubus strigosus*		✔	✔
Red sorrel	Forb	Polygonaceae	*Rumex acetosella*		✔	
Great waterdock	Forb	Polygonaceae	*Rumex orbiculatus*		✔	✔
Bebb's willow	Shrub/Tree	Salicaceae	*Salix bebbiana*		✔	✔
Sage-leaved willow	Shrub	Salicaceae	*Salix candida*		✔	✔
Pussy willow	Shrub/Tree	Salicaceae	*Salix discolor*		✔	✔
Heart-leaved willow	Shrub/Tree	Salicaceae	*Salix eriocephala*		✔	✔
Slender willow	Shrub/Tree	Salicaceae	*Salix gracilis*		✔	✔
Bog willow	Shrub	Salicaceae	*Salix pedicellaris var. hypoglauca*		✔	✔
Meadow willow	Shrub/Tree	Salicaceae	*Salix petiolaris*		✔	✔
Swamp saxifrage	Forb	Saxifragaceae	*Saxifraga pensylvanica*		✔	✔
Wool-grass	Grass	Cyperaceae	*Scirpus cyperinus*		✔	✔
Mad-dog skullcap	Forb	Lamiaceae	*Scutellaria lateriflora*		✔	✔
Golden ragwort	Forb	Asteraceae	*Senecio aureus*		✔	✔
Blue-eyed grass	Forb	Iridaceae	*Sisyrinchium campestre*		✔	✔
Water-parsnip	Forb	Apiaceae	*Sium suave*		✔	✔
Starry false Solomon's-seal	Forb	Liliaceae	*Smilacina stellata*		✔	✔
Gray goldenrod	Forb	Asteraceae	*Solidago nemoralis var. nemoralis*		✔	✔
Showy goldenrod	Forb	Asteraceae	*Solidago speciosa*		✔	✔
Prairie cordgrass	Grass	Poaceae	*Spartina pectinata*		✔	✔
Prairie wedge grass	Grass	Poaceae	*Sphenopholis obtusata*		✔	✔
Meadowsweet	Shrub	Rosaceae	*Spiraea alba*		✔	✔
Porcupine grass	Grass	Poaceae	*Stipa spartea*		✔	✔
Common dandelion	Forb	Asteraceae	*Taraxacum officinale*		✔	✔
Tall meadow rue	Forb	Ranunculaceae	*Thalictrum dasycarpum*		✔	✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Early meadow rue	Forb	Ranunculaceae	*Thalictrum dioicum*		✔	✔
Northern marsh fern	Forb	Thelypteridaceae	*Thelypteris palustris*		✔	✔
Yellow goat's-beard	Forb	Asteraceae	*Tragopogon dubius*		✔	
Marsh St. John's-wort	Forb	Clusiaceae	*Triadenum fraseri*		✔	✔
White clover	Forb	Fabaceae	*Trifolium repens*		✔	
Broad-leaved cattail	Forb	Typhaceae	*Typha latifolia*		✔	✔
Skullcap speedwell	Forb	Scrophulariaceae	*Veronica scutellata var. scutellata*		✔	✔
Northern bog violet	Forb	Violaceae	*Viola nephrophylla*		✔	✔
Kidney-leaf violet	Forb	Violaceae	*Viola renifolia*		✔	✔
Common blue violet	Forb	Violaceae	*Viola sororia*		✔	✔
Golden alexanders	Forb	Apiaceae	*Zizia aurea*		✔	✔
Box elder	Tree	Aceraceae	*Acer negundo*	✔		✔
Sweet flag (calamus)	Forb	Acorraceae	*Acorus americanus*	✔		✔
Tall hairy agrimony	Forb	Rosaceae	*Agrimonia striata*	✔		✔
Redtop grass	Grass	Poaceae	*Agrostis gigantea*	✔		
Tickle (hair) grass	Grass	Poaceae	*Agrostis hyemalis*	✔		✔
Wild garlic	Forb	Liliaceae	*Allium canadense*	✔		✔
Green amaranth	Forb	Amaranthaceae	*Amaranthus retroflexus*	✔		
Common ragweed	Forb	Asteraceae	*Ambrosia artemisiifolia*	✔		✔
Intermediate indian hemp	Forb	Apocynaceae	*Apocynum cannabinum*	✔		✔
Columbine	Forb	Ranunculaceae	*Aquilegia canadensis*	✔		✔
Common burdock	Forb	Asteraceae	*Arctium minus*	✔		
Absinthe wormwood	Forb	Asteraceae	*Artemisia absinthium*	✔		
Lady fern	Fern	Dryopteridaceae	*Athyrium filix-femina*	✔		✔
Oats	Grass	Poaceae	*Avena sativa*	✔		
Winter cress	Forb	Brassicaceae	*Barbarea vulgaris*	✔		
Sticktight beggar-ticks	Forb	Asteraceae	*Bidens frondosa*	✔		✔
Black mustard	Forb	Brassicaceae	*Brassica nigra*	✔		
Mouse-ear chickweed	Forb	Caryophyllaceae	*Cerastium vulgatum*	✔		

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Lamb's-quarters (pigweed)	Forb	Chenopodiaceae	*Chenopodium album*	✔		
Narrow-leaved goosefoot	Forb	Chenopodiaceae	*Chenopodium leptophyllum*	✔		✔
Goosefoot	Forb	Chenopodiaceae	*Chenopodium polyspermum*	✔		
Enchanter's nightshade	Forb	Onagraceae	*Circaea lutentiana*	✔		✔
Canada thistle	Forb	Asteraceae	*Cirsium arvense*	✔		
Field thistle	Forb	Asteraceae	*Cirsium discolor*	✔		✔
Bull thistle	Forb	Asteraceae	*Cirsium vulgare*	✔		
Red-osier dogwood	Shrub	Cornaceae	*Cornus sericea*	✔		✔
Pear hawthorn	Shrub/Tree	Rosaceae	*Crataegus calpodendron*	✔		✔
Narrow-leaved hawksbeard	Forb	Asteraceae	*Crepis tectorum*	✔		
Winged pigweed	Forb	Chenopodiaceae	*Cycloloma atriplicifolium*	✔		✔
Hound's-tongue	Forb	Boraginaceae	*Cynoglossum officinale*	✔		
Schweinitz's cyperus	Sedge	Cyperaceae	*Cyperus schweinitzii*	✔		✔
Purple prairie clover	Forb	Fabaceae	*Dalea purpurea*	✔		✔
Panic grass	Grass	Poaceae	*Dichanthelium depauperatum*	✔		✔
Common water weed	submergent	Hydrocharitaceae	*Elodea canadensis*	✔		✔
Quackgrass	Grass	Poaceae	*Elytrigia repens*	✔		
Wood strawberry	Forb	Rosaceae	*Fragaria vesca*	✔		✔
Brittle-stem hemp-nettle	Forb	Lamiaceae	*Galeopsis tetrahit*	✔		
White avens	Forb	Rosaceae	*Geum canadense*	✔		✔
Rough pennyroyal	Forb	Lamiaceae	*Hedeoma hispida*	✔		✔
Canada hawkweed	Forb	Asteraceae	*Hieracium canadense*	✔		✔
Foxtail (barley)	Grass	Poaceae	*Hordeum jubatum*	✔		✔
Dwarf juniper	Shrub	Cupressaceae	*Juniperus communis*	✔		✔
Tall blue lettuce	Forb	Asteraceae	*Lactuca biennis*	✔		✔
Wild lettuce	Forb	Asteraceae	*Lactuca canadensis*	✔		✔
Prairie lettuce	Forb	Asteraceae	*Lactuca ludoviciana*	✔		✔
Bristly sheepburr	Forb	Boraginaceae	*Lappula squarrosa*	✔		
Pinweed	Forb	Cistaceae	*Lechea tenuifolia*	✔		✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Prairie pepperweed	Forb	Brassicaceae	*Lepidium densiflorum*	✔		✔
Butter-and-eggs (toadflax)	Forb	Scrophulariaceae	*Linaria vulgaris*	✔		
Wild blue flax	Forb	Linaceae	*Linum perenne*	✔		
Canada honeysuckle	Shrub	Caprifoliaceae	*Lonicera canadensis*	✔		✔
Starry-false Solomon's seal	Forb	Liliaceae	*Maianthemum stellatum*	✔		✔
Dwarf mallow	Forb	Malvaceae	*Malva rotundifolia*	✔		
Ostrich fern	Fern	Dryopteraceae	*Matteuccia struthiopteris*	✔		✔
Alfalfa (lucerne)	Forb	Fabaceae	*Medicago sativa*	✔		
Hairy umbrellawort	Forb	Nyctaginaceae	*Mirabilis hirsuta*	✔		✔
Grove sandwort	Forb	Caryophyllaceae	*Moehringia lateriflora*	✔		✔
Carpetweed	Forb	Molluginaceae	*Mollugo verticillata*	✔		
Catnip	Forb	Lamiaceae	*Nepeta cataria*	✔		
Yellow wood-sorrel	Forb	Oxalidaceae	*Oxalis stricta*	✔		✔
Switch grass	Grass	Poaceae	*Panicum virgatum*	✔		✔
Pensylvanica pellitory	Forb	Urticaceae	*Parietaria pensylvanica*	✔		✔
Reed canary grass	Grass	Poaceae	*Phalaris arundinacea*	✔		✔
Lopseed	Forb	Verbenaceae	*Phryma leptostachya*	✔		✔
Norway or red pine	Tree	Pinaceae	*Pinus resinosa*	✔		
Common plantain	Forb	Plantaginaceae	*Plantago major*	✔		
Woolly plantain	Forb	Plantaginaceae	*Plantago patagonica*	✔		
Black bindweed	Forb	Polygonaceae	*Polygonum convolvulus*	✔		
Lady's thumb (redleg)	Forb	Polygonaceae	*Polygonum persicaria*	✔		
Purslane	Forb	Portulacaceae	*Portulaca oleracea*	✔		
Rough fruited cinquefoil	Forb	Rosaceae	*Potentilla recta*	✔		
Common cinquefoil	Forb	Rosaceae	*Potentilla simplex*	✔		✔
Pin cherry	Tree	Rosaceae	*Prunus pensylvanica*	✔		✔
Bristly buttercup	Forb	Ranunculaceae	*Ranunculus pensylvanicus*	✔		✔
Alderleaf buckthorn	Shrub	Rhamnaceae	*Rhamnus alnifolia*	✔		✔
Common buckthorn	Shrub	Rhamnaceae	*Rhamnus cathartica*	✔		
Missouri gooseberry	Shrub	Grossulariaceae	*Ribes missouriense*	✔		✔

List of Plant Species Found on Crane Meadows NWR (Continued)

Common Name	Type	Family	Scientific Name	Reference		Native
				Refuge List	DNR Releve	
Wild red raspberry	Shrub	Rosaceae	*Rubus idaeus*	✔		✔
Black-eyed susan	Forb	Asteraceae	*Rudbeckia hirta var. pulcherrima*	✔		✔
Saltwort	Forb	Chenopodiaceae	*Salsola kali*	✔		✔
Figwort	Forb	Scrophulariaceae	*Scrophularia lanceolata*	✔		✔
Smaller skullcap	Forb	Lamiaceae	*Scutellaria parvula*	✔		✔
Green bristle-grass	Grass	Poaceae	*Setaria viridis*	✔		
Starry campion	Forb	Caryophyllaceae	*Silene latifolia*	✔		
Wild mustard (charlock)	Forb	Brassicaceae	*Sinapis arvensis*	✔		
Carrion-flower	Forb	Liliaceae	*Smilax lasioneura*	✔		✔
Drop sand-seed	Grass	Poaceae	*Sporobolus cryptandrus*	✔		✔
Common chickweed	Forb	Caryophyllaceae	*Stellaria media*	✔		
Poison ivy	Shrub	Anacardiaceae	*Toxicodendron rydbergii*	✔		✔
Rabbit-foot clover	Forb	Fabaceae	*Trifolium arvense*	✔		
American elm	Tree	Ulmaceae	*Ulmus americana*	✔		✔
Stinging nettle	Forb	Urticaceae	*Urtica dioica*	✔		
Common mullein	Forb	Scrophulariaceae	*Verbascum thapsus*	✔		
Hoary vervain	Forb	Verbenaceae	*Verbena stricta*	✔		✔
Hairy vetch	Forb	Fabaceae	*Vicia villosa*	✔		
Sweet white violet	Forb	Violaceae	*Viola blanda*	✔		✔
Prickly-ash	Shrub	Rutaceae	*Zanthoxylum americanum*	✔		✔

Appendix D: Regional Conservation Priority Species

Regional Conservation Priority Species, Crane Meadows NWR

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
MAMMALS											
Gray wolf	*Canis lupus*	✔							✔	Visitor	Federally listed endangered (recovering)/ state-listed threatened, state special concern
BIRDS											
Common Loon	*Gavia immer*				✔	✔				Breeding	Rare, declining
Double-crested Cormorant	*Phalacrocorax auritus*				✔	✔				Summer Visitor	Nuisance
American Bittern	*Botaurus lentiginosus*		✔			✔				Breeding	Rare, declining
Least Bittern	*Ixobrychus exilis*					✔				Breeding	Rare, declining
Black-crowned Night-Heron	*Nycticorax nycticorax*			✔		✔	✔	✔		Summer Visitor	Rare, declining
Pied-billed Grebe	*Podilymbus podiceps*				✔	✔				Breeding	Low density?
Horned Grebe	*Podiceps auritus*				✔	✔				Migrant	Rare, declining/state-listed threatened
Snow Goose	*Chen caerulescens*				✔	✔				Migrant	Recreational/ Nuisance
Canada Goose-resident (giants)	*Branta canadensis*				✔	✔				Breeding	Recreational/ Nuisance
Canada Goose-migrant (giants)	*Branta canadensis maxima*				✔	✔				Migrant	Recreational

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
Trumpeter Swan	*Cygnus buccinator*				✔	✔	✔			Summer Visitor	Rare, declining/ state-listed threatened
Wood Duck	*Aix sponsa*	✔				✔	✔			Breeding	Recreational
American Black Duck	*Anas rubripes*				✔	✔				Migrant	Recreational
Mallard	*Anas platyrhynchos*	✔	✔			✔				Breeding	Recreational
Northern Pintail	*Anas acuta*		✔			✔				Migrant	Recreational/Rare, declining
Blue-winged Teal	*Anas discors*		✔			✔				Breeding	Recreational
Canvasback	*Aythya valisineria*				✔	✔	✔			Migrant	Recreational/ declining
Lesser Scaup	*Aythya affinis*				✔	✔	✔			Migrant	Recreational/ Rare, declining
Bald Eagle	*Haliaeetus leucocephalus*	✔			✔		✔			Breeding, Winter Migrant	Endangered Species Act delisted, Tribal trust/ state-protected, state special concern
Peregrine Falcon	*Falco peregrinus anatum*	✔	✔			✔	✔	✔	✔	Summer Visitor, Migrant	Rare, declining/ Endangered Species Act delisted/state-listed threatened
Northern Goshawk	*Accipiter gentilis*	✔								Migrant, Winter	Rare, declining
Red-shouldered Hawk	*Buteo lineatus*	✔								Breeding	Rare, declining/state special concern
Northern Harrier	*Circus cyaneus*		✔			✔				Breeding	Declining
Short-eared Owl	*Asio flammeus*		✔							Migrant	Rare, declining/state special concern
Long-eared Owl	*Asio otus*	✔							✔	Breeding	Rare, declining

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
Yellow Rail	*Coturnicops noveboracensis*			✔		✔				Breeding?, Migrant	Rare, declining/state special concern
Lesser Yellowlegs	*Tringa flavipes*			✔	✔	✔				Migrant	Rare, declining
Greater Yellowlegs	*Tringa melanoleuca*			✔	✔	✔				Migrant	Rare, declining
Solitary Sandpiper	*Tringa solitaria*				✔	✔	✔	✔		Migrant	Rare, declining
Semipalmated Sandpiper	*Calidris pusilla*			✔	✔	✔	✔			Migrant	Rare, declining
Upland Sandpiper	*Bartramia longicauda*		✔							Breeding	Rare, declining
Whooping Crane	*Grus americana*		✔	✔		✔				Summer visitor, rare migrant	Threatened (non-essential experimental population), federally listed endangered
American Woodcock	*Scolopax minor*	✔		✔		✔				Breeding	Recreational/ Rare, declining
Black Tern	*Chlidonias niger*				✔	✔				Breeding	Rare, declining
Forister's Tern	*Sterna forsteri*				✔	✔				Mirgrant	Rare, declining/state special concern
Short-billed Dowitcher	*Limnodromus griseus*				✔	✔	✔			Migrant	Rare, declining
Wilson's Phalarope	*Phalaropus tricolor*				✔	✔				Migrant	Rare, declining/state-listed threatened
Willow Flycatcher	*Empidonax traillii*	✔		✔				✔		Breeding	Rare, declining
Olive-sided Flycatcher	*Contopus cooperi*	✔								Potential, not confirmed	Rare, declining
Loggerhead Shrike	*Lanius ludovicianus*		✔						✔	Breeding	Rare, declining/state-listed threatened

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
Marsh Wren	*Cistothorus palustris*					✔		✔		Breeding	Rare, declining
Sedge Wren	*Cistothorus platensis*			✔		✔				Breeding	Rare, declining
Brown Thrasher	*Toxostoma rufum*		✔						✔	Breeding	Declining
Veery	*Catharus fuscescens*	✔					✔	✔		Breeding	Declining?
Wood Thrush	*Hylocichla mustelina*	✔								Migrant	Rare, declining
Golden-winged Warbler	*Vermivora chrysoptera*	✔								Breeding	Rare, declining
Canada Warbler	*Wilsonia canadensis*									Migrant	Rare, declining
Bobolink	*Dolichonyx oryzivorus*		✔							Breeding	Rare, declining
Western Meadowlark	*Sturnella neglecta*		✔							Breeding	Rare, declining
Eastern Meadowlark	*Sturnella magna*		✔							Breeding	Rare, declining
Rusty Blackbird	*Euphagus carolinus*	✔								Migrant	Rare, declining
Black-billed Cuckoo	*Coccyzus erythropthalmus*	✔					✔	✔		Breeding	Rare, declining
Red-headed Woodpecker	*Melanerpes erythrocephalus*	✔								Breeding	Rare, declining
Northern Flicker	*Colaptes auratus*	✔								Breeding	Declining
Dickcissel	*Spiza americana*		✔							Breeding	Rare, declining
Field Sparrow	*Spizella pusilla*		✔						✔	Breeding	Rare, declining

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
Grasshopper Sparrow	*Ammodramus savannarum*		✔						✔	Breeding	Rare, declining
Le Conte's Sparrow	*Ammodramus leconteii*		✔	✔		✔				Breeding	Rare, declining
Henslow's Sparrow	*Ammodramus henslowii*		✔							Potential, not confirmed	Rare, declining/state-listed endangered
Nelson's Sparrow	*Ammodramus nelsoni*			✔		✔		✔		Breeding?, Migrant	Rare, declining/state special concern
Orchard Oriole	*Icterus spurius*	✔							✔	Potential, not confirmed	Rare, declining
Louisiana Waterthrush	*Seiurus motacilla*	✔					✔			Potential, not confirmed	Rare, declining
FISH											
Brook trout (inland pop.)	*Salvelinus fontinalis*						✔			Potential	Rare, declining/ Recreational
Walleye (1836 Ceded Territory)	*Stizostedion vitreum*				✔		✔			Confirmed presence	Recreational/ Tribal trust
Muskellunge (1836)	*Esox masquinongy*				✔		✔			Potential, spawn	Recreational/ Tribal trust
Log perch	*Percina evermanni*				✔		✔			Potential	Rare, declining
Yellow perch	*Perca flavescens*				✔					Confirmed presence	Rare, declining/ Recreational

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
MUSSELS											
Black sandshell	*Ligumia recta*						✔			Confirmed presence	Rare, declining (range overlaps commercial harvested areas)/ SC
Elktoe	*Alasmidonta marginata*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/ST
Mapleleaf	*Quadrula quadrula*				✔		✔			Potential, not confirmed	Recreational
Monkeyface	*Quadrula metanevra*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/state-listed threatened
Round pigtoe	*Pleurobema coccineum*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/ state-listed threatened
Threeridge	*Amblema plicata*						✔			Potential, not confirmed	Recreational
Winged mapleleaf	*Quadrula fragosa*						✔			Potential, not confirmed	Federally-listed endangered, state-listed endangered
Snuffbox	*Epioblasma triquetra*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/state-listed threatened
Salamander mussel	*Simpsonaias ambigua*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/state-listed threatened
Pistolgrip	*Tritogonia verrucosa*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/ state-listed threatened

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
Higgins' eye pearlymussel	*Lampsilis higginsi*						✔			Potential, not confirmed	Federally listed endangered, state-listed endangered
Scaleshell mussel	*Leptodea leptodon*						✔			Potential, not confirmed	Federally listed endangered
Washboard	*Megalonaias nervosa*						✔			Potential, not confirmed	state-listed threatened/ Recreational
Sheepnose	*Plethobasus cyphyus*						✔			Potential, not confirmed	Rare, declining (range overlaps commercial harvested areas)/state-listed endangered
Fat pocketbook	*Potamilus capax*						✔			Potential, not confirmed	Federally listed endangered
Asiatic clam	*Corbicula fluminea*						✔			Potential, not confirmed	Nuisance, Exotic
Zebra mussel	*Dreissena polymorpha*				✔		✔			Potential, not confirmed	Nuisance, Exotic
SNAILS											
Crested vertigo	*Vertigo cristata*	X								Potential, not confirmed	Rare, declining
Six-whorl vertigo	*Vertigo morsei*					✔				Potential, not confirmed	Rare, declining
Mystery vertigo	*Vertigo paradoxa*	✔								Potential, not confirmed	Rare, declining
CRUSTACEANS											
Rusty crayfish	*Orconectes rusticus*				✔		✔			Resident	Nuisance, Exotic

Regional Conservation Priority Species, Crane Meadows NWR (Continued)

Species or Group	Scientific Name	Habitat								Lifestage/ Use	Concern
		Woodlands	Prairie	Sedge Meadow	Open Water	Marsh	River/ Stream	Swamp	Oak Savanna		
INSECTS											
Karner blue butterfly	*Lycaeides melissa samuelis*	✔							✔	Potential, not confirmed	Federally listed endangered
Hungerford's crawling water beetle	*Brychius hungerfordi*						✔			Potential, not confirmed	Federally listed endangered
Dakota skipper	*Hesperia dacotae*		✔							Potential, not confirmed	Rare, declining
Ottoe skipper	*Hesperia ottoe*		✔							Potential, not confirmed	Rare, declining
Powesheik skipper	*Oarisma powesheik*		✔							Potential, not confirmed	Rare, declining
PLANTS											
Prairie bush-clover	*Lespedeza leptostachya*		✔							Potential, not confirmed	Federally listed threatened
Western prairie fringed orchid	*Platanthera praeclara*					✔				Potential, not confirmed	Federally listed threatened
Earleaf foxglove	*Agalinis auriculata*		✔						✔	Potential, not confirmed	Rare, declining
Roundstem foxglove	*Agalinis gattingeri*		✔						✔	Potential, not confirmed	Rare, declining

Appendix E: Deferred Maintenance and Improvement Projects

Deferred Maintenance and Improvement Projects

Project Number	Project Description	Estimated Cost
2008858032	Crane Meadows NWR Interpretive Trail	$130,000
2008858036	Repair Deteriorated Items on Maintenance Shop	$150,000
2008858140	Crane Meadows NWR Service Entrance Road (Platte River West Unit)	$41,000
2008858147	Crane Meadows NWR Service Entrance Road (Headquarters Unit)	$41,000
2008858150	Crane Meadows NWR Entrance Road	$81,000
2008858152	Crane Meadows NWR Trailhead Parking Lot	$11,000
2008858153	Rehabilitate Deficiencies on the Headquarters Building	$27,000
2008858155	Crane Meadows NWR Rehab Residence (Sedge Meadow Unit)	$10,000
2008858165	Rehab Deficiencies on Barn Storage	$34,000

Appendix F: Compliance Requirements

Rivers and Harbor Act (1899) (33 U.S.C. 403)

Section 10 of this Act requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States.

Antiquities Act of 1906. 16 U.S.C. 431 et seq.

Authorizes the scientific investigation of antiquities on federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Migratory Bird Treaty Act, 16 U.S.C. 703 et seq.

Designates the protection of migratory birds as a federal responsibility. This Act enables the setting of seasons, and other regulations including the closing of areas, federal or non federal, to the hunting of migratory birds.

Migratory Bird Conservation Act, 16 U.S.C. 715 et seq.

Establishes procedures for acquisition by purchase, rental, or gift of areas approved by the Migratory Bird Conservation Commission.

Fish and Wildlife Coordination Act 16 U.S.C. 661 et seq. (1934)

Requires that the Fish and Wildlife Service and state fish and wildlife agencies be consulted whenever water is to be impounded, diverted or modified under a federal permit or license. The Service and state agency recommend measures to prevent the loss of biological resources, or to mitigate or compensate for the damage. The project proponent must take biological resource values into account and adopt justifiable protection measures to obtain maximum overall project benefits. A 1958 amendment added provisions to recognize the vital contribution of wildlife resources to the Nation and to require equal consideration and coordination of wildlife conservation with other water resources development programs. It also authorized the Secretary of Interior to provide public fishing areas and accept donations of lands and funds.

Migratory Bird Hunting Stamp Act. Also known as the Duck Stamp Act, 16 U.S.C. 718 et seq. (1934)

Requires every waterfowl hunter 16 years of age or older to carry a stamp and earmarks proceeds of the Duck Stamps to buy or lease waterfowl habitat. A 1958 amendment authorizes the acquisition of small wetland and pothole areas to be designated as 'Waterfowl Production Areas,' which may be acquired without the limitations and requirements of the Migratory Bird Conservation Act.

Historic Sites, Buildings and Antiquities Act. Also known as the Historic Sites Act of 1935, 16 U.S.C. 461 et seq.

Declares it a national policy to preserve historic sites and objects of national significance, including those located on refuges. Provides procedures for designation, acquisition, administration, and protection of such sites.

Refuge Revenue Sharing Act,16 U.S.C. 715s (1935)

Requires revenue sharing provisions to all fee-title ownerships that are administered solely or primarily by the Secretary through the Service.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act, 16 U.S.C. 667b-667d (1948)

Provides that upon a determination by the Administrator of the General Services Administration, real property no longer needed by a federal agency can be transferred without reimbursement to the Secretary of Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes.

Federal Records Act of 1950, 44 U.S.C. 31

Directs the preservation of evidence of the government's organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

Fish and Wildlife Act of 1956, 16 U.S.C. 742a et seq.

Established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges.

Refuge Recreation Act, 16 U.S.C. 460k et seq. (1962)

Allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient funds are available to manage the uses.

Wilderness Act of 1964, 16 U.S.C. 1131 et seq.

Directed the Secretary of Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System, with final decisions made by Congress. The Secretary of Agriculture was directed to study and recommend suitable areas in the National Forest System.

Land and Water Conservation Fund Act of 1965, 16 U.S.C. 460 et seq.

Uses the receipts from the sale of surplus federal land, outer continental shelf oil and gas sales, and other sources for land acquisition under several authorities.

National Wildlife Refuge System Administration Act of 1966, 16 U.S.C. 668dd, 668ee

Defines the National Wildlife Refuge System and authorizes the Secretary to permit any use of a refuge provided such use is compatible with the major purposes for which the refuge was established. The Refuge Improvement Act clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, or environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of Interior for managing and protecting the System; and requires a Comprehensive Conservation Plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

National Historic Preservation Act, 16 U.S.C. 470 et seq. (1966)

Establishes as policy that the federal government is to provide leadership in the preservation of the nation's prehistoric and historic resources. Section 106 requires federal agencies to consider impacts their undertakings could have on historic properties; Section 110 requires federal agencies to manage historic properties, e.g., to document historic properties prior to destruction or damage; Section 101 requires federal agencies to consider Indian tribal values in historic preservation programs, and requires each federal agency to establish a program leading to inventory of all historic properties on its land.

Architectural Barriers Act of 1968, 42 U.S.C. 4151 et seq.

Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq.

Requires the disclosure of the environmental impacts of any major federal action significantly affecting the quality of the human environment.

Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, 42 U.S.C. 4601 et seq.

Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.

Endangered Species Act of 1973, 16 U.S.C. 1531 et seq.

Requires all federal agencies to carry out programs for the conservation of endangered and threatened species.

Rehabilitation Act of 1973, 29 U.S.C. 701 et seq.

Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the federal government to ensure that anybody can participate in any program.

Archaeological and Historic Preservation Act 16 U.S.C.469-469c

Directs the preservation of historic and archaeological data in federal construction projects.

Clean Water Act of 1977, 33 U.S.C. 1251

Requires consultation with the Corps of Engineers (404 permits) for major wetland modifications.

Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1201 et seq.

Regulates surface mining activities and reclamation of coal-mined lands. Further regulates the coal industry by designating certain areas as unsuitable for coal mining operations.

Executive Order 11988 (1977)

Each federal agency shall provide leadership and take action to reduce the risk of flood loss and minimize the impact of floods on human safety, and preserve the natural and beneficial values served by the floodplains.

Executive Order 11990

Executive Order 11990 directs federal agencies to (1) minimize destruction, loss, or degradation of wetlands and (2) preserve and enhance the natural and beneficial values of wetlands when a practical alternative exists.

Executive Order 12372 (Intergovernmental Review of Federal Programs)

Directs the Service to send copies of the Environmental Assessment to state planning agencies for review.

American Indian Religious Freedom Act, 42 U.S.C. 1996, 1996a (1976)

Directs agencies to consult with native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve American Indian religious cultural rights and practices.

Fish and Wildlife Improvement Act of 1978, 16 U.S.C. 742a

Improves the administration of fish and wildlife programs and amends several earlier laws including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out a volunteer program.

Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa et seq.

Protects materials of archaeological interest from unauthorized removal or destruction and requires federal managers to develop plans and schedules to locate archaeological resources.

Farmland Protection Policy Act, Public Law 97-98, 7 U.S.C. 4201 (1981)

Minimizes the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.

Emergency Wetlands Resources Act of 1986, 16 U.S.C. 3901 et seq.

Promotes the conservation of migratory waterfowl and offsets or prevents the serious loss of wetlands by the acquisition of wetlands and other essential habitats.

Federal Noxious Weed Act of 1974, 7 U.S.C. 2801 et seq.

Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other federal and state agencies.

Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001 et seq. (1990)

Requires federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

Americans with Disabilities Act of 1990, 42 U.S.C. 12101 et seq.

Prohibits discrimination in public accommodations and services.

Executive Order 12898 (1994)

Establishes environmental justice as a federal government priority and directs all federal agencies to make environmental justice part of their mission. Environmental justice calls for fair distribution of environmental hazards.

Executive Order 12996 Management and General Public Use of the National Wildlife Refuge System (1996)

Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the System.

Executive Order 13007 Indian Sacred Sites (1996)

Directs federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where appropriate, maintain the confidentiality of sacred sites.

National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd

Considered the "Organic Act of the National Wildlife Refuge System. Defines the mission of the System, designates priority wildlife-dependent public uses, and calls for comprehensive refuge planning. Section 6 requires the Service to make a determination of compatibility of existing, new and changing uses of Refuge land; and Section 7 requires the Service to identify and describe the archaeological and cultural values of the refuge.

The Act also directs the administration of the Refuge System to ensure the biological integrity, diversity, and environmental health of the System. According to the U.S. FWS Service Manual (601 FW3) this refers to the maintenance of existing elements, and where appropriate the restoration of lost or severely degraded elements. Integrity pertains to biotic composition, structure, and function at genetic, organismal, and community levels. Diversity includes protection of the broad variety of living organisms, genetic distinctions, and community compositions. Environmental health recognizes the importance of both biotic and abiotic features and processes in the System. The standard of measure for each of these terms is defined using historic conditions, or conditions and processes present prior to substantial anthropogenic changes, as indicated by the best available science and sound professional judgment.

National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998, 16 U.S.C. 742a

Amends the Fish and Wildlife Act of 1956 to promote volunteer programs and community partnerships for the benefit of national wildlife refuges, and for other purposes.

National Trails System Act, 16 U.S.C. 1241 et seq. (1968)

Assigns responsibility to the Secretary of Interior and thus the Service to protect the historic and recreational values of congressionally designated National Historic Trail sites.

Treasury and General Government Appropriations Act, Pub. L. 106-554, §1(a)(3), Dec. 21, 2000, 114 Stat. 2763, 2763A–125

In December 2002, Congress required federal agencies to publish their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information that they disseminate to the public (44 U.S.C. 3502). The amended language is included in Section 515(a). The Office of Budget and Management (OMB) directed agencies to develop their own guidelines to address the requirements of the law. The Department of the Interior instructed bureaus to prepare separate guidelines on how they would apply the Act. The U.S. Fish and Wildlife Service has developed "Information Quality Guidelines" to address the law.

Cultural Resources and Historic Preservation

The National Wildlife Refuge System Improvement Act of 1997, Section 6, requires the Service to make a determination of compatibility of existing, new and changing uses of Refuge land; and Section 7 requires the Service to identify and describe the archaeological and cultural values of the refuge.

The National Historic Preservation Act (NHPA), Section 106, requires federal agencies to consider impacts their undertakings could have on historic properties; Section 110 requires federal agencies to manage historic properties, e.g., to document historic properties prior to destruction or damage; Section 101 requires federal agencies consider Indian tribal values in historic preservation programs, and requires each federal agency to establish a program leading to inventory of all historic properties on its land.

The Archaeological Resources Protection Act of 1979 (ARPA) prohibits unauthorized disturbance of archeological resources on federal and Indian land; and other matters. Section 10 requires establishing "a program to increase public awareness" of archeological resources. Section 14 requires plans to survey lands and a schedule for surveying lands with "the most scientifically valuable archaeological resources." This Act requires protection of all archeological sites more than 100 years old (not just sites meeting the criteria for the National Register) on federal land, and requires archeological investigations on federal land be performed in the public interest by qualified persons.

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) imposes serious delays on a project when human remains or other cultural items are encountered in the absence of a plan.

The American Indian Religious Freedom Act (AIRFA) iterates the right of Native Americans to free exercise of traditional religions and use of sacred places.

EO 13007, Indian Sacred Sites (1996), directs federal agencies to accommodate access to and ceremonial use, to avoid adverse effects and avoid blocking access, and to enter into early consultation.

Appendix G: Compatibility Determinations

Environmental Education and Interpretation 164
Firewood Cutting/Timber Harvest 167
Fishing 170
Hunting 172
Research Programs by Third Parties 176
Wildlife Observation and Photography 179

COMPATIBILITY DETERMINATION

Use: Environmental Education and Interpretation

Refuge Name: Crane Meadows NWR

Establishing and Acquisition Authorities:

- Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)) & (16 U.S.C. 742f(b)(1))
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b), 100 Stat. 3583)

Refuge Purpose(s):

Crane Meadows National Wildlife Refuge was established in 1992…

- "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)

National Wildlife System Mission:

The National Wildlife Refuge System mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee).

Description of Use:

What is the use? The Refuge conducts wildlife interpretation and environmental education programs. Refuge staff prepare, schedule, and organize formal programs for school-aged children and other organized groups upon request. In most cases, curriculums and program schedules are prepared in advance. These curriculums address a number of wildlife conservation topics such as oak savanna restoration, wetland conservation, prescribed fire management, protection of water resources, migratory bird management, and the conservation of endangered species. Informal programs are also common, and include casual visitors, self-guided tours along public roads and nature trails, impromptu presentations and discussions of wildlife conservation issues with interested citizens, and visitation by unscheduled groups. Visitation and use of the Refuge by local educators and their classes would also be classified as an informal program.

Where is the use conducted? Refuge trails and the shop can be utilized as environmental education and interpretation sites for schools, natural resource organizations, and other visitors to the Refuge. Staff will assist teachers with group visits and presentations on the Refuge, and also present numerous programs and demonstrations off-refuge.

When is the use conducted? Visitation to the Refuge, specifically the Headquarters Unit, is available daily during daylight hours. Programs are conducted year round with weekday programs for school groups and some weekend activities for special public programs. Currently, the Refuge provides environmental education to 750 to 1,250 students per year, and to an additional 2,000 to 3,000 people per year for interpretation events/opportunities on the Refuge.

How is the use conducted? In most cases, programs are scheduled in advance. There are also impromptu presentations and discussions of wildlife conservation issues by Refuge staff with interested citizens, casual visitors, and unscheduled groups. Group size varies from just a few people to larger groups during educational field days. Interpretive and environmental education programs are provided on the Refuge by Refuge staff and volunteers. Teachers may also give programs if a Refuge curriculum is developed.

Interpretive or environmental education programs focus on wildlife and habitats. These programs address a number of wildlife conservation issues including wetland and savanna conservation, water resources protection, migratory bird management, and endangered species conservation. Programs also involve development of outdoor skills, which enhance appreciation of wildlife and their associated habitats. The Refuge provides public

facilities which support environmental education and interpretation, including the shop area available for use by groups of up to 100 people, along with, 60 pairs of snowshoes, 30 pairs of field binoculars, the Platte River Trail for hiking and cross-country skiing, a restroom at the Platte River Trailhead, and the green house. The Refuge also offers four annual programs co-sponsored by the Friends of Crane Meadows NWR and are free to the public. The Refuge partners with the Friends of Crane Meadows NWR to provide environmental education opportunities to teachers and students.

Why is the use being proposed? Interpretation and environmental education are priority general public uses of the National Wildlife Refuge System. The programs promote understanding and appreciation of natural and cultural resources and their management on all lands and waters of the Refuge System. The Refuge is proposing this use to interpret Refuge resources to local school children, adults, and the visiting public, and educate them about broader conservation issues that would promote support for the Refuge System, migratory birds, habitat conservation, conservation issues, and a greater appreciation of our natural resources.

Availability of Resources:

Approximately 0.5 FTE will be required to administer and manage these activities adequately. In addition, maintenance and improvement of Refuge interpretive signs, trails, and visitor center displays will periodically be required. The total estimated cost per year would range from $50,000 to $75,000. Based on a review of the Refuge budget allocated for these activities, there is currently sufficient funding to ensure compatibility and to administer and manage the existing use. Strategies to improve the environmental education and program have been identified and would require hiring another FTE to capture the potential for this area.

The CCP recommends additional staffing and facilities to support interpretation and an expanded environmental education program. Greater numbers of people would learn about, and benefit from, the Refuge with additional staff and interpretative materials. Additional staff would be able to provide teacher workshops, Refuge orientations, and would help develop site-specific curricula, materials, and activities linked to state standards. Students and teachers would also be able to participate in coordinated restoration and monitoring programs through long-term monitoring studies.

Anticipated Impacts of the Use:

Short-term impacts: The overall impacts to the Refuge and its associated wildlife populations from environmental education and interpretation would be minimal. There would be some disturbance to wildlife and vegetation at the locations where interpretive programs occur, but at levels that would not interfere with the purposes of the Refuge. School buses and personal vehicles would utilize developed roads and parking areas to access trails which are already in place. Self-guided interpretation would be sporadic, by small groups of people, and at established trails and kiosks. This may cause short term disturbance as well, but would have minimal impact.

Long-term impacts: Anticipated long-term impacts are beneficial to the Refuge, as these activities promote a conservation ethic in the local community. This use would increase in the future if a new visitor reception area is added, and an additional staff position with visitor services responsibilities is added as proposed in the CCP. As improvements are made there may be some additional short-term, localized disturbance, but use would continue to be in existing developed areas.

Cumulative impacts: There are no anticipated cumulative impacts. Other public uses such as wildlife observation and photography at the same sites used for environmental education and interpretation may increase over time, but it is not anticipated to be significant enough to cause cumulative impacts. The cumulative impacts of educating the public about conservation issues would be beneficial to meeting the Service mission and Refuge purposes.

Public Review and Comment:

This compatibility determination is part of the Draft CCP and EA for Crane Meadows NWR. Public notification and review includes a notice of availability published in the Federal Register, 30-day comment period, local media announcements, and a public meeting at the Refuge. Comments received and agency responses will be included in the final CCP.

Determination:

_____ Use is not compatible.

__X__ Use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility:

To ensure compatibility with National Wildlife Refuge System and Crane Meadows NWR goals and objectives the activity can only occur under the following stipulations:

1. The Refuge is open to public access year-round during daylight hours.
2. Environmental education and interpretation activities that are not led by Refuge staff would require verbal approval or a Special Use Permit

by the Refuge Manager to minimize conflicts with other groups, safeguard students and resources, and to allow tracking of use levels.

3. Educational groups are required to have a sufficient number of adults to supervise their groups.
4. Harassment of wildlife or excessive damage to vegetation is prohibited.
5. Use of motorized vehicles is limited to maintained roads and parking areas.
6. Camping, overnight use, and fires are prohibited.

Justification:

Provided compliance with the above stipulations, interpretation and environmental education have been determined compatible because the use would benefit the conservation role of the Refuge, would cause minimal disturbance to wildlife and habitats, and would not increase costs to the Refuge with the exception of adding a staff position with visitor services responsibilities when funds allow. The level of use would be light to moderate, and generally consolidated to developed public-use areas (roads, parking lots, and trails). The associated disturbance to wildlife is temporary and minor. Interpretation and environmental education are priority public uses that help fulfill the mission of the National Wildlife Refuge System. This use would not materially interfere with or detract from Refuge purposes.

Refuge Manager: s/Anne Sittauer, Aug. 25, 2010

Concurrence:

Regional Chief: s/Rick Schultz, Sept. 14, 2010

Mandatory 10 or 15 year Re-evaluation Date: 2025

COMPATIBILITY DETERMINATION

Use: Firewood Cutting/Timber Harvest

Refuge Name: Crane Meadows National Wildlife Refuge

Establishing and Acquisition Authorities:

- Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)) & (16 U.S.C. 742f(b)(1))
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b), 100 Stat. 3583)

Refuge Purpose(s):

- Crane Meadows National Wildlife Refuge was established in 1992…"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)

National Wildlife System Mission:

The National Wildlife Refuge System mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee).

Description of Use:

What is the use? The removal of standing or fallen trees by contractors or private individuals on Crane Meadows NWR. This covers all wood removal activities regardless of the ultimate use of the wood (i.e., firewood, timber, pulp, wood chips, etc.). This use is not wildlife-dependent but may affect local wildlife populations.

Where is the use conducted? Throughout all property held in fee-title at Crane Meadows National Wildlife Refuge. Harvestable cover types on the Refuge include bottomland and upland forest, oak savanna, and any remaining areas of tree plantations. The Refuge acquisition boundary currently contains approximately 435 acres of northern floodplain forest which hosts ash, American elm, box elder, basswood; 1,180 acres of oak woodland containing bur oak, pin oak, northern red oak, white oak, basswood, and American elm; 670 acres of oak-aspen woodland containing northern pin oak, with quaking aspen, paper birch, big-toothed aspen, bur oak, northern red oak or red pine; 200 acres of conifer plantation with jack, red, and white pine; 85 acres of jack pine woodland; and 185 acres of oak savanna - primarily bur oak. During timber harvest and wood cutting activities, buffers will be implemented according to best management practices around wetlands, rivers, and creeks to prevent erosion, sedimentation, and pollution thereby limiting degradation of water quality.

When is the use conducted? Wood removal activities may be authorized throughout the year. Most often, removal of dead, dry, or cured firewood will occur from September through December. Some of this wood may then be used for the upcoming prescribed burn season. Commercial harvest activities will most likely occur during the winter months. During winter, frozen ground will facilitate access while providing protection to underlying soils and vegetation, and to adjacent wetlands by reducing sedimentation and erosion. Due to the extensive wetland system on the Refuge, access and working conditions are generally limited by hydric soils and open water. Cutting or harvesting activities will be prohibited from April 15th to July 1st to prevent the spread of oak wilt, a fungal disease affecting oak trees.

How is the use conducted? Harvest may include standing and fallen trees for personal use and commercial timber harvest. Equipment used for harvest may range from chainsaws and axes, to traditional logging equipment such as feller-bunchers and log skidders. Access may be by car and trailer, pick-up truck, farm tractor, or larger traditional logging equipment, and must be approved by the Refuge Manager. Differences in scope and necessary equipment will occur depending on the amount and type of wood available for removal. Fire wood cutters must be issued a special use permit. Commercial

harvesting will be awarded through a bidding process. The number of people participating in this activity will vary from year to year depending on need and weather cycles.

Why is the use being proposed? This activity will only occur where the Service has determined that a management need exists to remove wood. Wood removal may be desirable where trees are encroaching on hiking trails, fire breaks and/or roads, open marshes, grassland areas, or degrading earthen water impoundment structures. Most timber removal will occur in heavily wooded areas. These thinnings are intended to restore oak savanna habitat. Also, tree harvest serves the purpose of improving forest diversity and health through thinning, creating openings, removal of invasive tree species, and suppressing the transmission of oak wilt and other diseases. Wood cutting is not a priority public use, as defined by the Refuge Improvement Act of 1997, of the National Wildlife Refuge System.

Availability of Resources: Periodic and small-scale harvest operations can be adequately administered with existing staff resources. Planning, issuing permits, and monitoring a wood product harvest program would require a minimal commitment of staff hours. In the past, the Refuge has issued approximately six permits annually for this activity. All harvest sites are marked with flagging tape or paint by Refuge staff. Based on past activity, we estimate that administering a small timber harvest program will require from $1,000 to $2000 in staff salary costs. If larger timber harvests are needed salary cost could be as much as $5,000. Large-scale operations affecting many acres would have to be deferred until staff and funding are available. By permitting a wood products harvest, the manager has identified a management need and will have secured and prioritized the necessary station resources.

Anticipated Impacts of the Use:

Short-term impacts: Many wildlife species may be affected by tree harvest activities. Key waterfowl species using tree cavities for nesting include wood duck, common goldeneye and hooded merganser. Many other bird species use forested habitat for nesting, roosting, protective cover, or feeding. Examples of important species include: bald eagle, red-shouldered hawk, barred owl, several woodpecker species, and many passerine bird species. The forests are also important to a variety of mammals, reptiles and amphibians, insects, and flowering plants.

During harvest activities, wildlife would be displaced to adjacent areas, though this disturbance is not likely to have a measurable impact and would be mitigated by timing and duration of harvest, i.e., larger harvests conducted during winter months when most avian species have migrated. Potential adverse impacts include: short-term loss of site-specific habitats; short-term fragmentation of the landscape with resulting impact to bird use and productivity; loss of dead whole trees on the ground; soil disturbance that may increase exotic plant invasion and erosion; damage to roads and wetlands from equipment; damage to cultural resources; reduced visual esthetics; and disturbance to wildlife and visitors from cutting operations. These impacts are generally short-term in nature and on relatively small areas, and can be controlled to a large extent by permit conditions and management oversight. In addition, many of these impacts can be avoided by the timing of the activity in accordance with site specific characteristics and requiring equipment be cleaned prior to entering the Refuge to minimize the potential spread of invasive or invasive-exotic species. Required cultural resource surveys and actions would be conducted as determined in consultation with the Service's Regional Historic Preservation Officer prior to the initiation of any mechanized logging operation.

Long-term impacts: Carefully managed harvest would provide long-term benefits to wildlife and plants by improving overall forest and savanna structure, composition, and health. Potential positive impacts include: restoration, maintenance and enhancement of forest and savanna habitats; maintained or increased forest diversity (age, species, and structure), and provision of essential habitat requirements for declining savanna-dependent plant and animal species.

The removal of woody vegetation facilitates native habitat restoration efforts on the Refuge. While habitat transition from forest to savanna will displace species which depend on dense forest cover, forested areas thinned to oak savanna densities would restore a threatened and declining habitat, and support associated savanna wildlife species.

Cumulative impacts: Much of the land adjacent to the Refuge was cleared for agriculture over the past century and a half. Tree harvest may continue to occur on lands adjacent to the Refuge, which would cause cumulative disturbance or changes in broader regional forest habitat. However, historical records indicate that forest cover in the area of the Refuge was minimal in the past, and has only increased over the past century due to the elimination of major disturbance mechanisms - primarily fire.

Implementing tree harvest in addition to prescribed fire as forest management tools will benefit the ecosystem by promptly setting back succession

and maintaining native oak savannas and prairie openings - habitats that have been significantly reduced throughout the Nation by fragmentation and degradation. These restoration efforts will also benefit many declining migratory birds and other wildlife species dependent on "open" habitats.

Potentially negative cumulative impacts within the Refuge and in the watershed downstream of the Refuge may include water quality issues associated with deforestation – particularly sedimentation, erosion, and pollution resulting from tree removal near wetlands, rivers, or creeks; and the spread of invasive/exotic species and tree diseases resulting from equipment use and transport of wood. However, these impacts could be mitigated through controlling the timing, frequency, and duration of the harvest activities in accordance with forest management planning, and by applying best management practices.

Public Review and Comment:

This compatibility determination is part of the Draft CCP and EA for Crane Meadows NWR. Public notification and review includes a notice of availability published in the Federal Register, 30-day comment period, local media announcements, and a public meeting at the Refuge. Comments received and agency responses will be included in the final CCP.

Determination:

_____ Use is not compatible.

__X__Use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility:

To ensure compatibility with National Wildlife Refuge System and Crane Meadows NWR goals and objectives the activity can only occur under the following stipulations:

1. Any tree cutting must meet specific habitat and related wildlife objectives and contribute to the purposes of the Refuge.
2. A special use permit will be issued so that Service management goals are met, and to reduce or eliminate site specific impacts to habitat, fish and wildlife resources, cultural resources, and the visiting public.
3. When possible, vehicle access for wood removal will be limited to existing roads, trails, or fire breaks. In addition, timing of removal activities will be restricted to prevent excessive damage to actively growing vegetation, disturbance to wildlife, and the spread of tree disease. Appropriate timing (i.e., late summer which is typically dry following the growing season or during winter when the ground is frozen) is also necessary to prevent unnecessary site damage such as soil rutting.
4. Commercial equipment must be cleaned prior to entering the Refuge.
5. Standing cavity trees which are actively being used by wildlife will be marked and protected.

Justification:

Tree harvest has been determined to be compatible because beneficial impacts would far out-weigh any foreseeable negative impacts, the activity can be controlled by permits, and tree harvest will ultimately benefit habitats and wildlife species on the Refuge. Indirect impacts of tree harvest are generally considered positive and thus do not materially interfere with or detract from the purpose of the Refuge or the Refuge System mission. Individuals participating in the wood harvest program will be guided by a special use permit, and thus, site specific stipulations will ensure resource protection and achievement of management goals.

Historical accounts of tree density in the upland areas of the Refuge depict primarily oak and jack pine savanna conditions - not the dense forest cover which is present in many areas today. The removal of trees at strategic locations will benefit habitat restoration objectives and increase the extent of these rare savanna habitats. Furthermore, control of woody species encroachment on wetland and grassland habitats is a necessary management activity and directly supports the mission of the National Wildlife Refuge System.

The removal of some dead trees reduces fuel buildup and the severity of potential wildfires. Openings created by woodcutting allows light to penetrate and stimulate the understory growth which increases woodland diversity. Impacts to the habitat as a result of access for wood removal purposes are potentially significant, but are also easily avoided via permit stipulations. Any direct impacts on wildlife production and survival (take, disturbance, etc.) can be largely avoided by timing the activity so that it does not coincide with the breeding/production season. Adverse impacts from harvest would be short-term and more than offset by the long-term benefits for wildlife and plants.

Refuge Manager: Anne Sittauer, Aug. 25, 2010

Concurrence:

Regional Chief: s/Rick Schultz, Sept. 14, 2010

Mandatory 10 or 15 year Re-evaluation Date: 2020

COMPATIBILITY DETERMINATION

Use: Fishing

Refuge Name: Crane Meadows NWR

Establishing and Acquisition Authorities:

- Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)) & (16 U.S.C. 742f(b)(1))
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b), 100 Stat. 3583)

Refuge Purpose(s):

Crane Meadows National Wildlife Refuge was established in 1992…

- "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)

National Wildlife System Mission:

The National Wildlife Refuge System mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee).

Description of Use:

What is the use? Public fishing from the river banks and lake shores of Service property at Crane Meadows NWR, in accordance with state regulations and seasons.

Where is the use conducted? Currently, all navigable waters of lakes, rivers, and streams associated with the Refuge are managed by the state of Minnesota, and are open to fishing. These areas include Rice, Skunk, and Mud Lakes, the Platte and Skunk Rivers, and Buckman, Rice, and Little Rock Creeks. On Service-owned lands, the shoreline areas of these lakes, rivers, and streams, as well as wetland areas, have not been open to fishing in the past, but are potential fishing sites. In accordance with objectives outlined in the CCP, specific, designated shoreline areas of Crane Meadows NWR may be opened to public bank fishing pending the acceptable results of individual site reviews. These reviews are designed to evaluate management's ability to offer a quality fishing experience opportunity at specified locations with no long-term detrimental effects to land, water, vegetation, or wildlife populations. Furthermore, acquisition of new Refuge lands is an ongoing process, and upon acquisition, newly acquired lands will also be evaluated for the potential to offer quality fishing opportunities.

When is the use conducted? Seasonality and timing of fishing opportunities will be determined as a part of the review for all new fishing sites established at Crane Meadows NWR, and will be consistent with state regulations. Some additional restrictions may be added to meet specific management objectives. The game fish season ordinarily runs from the second Sunday in May through the last Sunday in February, while other seasons for taking of aquatic species including reptiles, amphibians, crustaceans, and bivalves, run from April or May through November to February. All forms of fishing, or entry on any part of the Refuge, may be temporarily suspended by posting during occasions of unusual or critical conditions of, or affecting land, water, vegetation, or wildlife populations.

How is the use conducted? All fishing activities would be conducted with the Refuge's primary goals and objectives as guiding principles. All fishing activities will follow applicable state laws, except where the Refuge administers further restrictions to ensure compatibility with the Refuge's primary purposes and management objectives. Minnesota's recreational fishing regulations allow the traditional take of game fish species with rod and reel from shore, a boat, or through the ice; removal of rough fish by spear, harpoon, archery and dip net; as well as the taking of limited quantities of mussels, crayfish, frogs, minnows and turtles for personal use. Any new sites opened to fishing will have access trails to and from public roads, and for safety reasons, small pull-offs or parking lots may be provided in areas of higher use.

Why is the use being proposed? Fishing is a priority public use on National Wildlife Refuge System lands, as designated in the 1997 National Wildlife Refuge Improvement Act.

Availability of Resources:

Staff time would be required to administer and manage this activity. First, an initial review period would be required to determine if the activity is appropriate for a site, and if a quality experience opportunity can be provided. Once deemed acceptable, site plans would need to be generated followed by development of the area, such as a parking area, trail, fishing platform, signage, etc. Additional expenses associated with management of fishing activities would include fuel use, maintenance costs to Refuge vehicles, inspection and maintenance of any associated trails and parking lots, and sign posting. If Refuge staff choose to open new areas of the Refuge to fishing, an evaluation of the associated costs and management needs will be a part of the planning process. A review of the Refuge budget must corroborate that there is enough funding to ensure compatibility and to administer and manage the use.

Anticipated Impacts of the Use:

Fishing poses no foreseeable detrimental environmental impacts to the Refuge, its habitats, or wildlife species. Fishing activities and harvest of other aquatic species may cause temporary, localized disturbance to habitat (i.e., erosion of river banks, pollution, etc.) and may temporarily impact nearby waterfowl and other wildlife. This disturbance may displace individual animals to other parts of the Refuge. There should be only negligible effects to local fisheries. Anglers are required to harvest only surplus quantities of fish without affecting breeding populations, thereby assuring viable, healthy populations within management and habitat guidelines. Restrictions to the fishing program assure that these activities have no adverse impacts on other wildlife species and little adverse impact on other public use programs. These activities are compliant with the purposes of the Refuge and the mission of the National Wildlife Refuge System. Offering this activity would not alter the Refuge's ability to meet habitat goals, and it can help support several of the primary objectives of the Refuge.

Public Review and Comment:

This compatibility determination is part of the Draft CCP and EA for Crane Meadows NWR. Public notification and review includes a notice of availability published in the Federal Register, 30-day comment period, local media announcements, and a public meeting at the Refuge. Comments received and agency responses will be included in the final CCP.

Determination:

_____ Use is not compatible.

__X__ Use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility:

To ensure compatibility with National Wildlife Refuge System and Crane Meadows NWR goals and objectives the activity can only occur under the following stipulations:

1. Specific areas adjacent to lakes, rivers, streams, and wetlands on the Refuge may be opened to fishing only after site evaluations have demonstrated the presence of a quality fishing experience opportunities and that no long-term, detrimental effects to land, water, vegetation, and wildlife are expected.
2. All applicable state and federal Regulations will apply, except where the Refuge administers further restrictions to ensure compatibility with the Refuge's primary management.
3. Littering or disposal of entrails is prohibited, and all anglers are required to adhere to 'Leave No Trace' practices and ethics.
4. Camping, overnight use, and fires are prohibited.

Justification:

Allowing limited fishing on Crane Meadows NWR, within the stipulations above, would have minimal impact on the wildlife resources of the Refuge. Fishing is a priority public use listed in the 1997 National Wildlife Refuge Improvement Act. Facilitating this use on the Refuge would increase visitors' knowledge and appreciation of fish and wildlife, which leads to increased public stewardship of fish and wildlife and their habitats on the Refuge, and in general. Increased public stewardship supports and complements the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System. This determination was made as part of the environmental assessment associated with the comprehensive conservation planning process.

Refuge Manager: s/Anne Sittauer, Aug. 25, 2010

Concurrence:
Regional Chief: s/Rick Schultz, Sept. 14, 2010

Mandatory 10 or 15 year Re-evaluation Date: 2025

COMPATIBILITY DETERMINATION

Use: Hunting

Refuge Name: Crane Meadows NWR

Establishing and Acquisition Authorities:

- Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)) & (16 U.S.C. 742f(b)(1))
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b), 100 Stat. 3583)

Refuge Purpose(s):

Crane Meadows National Wildlife Refuge was established in 1992…

- "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)

National Wildlife System Mission:

The National Wildlife Refuge System mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee).

Description of Use:

What is the use? Hunting of game is an activity conducted by the public under regulation authority of the National Wildlife Refuge System Improvement Act and the National Wildlife Refuge System. Under the National Wildlife Refuge Improvement Act of 1997 hunting is a priority public use. The Refuge plans to open hunting as a public use within the 15-year life of the CCP, however at this stage in the Refuge's development, the hunting opportunity will take the form of special, managed hunting events for white-tailed deer and turkey.

Where is the use conducted? Refuge hunting areas must meet minimum size criteria in order to offer quality hunting experience opportunities, and must have enforceable boundaries. Within the existing Refuge landholdings, special, managed hunting events will occur primarily on the Headquarters Unit of the Refuge until additional lands are acquired in fee-title by the Refuge to create hunting areas of sufficient size. The west, north, and most of the east sides of the Headquarters Unit are bound by water features, and the south side is bound by Iris Road, simplifying containment of the activity. The Platte River West and Sedge Meadow Units may also be opened in the future as resources allow. Similar to the Headquarters Unit, the Platte River West Unit is bound by natural water features or roads on nearly all sides. In the future it is expected that hunting will be opened on these additional portions of the Refuge, and ultimately Refuge-wide upon full acquisition.

When is the use conducted? Special, managed hunting events for persons with disabilities and for youth will be scheduled at a time coordinated with, and agreed upon by the Minnesota Department of Natural Resources (DNR). There are eight spring turkey hunting periods in the state of Minnesota, each lasting 5 days in length generally starting on the second Wednesday of April. Where possible, managed turkey hunts on the Refuge will coincide with these state seasons and managed deer hunting events will coincide with the state gun deer season in November and December. Typically, deer hunts for persons with disabilities are conducted earlier than the normal Minnesota deer hunting season to coincide with warmer temperatures. The Refuge staff will work with other FWS stations, Camp Ripley, the Minnesota DNR, the Minnesota Deer Hunters Association, organizations devoted to persons with disabilities, as well as other groups to determine the type of hunt, timing, location, and resources needed to conduct a quality hunt.

How is the use conducted? Special, managed white-tailed deer and turkey hunting events will occur in collaboration with partners such as Minnesota DNR, Wheelin' Sportsmen, National Wild Turkey Foundation, Capable Partners, Minnesota Deer Hunters Association, Pheasants Forever, Camp

Ripley, Minnesota State Archery Association, local sportsmen's clubs, and others. These events will require a substantial amount of coordination and support from volunteers, but these efforts will allow the Refuge to open hunting as a use on the Refuge in a controlled and manageable way despite minimal landholdings. They will also allow the Refuge to tailor these events to reach target audiences, including hunters with disabilities and youth hunters. Hunting at Crane Meadows NWR will adhere to the hunting step-down management plan, which will be completed within 2 years of CCP approval and will provide further details for hunting on the Refuge. All hunting activities follow applicable state regulations, except where the Refuge administers further restrictions to ensure a quality hunt and visitor and staff safety.

Why is the use being proposed? Hunting is a priority general public use of the Refuge System that is also an important wildlife management tool. The Service recognizes hunting as a healthy, traditional outdoor pastime, deeply rooted in the American heritage. Hunting can instill a unique understanding and appreciation of wildlife, their behavior, and their habitat needs. Hunting programs can promote understanding and appreciation of natural resources and their management on lands and waters in the Refuge System. A substantial portion of land within the Refuge acquisition boundary is already currently utilized for hunting, including land owned and managed by the Minnesota DNR in wildlife management areas, by private hunting clubs, and by private landowners. Hunting was discussed during initial planning events for the establishment of Crane Meadows NWR, and has been a desired activity on the Refuge ever since.

Availability of Resources:

These events will require a great deal of coordination and collaboration with partners and local hunters. No current staff time is allocated for coordinating hunting activities, but it is anticipated that a considerable amount of time and financial resources will be required to host these managed hunts. A great deal of time would be required to make initial contacts, write grants, and coordinate activities with partners and other contributing groups. Scouting and setup activities would follow, as well as coordinating logistics such as transportation of hunters to and from blinds. It is estimated that at least 160 hours of preparation time would be required to conduct the first special hunt, and that planning would begin a minimum of one year in advance of the event. Once established, it is assumed that planning and setup for successive hunts would be less labor intensive.

A small amount of road maintenance, mowing, and other upkeep will need to be performed, but are funded as part of regular Refuge management activities. Based on a review of the Refuge budget there is currently enough funding to ensure compatibility and to administer and manage the use. Law enforcement is a primary tool necessary to ensure proper and safe administration of this use, and although there is no Law Enforcement Officer stationed at the Refuge, law enforcement services are available through the Service's Regional Law Enforcement Program. The Refuge will work with the Minnesota DNR to ensure that conservation officers are aware of this use on the Refuge, and are available to assist with law enforcement as a part of their routine duties.

Anticipated Impacts of the Use:

Short-term impacts: Providing carefully planned and managed hunting events with restrictions that limit access to specific Refuge locations will generally minimize disturbance to wildlife populations, the environment, and non-consumptive users. Although hunting causes mortality of target species, harvesting populations to the carrying capacity of existing habitat and only taking the harvestable surplus ensures long-term health and survival of game species, populations, and their associated ecosystem. The presence and activity of hunters may cause temporary disturbance to other wildlife in the area, but there are no foreseeable detrimental impacts to these species. Concerns are primarily centered on the possibility of impacting non-target species that are sensitive to disturbance; especially during spring turkey hunting when most animals are breeding or nesting. Non-hunting public uses may be temporarily disrupted or postponed during specialized hunts. Visitor safety and law enforcement issues are the priority when designing and planning all hunting activities on refuges. Vehicle traffic will increase slightly during the hunting events, and the sound of gun shots will temporarily reduce the serenity for the non-hunting public. Loss of plants from foot traffic is minor, or temporary. Soil and plant disturbance may occur in ingress and egress routes, but will be minor and temporary because of the limited and controlled use associated with the managed hunts.

Long-term impacts: No detrimental long-term impacts from hunting are anticipated as long as wildlife populations are monitored through the Refuge biological program or by state officials. Long-term beneficial impacts of this use would be the ability to manage targeted wildlife populations to levels that reflect the carrying capacity of the ecosystem. When deer populations become over-abundant they can have profound negative impacts on their envi-

ronment through herbivory thereby directly and indirectly affecting other native plants and wildlife species.

Cumulative impacts: There are no anticipated cumulative impacts. Harvest on the Refuge would be very limited and would fall within the state's population management goals which are based on the best available information.

All hunts would follow all applicable laws, regulations and policies; including title 50 of the Code of Federal Regulations, the National Wildlife Refuge System Manual, the mission and goals of the National Wildlife Refuge System, and the purposes, goals, and objectives of Crane Meadows NWR. Operating this activity does not hinder the Refuge's ability to meet habitat goals, provides for the safety of the area's citizens, and supports several of the primary objectives of the Refuge. The Environmental Assessment for the Draft CCP for Crane Meadows NWR contains a more detailed discussion of the anticipated impacts of hunting on the Refuge.

Public Review and Comment:

This compatibility determination is part of the Draft CCP and EA for Crane Meadows NWR. Public notification and review includes a notice of availability published in the Federal Register, 30-day comment period, local media announcements, and a public meeting at the Refuge. Comments received and agency responses will be included in the final CCP.

Determination:

_____ Use is not compatible.

__X__Use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility:

To ensure compatibility with National Wildlife Refuge System and Crane Meadows NWR goals and objectives the activity can only occur under the following stipulations:

1. Hunting will only occur on the Refuge during special, managed hunting events, and will adhere to the Refuge's hunting step-down management plan.
2. Appropriate state hunting licenses and antlerless harvest permits (for deer) are required. Deer and turkeys harvested must be registered at MNDNR check stations in accordance with state regulations. All state hunting regulations apply unless otherwise stated in the Refuge hunt plan and state regulations.

- Hunting will only occur within designated areas on the Refuge that meet minimum size requirements and have enforceable boundaries. These areas may include, but are not limited to the following Refuge Units: Headquarters, Platte River West, and Sedge Meadows.
- Use of motorized vehicles is limited to maintained roads and parking areas. Exceptions would be allowed as a means to provide access to hunters with disabilities, but only under the review of the Refuge Manager.
- This use is subject to modification if on-site monitoring by Refuge personnel or other authorized personnel results in unanticipated negative impacts to public safety, wildlife species, or their habitats.
- Camping, overnight use, and fires are prohibited.

Justification:

This use has been determined compatible provided the above stipulations are implemented. This use is being permitted because it is a priority public use and will not diminish the primary purposes of the Refuge. This use will meet the mission of the NWRS by providing renewable resources for the benefit of the American public while conserving fish, wildlife, and plant resources on Refuge lands.

Hunting is one of the six priority wildlife-dependent recreational uses identified in the National Wildlife Refuge System Improvement Act of 1997. Service policy directs us to provide hunting opportunities when compatible with Refuge management, and offering this use was a long-term goal of the Refuge when it was established in 1992. Managed hunting programs help promote an understanding and appreciation of natural resources and their management. Additionally, managed hunts on the Refuge provide a traditional recreational activity with no definable adverse impacts to the biological integrity or habitat sustainability of Refuge resources. The limited size and distribution of current Service land ownership at the Refuge continues to limit our ability to offer quality hunting experience opportunities, but management has long understood the demand for, and importance of providing this activity on the Refuge. By beginning with short-duration, assisted, managed hunts, Refuge staff can provide hunting opportunities in a controlled fashion, direct these activities to specific audiences, and adaptively evaluate the hunting program for expansion or reduction based on demand and program success.

Without a deer hunting program as a management tool, this species could adversely affect plant communities and hence alter ecological diversity and succession. Excessive herbivory by deer populations could result in significant negative impacts to plant and animal communities, including those of special concern, or of Service trust responsibility. This impact has been well documented and accepted through research. Hunting is also an effective management tool to keep turkey populations within ecosystem limits.

Refuge Manager: s/Anne Sittauer, Aug. 25, 2010

Concurrence:

Regional Chief: s/Rick Schultz, Sept. 14, 2010

Mandatory 10 or 15 year Re-evaluation Date: 2025

COMPATIBILITY DETERMINATION

Use: Research Projects by Third Parties

Refuge Name: Crane Meadows NWR

Establishing and Acquisition Authorities:

- Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)) & (16 U.S.C. 742f(b)(1))
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b), 100 Stat. 3583)

Refuge Purpose(s):

Crane Meadows National Wildlife Refuge was established in 1992…

- "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)

National Wildlife System Mission:

The National Wildlife Refuge System mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee).

Description of Use:

What is the use? The Refuge allows research investigations on a variety of biological, physical, archeological, and social components to address Refuge management information needs or other issues not related to Refuge management. Studies are or may be conducted by federal, state, and private entities, including the U.S. Geological Survey, state departments of natural resources, state and private universities, and independent researchers and contractors. This is not a wildlife-dependent use. Examples of past biological research subjects include:

Territory, Nesting, and Habitat Utilization of Greater Sandhill Cranes – St. Cloud State University

Department of Natural Resources, Anoka Sandplain Study – Upland Relevé Plots

Department of Natural Resources, Lake Habitat Surveys

Where is the use conducted? Sites for this use would depend on the particular study being conducted and could occur in a variety of habitat types. Access would be restricted by special use permit to the study sites needed to meet the objectives of the research.

When is the use conducted? The timing of research activities would depend on the individual project, but currently most research occurs during the growing season. The entire Refuge is open for allowed research activities throughout the year in conjunction with the issuance of a special use permit. The timing and number of visits by researchers may be restricted by special use permit.

How is the use conducted? Any research study sites, sampling locations, and transects can be temporarily marked by highly visible wooden or metal posts and must be removed when research ceases. Access to study sites must be approved by the Refuge Manager and may be by foot, truck, all-terrain vehicle, boat, airboat, canoe, and other watercraft. Vehicle use is allowed on Refuge roads, trails, and parking lots normally open to the public.

Why is the use being proposed? Most research by third parties is a collaborative effort between the researcher and Refuge staff. Research activities are generally done to address needs identified by Refuge management, or to contribute to a larger knowledge base about resources of concern on the Refuge.

Availability of Resources:

Facilities and staff are currently available for approval of the research, to provide access, maintain roads, parking lots, secondary access roads, as well as to issue special use permits. Staff resources are deemed adequate to manage this use at anticipated

use levels. Access points, boats, vehicles, miscellaneous equipment, and limited logistical support are available on the Refuge. Housing is not available.

Anticipated Impacts of the Use:

Short-term impacts: Research activities may disturb fish, wildlife, and their associated habitats. For example, the presence of researchers can cause bird species to flush from their nests, resting, and/or feeding areas, cause disruption of other wildlife species from normal activities in their territories, or may increase predation on bird nests as predators and scavengers may follow human scents or trails. Efforts to capture animals can cause disturbance, injury, or death to groups or individual animals. In addition, some projects require the collection of animals and plants for study, thereby removing these animals from the breeding population. To animals that are sensitive to disturbance, the energy cost to evade disturbance may be appreciable and may have temporary or permanent consequences due to extra energy expended, disruption of feeding and/or nesting, or displacement from preferred habitat. Sampling activities can cause disturbance to soils and vegetation when temporary foot trails and/or boat trails through vegetation are established. All equipment or supplies must be adequately marked in the field and removed at appropriate times or upon completion of the project to minimize environmental impact.

Long-term impacts: Long-term effects should generally be beneficial by gaining information valuable to Refuge management. No long-term negative impacts are expected and the Refuge Manager can control the potential for long-term impacts through special use permits.

Cumulative impacts: Cumulative impacts would occur if multiple research projects were occurring on the same resources at the same time, if the duration of the research is excessive, or if the nature of the research is intense, extensive, or invasive. No cumulative impacts are expected and the Refuge Manager can control the potential for cumulative impacts through special use permits. Managers retain the option to prohibit research on the Refuge that does not contribute to the purposes of the Refuge or the mission of the Refuge System, or causes undue resource disturbance or harm.

Public Review and Comment:

This compatibility determination is part of the Draft CCP and EA for Crane Meadows NWR. Public notification and review includes a notice of availability published in the Federal Register, 30-day comment period, local media announcements, and a public meeting at the Refuge. Comments received and agency responses will be included in the final CCP.

Determination:

_____ Use is not compatible.

__X__ Use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility:

To ensure compatibility with National Wildlife Refuge System and Crane Meadows NWR goals and objectives the activity can only occur under the following stipulations:

1. Prior to conducting investigations, researchers will obtain special use permits from the Refuge that make specific stipulations related to when, where, and how the research will be conducted. Managers retain the option to prohibit research on the Refuge which does not contribute to the purposes of the Refuge or the mission of the Refuge System, or causes undo resource disturbance or harm.
2. Researchers must possess all applicable state and federal permits for the capture and possession of protected species, for conducting regulated activities in wetlands, and for other regulated activities.
3. Archeological researchers must obtain an Archeological Resource Protection Act permit from the Regional Director prior to obtaining a special use permit from the Refuge Manager.
4. Researchers will submit annual status reports and a final report related to the research conducted on Refuge resources to appropriate Refuge staff.

Justification:

Research by third parties may play an integral role in Refuge management by providing information needed to manage the Refuge on a sound scientific basis and practice adaptive management. Investigations into the biological, physical, archeological, and social components of the Refuge provide a means to analyze management actions, impacts from internal and external forces, and ongoing natural processes on the Refuge environment. Adverse impacts of research that cause localized vegetation trampling or disruption of wetland bottom sediments are often short-term and would be minimized through stipulations above. Any research equipment that remains in the field for the duration of the project would be clearly marked to avoid potential

hazards presented to other Refuge users and Refuge staff, and removed upon completion of the project.

Refuge Manager: s/Anne Sittauer, Aug. 25, 2010

Concurrence:

Regional Chief: s/Rick Schultz, Sept. 14, 2010

Mandatory 10 or 15 year Re-evaluation Date: 2020

COMPATIBILITY DETERMINATION

Use: Wildlife Observation and Photography (Including the Means of Access)

Refuge Name: Crane Meadows NWR

Establishing and Acquisition Authorities:

- Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(4)) & (16 U.S.C. 742f(b)(1))
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b), 100 Stat. 3583)

Refuge Purpose(s):

Crane Meadows National Wildlife Refuge was established in 1992…

- "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)

National Wildlife System Mission:

The National Wildlife Refuge System mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. (National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee).

Description of Use:

What is the use? The use is general public access to observe and/or photograph wildlife and Refuge habitats on Crane Meadows NWR including the means of access such as automobile, hiking, snowshoeing, and cross-country skiing. Under the National Wildlife Refuge Improvement Act of 1997 wildlife observation and photography are priority public uses. The use is concentrated in areas with developed public access, such as trails and roads, because of the fragmented nature of Service land ownership in the Refuge acquisition boundary and the limited access to many Refuge Units.

Where is the use conducted? Wildlife observation occurs along state, county, township, and Refuge roads, and designated trails throughout the land that is held in fee title; however most of the public use currently occurs on the Headquarters Unit and along the County Soo Line multiple use trail. It is expected that concentrated access and use may occur in the future on the Sedge Meadow Unit as visitor facilities are developed in accordance with the CCP and associated step-down plans.

Most of the Refuge's wildlife observation and photography currently occurs along the Platte River Trail on the Headquarters Unit. The Trail traverses the west and north portions of the Headquarters Parcel. It is circular with four separate, but connecting components. The first loop was initially set up to accommodate persons with disabilities, and is one-tenth of a mile in length. The second loop is 1 mile in length, the third loop is 0.6 mile, and the last loop is 2 miles in length. In 2008 the entire trail system was surfaced with crushed granite to improve accessibility.

Although not managed or maintained by the Service, Morrison County's Soo Line trail is another corridor of concentrated visitor access and use through Refuge lands and provides opportunities for wildlife observation and photography. Currently two Service units (Grewe and Soo Line East) intersect the trail, and this frontage is expected to increase as additional acquisitions are made. Visitors are required to stay on the trail and obey all posted regulations.

When is the use conducted? Priority use activities will be allowed during daylight hours throughout the entire year. Most wildlife observation and photography occurs during the spring, summer, and fall seasons. Less use of the Refuge occurs in the winter due to the cold weather and lack of wildlife activity. Most winter visitation is for cross-country skiing. Snow conditions permitting, the Platte River Trail is groomed regularly throughout the winter season by Refuge staff volunteers.

How is the use conducted? All priority public uses will be conducted with the Service's mission and the Refuge's purposes, goals, and objectives as the guiding principles. Activities done with these considerations in mind allow the Refuge to accomplish its management goals, while providing safe, high quality visitor experience opportunities. The trail system is used by several thousand people each year. That number is expected to increase with increased awareness and recognition of the Refuge. Use is year-round, and is restricted to the trails and roads to minimize disturbance to habitat and the wildlife.

Why is the use being proposed? Priority public uses on National Wildlife Refuge System lands are identified in the Refuge Improvement Act of 1997. Trails provide opportunities for the general public, as well as organized groups such as schools, clubs, scout troops, etc., to use Refuge lands for priority use activities, and at the same time minimize impacts to wildlife habitat by restricting their travels. Access to the Refuge for these priority public uses will help in meeting the goals of the Refuge, as well as the National Wildlife Refuge System.

Availability of Resources:

Approximately $5,000 is spent each year to maintain the trails, observation decks, and the restroom at Crane Meadows NWR. The Platte River Trail is surfaced with crushed granite and the edges mowed as needed. In general, the sides of the trail are mowed after the growing season yet prior to winter to facilitate grooming activities. Costs come out of the annual Refuge budget. Monitoring of the trail is conducted weekly and maintenance occurs as needed. Existing staff and funding are available to administer these activities at their current level. Upgrades to the trail are implemented as necessary.

Anticipated Impacts of the Use:

Priority uses such as wildlife observation and photography have shown no measurable environmental impacts to the Refuge, its habitat, or wildlife species. There is some temporary disturbance to wildlife due to human activity on the land. The most likely impacts will be during spring and early summer when many animals are nesting and brood rearing, and during spring and fall migration. Visitor access is typically by individuals or small groups for short durations. Destruction or negative impacts to habitat and associated vegetation are minimal because public use is confined to trails, and to state, county, township, and Refuge roads. Reducing the size of the impacted area, combined with sporadic, limited use by the public should prevent unacceptable impacts. Winter activities pose little to no impact on vegetation, and winter disturbance to resident wildlife is temporary and minor.

The activities follow all applicable laws, regulations and policies, including: Migratory Bird Conservation Act, Title 50 Code of Federal Regulations, National Wildlife Refuge System Manual, National Wildlife Refuge System goals and objectives, and Refuge goals and objectives.

These activities are compliant with the purpose of the Refuge and the National Wildlife Refuge System Mission. Operating this activity does not alter the Refuge's ability to meet habitat goals and it helps support several of the primary objectives of the Refuge.

Public Review and Comment:

This compatibility determination is part of the Draft CCP and EA for Crane Meadows NWR. Public notification and review includes a notice of availability published in the Federal Register, 30-day comment period, local media announcements, and a public meeting at the Refuge. Comments received and agency responses will be included in the final CCP.

Determination:

_____ Use is not compatible.

__X__Use is compatible with the following stipulations.

Stipulations Necessary to Ensure Compatibility:

To ensure compatibility with National Wildlife Refuge System and Crane Meadows NWR goals and objectives the activity can only occur under the following stipulations:

1. Use is confined to daylight hours.
2. Camping and fires are prohibited.
3. No photo or viewing blinds may be left over night.
4. Harassment of wildlife or excessive damage to vegetation is prohibited.
5. Use is restricted to designated trails and along established state, county, township, and Refuge roads.

Justification:

Wildlife observation and photography are priority public uses listed in the National Wildlife Refuge System Improvement Act (1997). By facilitating these uses on the Refuge, we will increase visitors' knowledge and appreciation of fish and wildlife,

which will potentially lead to increased public stewardship of fish and wildlife and their habitats on the Refuge and elsewhere. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes, and the mission of the National Wildlife Refuge System. The trail network and associated activities of wildlife observation, photography, education, interpretation, and recreation are compatible uses at Crane Meadows NWR.

Refuge Manager: s/Anne Sittauer, Aug. 25, 2010

Concurrence:

Regional Chief: s/Rick Schultz, Sept. 14, 2010

Mandatory 10 or 15 year Re-evaluation Date: 2025

Appendix H: Appropriate Use

Refuge Appropriate Refuge Uses

The Service's Appropriate Use policy describes the initial decision process a refuge manager follows when first considering whether or not to allow a proposed use on a refuge. The refuge manager must first find a use to be appropriate before undertaking a compatibility review of the use and outlining the stipulations of the use.

This policy clarifies and expands on the compatibility policy (603 FW 2.10D(1)), which describes when refuge managers should deny a proposed use without determining compatibility. If we find a proposed use is not appropriate, we will not allow the use and will not prepare a compatibility determination. By screening out proposed uses not appropriate to the refuge, the refuge manager avoids unnecessary compatibility reviews. By following the process for finding the appropriateness of a use, we strengthen and fulfill the Refuge System mission. Although a refuge use may be both appropriate and compatible, the refuge manager retains the authority to not allow the use or modify the use.

Background for this policy as it applies to Muscatatuck NWR is found in the following statutory authorities:

National Wildlife Refuge System Administration Act of 1966, as amended by the *National Wildlife Refuge System Improvement Act of 1997* (16 U.S.C. 668dd-668ee). This law provides the authority for establishing policies and regulations governing refuge uses, including the authority to prohibit certain harmful activities. The Administration Act does not authorize any particular use, but rather authorizes the Secretary of the Interior to allow uses only when they are compatible. The Improvement Act provides the Refuge System mission and includes specific directives and a clear hierarchy of public uses on the Refuge System.

Refuge Recreation Act of 1962, (16 U.S.C. 460k). This law authorizes the Secretary of the Interior to allow public recreation in areas of the Refuge System when the use is an "appropriate incidental or secondary use."

This policy does NOT apply to:

Situations Where Reserved Rights or Legal Mandates Provide We Must Allow Certain Uses.

Refuge Management Activities. Refuge management activities conducted by the Refuge System or a Refuge System-authorized agent are designed to conserve fish, wildlife, and plants and their habitats. These activities are used to fulfill a refuge purpose(s) or the Refuge System mission, and are based on sound professional judgment.

Uses that have been administratively determined to be appropriate are:

Six wildlife-dependent recreational uses. As defined by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are determined to be appropriate. However, the refuge manager must still determine if these uses are compatible.

Take of fish and wildlife under state regulations. States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. We consider take of wildlife under such regulations appropriate. However, the refuge manager must determine if the activity is compatible before allowing it on a refuge.

Refuge uses must meet at least one of the following four conditions to be deemed appropriate:

- It is a wildlife-dependent recreational use of a refuge as identified in the Improvement Act.
- It contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after the Improvement Act was signed into law.
- The use involves the take of fish and wildlife under state regulations.

The refuge manager has evaluated the use following the guidelines in this policy and found that it is appropriate. The criteria used by the manager to evaluate appropriateness can be found on each of the appropriate use forms included in this appendix. Also included under this condition are 'specialized uses,' or uses that require specific authorization from the Refuge System, often in the form of a special use permit, letter of authorization, or other permit document. These uses do not include uses already granted by a prior existing right. We make appropriateness findings for specialized uses on a case-by-case basis.

Refuge Name: Crane Meadows National Wildlife Refuge

Use: Firewood Cutting/Timber Harvest

This exhibit is not required for wildlife-dependent recreational uses, forms of take regulated by the state, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

	Decision Criteria:	**Yes**	**No**
(a)	Do we have jurisdiction over the use?	✔	
(b)	Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	✔	
(c)	Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d)	Is the use consistent with public safety?	✔	
(e)	Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f)	Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g)	Is the use manageable within available budget and staff?	✔	
(h)	Will this be manageable in the future within existing resources?	✔	
(i)	Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j)	Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with state fish and wildlife agencies.

Yes X

No ____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ___

Appropriate X

Refuge Manager: Anne Sittauer

Date: Aug. XX, 2010

If found to be Not Appropriate, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found Not Appropriate outside the CCP process, the refuge supervisor must sign concurrence.

If found to be Appropriate, the refuge supervisor must sign concurrence.

Refuge Supervisor: s/James T. Leach

Date: Sept. 13, 2010

A compatibility determination is required before the use may be allowed.

Refuge Name: Crane Meadows National Wildlife Refuge

Use: Research Projects by Third Parties

This exhibit is not required for wildlife-dependent recreational uses, forms of take regulated by the state, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

	Decision Criteria:	**Yes**	**No**
(a)	Do we have jurisdiction over the use?	✔	
(b)	Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	✔	
(c)	Is the use consistent with applicable Executive orders and Department and Service policies?	✔	
(d)	Is the use consistent with public safety?	✔	
(e)	Is the use consistent with goals and objectives in an approved management plan or other document?	✔	
(f)	Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✔	
(g)	Is the use manageable within available budget and staff?	✔	
(h)	Will this be manageable in the future within existing resources?	✔	
(i)	Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✔	
(j)	Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	✔	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with state fish and wildlife agencies.

Yes X

No ____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ___

Appropriate X

Refuge Manager: s/Anne Sittauer

Date: Aug. XX, 2010

If found to be Not Appropriate, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found Not Appropriate outside the CCP process, the refuge supervisor must sign concurrence.

If found to be Appropriate, the refuge supervisor must sign concurrence.

Refuge Supervisor: s/James T. Leach

Date: Sept. 13, 2010

A compatibility determination is required before the use may be allowed.

Appendix I: References Cited

Ahern, J. (1995). *Greenways as a Planning Strategy.* Landscape and Urban Planning 33, 131-155.

Albert, Dennis A. (1995). *Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: a working map and classification.* Gen. Tech. Rep. NC-178. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. Northern Prairie Wildlife Research Center. Home Page. http://www.npwrc.usgs.gov/resource/1998/rlandscp/rlandscp.htm (Version 03JUN98).

Almendinger, J.C. (1997). *Minnesota's Bearing Tree Database.* Biological Report No. 56. Minnesota Department of Natural Resources, St. Paul, MN. 23 p.

Andreas, A.T. (1874). *An Illustrated Historical Atlas of the State of Minnesota.* Online access via Minnesota Digital Library. http://reflections.mndigital.org/u?/mhs,1029 Accessed 30 January 2009.

Anoka Conservation District. (2009). *Geologic History of the Anoka Sandplain,* on Anoka Natural Resources Website. Ham Lake, MN. Website accessed on 7 August 2009 at: http://www.anokanaturalresources.com/soil/geo_his_sandplain.htm

Bailey, R.G. (1980). *Description of the Ecoregions of the United States.* Miscellaneous Publication 1391. USDA Forest Service, Intermountain Region: Ogden, Utah.

Bailey, R.G. (1995). *Descriptions of the Ecoregions of the United States (2nd Edition).* Miscellaneous Publication No.1391. U.S.D.A. Forest Service. Online Access via: http://www.fs.fed.us/land/ecosysmgmt/index.html

Bowman, J.T. (2008). *Connecting National Wildlife Refuges with Green Infrastructure: The Sherburne-Crane Meadows Complex.* (Graduate Student Thesis) University of Minnesota: St. Paul, MN. Available on-line at: http://www.greeninfrastructure.net/sites/greeninfrastructure.net/files/JTB_ThesisDocument_Final_20080926.pdf

Brown, S., Hickey, C., Harrington, B., and Gill, R. editors. (2001). *United States Shorebird Conservation Plan, 2nd edition.* Manomet Center for Conservation Sciences: Manomet, MA. pp. 61

Buchanan, H. (1996). *Oak savanna restoration at Myre-Big Island State Park.* Website accessed 4 March 2010 at: http://horticulture.cfans.umn.edu/vd/h5015/96papers/buchanan.htm

Caudill, J. and Henderson, E. (2005). *Banking on Nature 2004: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation.* U.S. Fish and Wildlife Service: Division of Economics. Washington D.C.

Cleland, D.T.; Avers, P.E.; McNab, W.H.; Jensen, M.E.; Bailey, R.G., King, T.; Russell, W.E. (1997). *National Hierarchical Framework of Ecological Units.* Published in, Boyce, M. S.; Haney, A., ed. 1997. Ecosystem Management Applications for Sustainable Forest and Wildlife Resources. Yale University Press, New Haven, CT. pp. 181-200.

Congdon, J. and Keinath, D. (2006). *Blanding's Turtle (Emydoidea blandingii), A Technical Conservation Assessment*. USDA Forest Service, Rocky Mountain Region. Available at: http://www.fs.fed.us/r2/projects/scp/assessments/blandingsturtle.pdf

Cowardin L.M., Carter, V., Golet, F.C., LaRoe, E.T. (1979). *Classification of Wetlands and Deepwater Habitats of the Unities States*. U.S. Fish and Wildlife Service. Washington D.C.

Cox, C. (1991). *Pesticides and Birds: From DDT to Today's Poisons*. Journal of Pesticide Reform 11(4): 2-6.

Dirks, B.J., Diets, N.J., DeJong, J.R. (2008). *Camp Ripley and Arden Hills Minnesota Army national Guard Training Sites Conservation Program Report – 2007 Annual Review, January 1-December 31, 2007*. Camp Ripley Series Report No. 17. Minnesota Department of Natural Resources, Division of Ecological Services: St. Paul, MN.

Dunevitz, H. (1993). *Characterization of Midwestern oak savannas*. 1993 Proceedings of the Midwest Oak Savanna conferences. U.S. Environmental Protection Agency. Accessed 4 March 2010 at: http://www.epa.gov/ecopage/upland/oak/oak93/dunevitz.htm

Goldman, C.R. and A.J. Horne. (1983). *Limnology*. McGraw-Hill, Inc. New York. 464p.

Green, R., Harley, M., Spalding, and M., Zockler, C. (2000). *Impacts of Climate Change on Wildlife*. Royal Society for the Protection of Birds. Available online at: http://naturalengland.etraderstores.com/NaturalEnglandShop/UserFiles/Files/cc1.pdf

Law, J.R., Johnson, P.S., and Houf, G. (1994). *A Crown Cover Chart for Oak Savannas*. Silviculture and Ecology Upland Central Hardwood Forests Research Unit. U.S. Department of Agriculture, Forest Service. Accessed 4 March 2010 at: http://ncrs.fs.fed.us/pubs/tb/tb2/techbrf2.html

Johnson, D.L. and Lewis, L.A. (2007). *Land Degradation: Creation and Destruction (second edition)*. Rowman and Little.

Karl, T.R., Melillo, J.M., and Peterson, T.C. (2009). *Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program*. Cambridge University Press: New York, NY. Available at: http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/download-the-report

Kushlan, J.A.; Steinkamp, M.J.; Parsons, K.C.; Capp, J.; Cruz, M.A.; Erwin, M.; Hatch, S.; Kress, S.; Milko, R.; Miller, S.; Mills, K.; Paul, R.; Phillips, R.; Saliva, J.E.; Sydeman, B.; Trapp, J.; Wheeler, J.; and Wohl, K. (2002). *Waterbird Conservation for the Americas: North American Waterbird Conservation Plan – Version 1*. Waterbird Conservation for the Americas: Washington, D.C. pp. 78

Kratz, T.K., Jensen, G.L. (1983). *Minnesota's Landscape Regions*. Natural Areas Journal. 3(2): 33-44.

Louv, R. (2005). *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder, Updated and Expanded Edition*. Algonquin Books: Chapel Hill, North Carolina.

Lubowski R., Vesterby M., Bucholtz S., Baez A., and Roberts M. (2006). *Major Uses of Land in the United States, 2002*. U.S.D.A. Economic Information Bulletin No. 14. Available at: http://www.ers.usda.gov/publications/EIB14/eib14.pdf

Marschner, F.J. (1930). *The Original Vegetation of Minnesota*, General Land Office Survey Notes (1:500,000), unpublished until M.L. Heinselman - U.S. Forest Service, 1974.

McMurry, M. (2007). *Minnesota Population Projections 2005-2035*. Minnesota State Demographic Center: St. Paul, MN. Available at: http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf

Minnesota Department of Natural Resources. (1993). *Minnesota's Native Vegetation, A Key to Natural Communities: Version 1.5*. Minnesota Natural Heritage Program. St. Paul, MN.

Minnesota Department of Natural Resources. (2005). *Field Guide to the Native Plant Communities: 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. (2006a). *Operating Plan: Rice Lake "George Selke Memorial" Dam, 2006 update*. Minnesota DNR, Little Falls Area Wildlife Office: Little Falls, MN.

Minnesota Department of Natural Resources. (2006b). *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. Available at: http://www.dnr.state.mn.us/cwcs/strategy.html

Minnesota Department of Natural Resources. (2007). *Long Range Plan for the Wild Turkey in Minnesota.* St. Paul, MN. Available at: http://files.dnr.state.mn.us/recreation/hunting/turkey/long_range_turkey_plan_2007.pdf

Minnesota Department of Natural Resources. (2008a). *Adapting to Change: Minnesota's State Comprehensive Outdoor Recreation Plan*. Minnesota Department of Natural Resources: St. Paul, MN. Available at: http://files.dnr.state.mn.us/aboutdnr/reports/scorp_final_3308.pdf

Minnesota Department of Natural Resources. (2008b). *Natural Wild Rice in Minnesota* (submitted to the Minnesota Legislature). Saint Paul, MN.

Minnesota Department of Natural Resources. (2009a). *Ecological Classification System: Anoka Sand Plain Subsection.* Accessed 15 July 2009 at: http://www.dnr.state.mn.us/ecs/222Mc/index.html

Minnesota Department of Natural Resources. (2009b). *Ecological Classification System: Eastern Broadleaf Forest Province.* Accessed 15 July 2009 at: http://www.dnr.state.mn.us/ecs/222/index.html

Minnesota Department of Natural Resources. (2009c). *Ecological Classification System: Minnesota and Northeast Iowa Morainal Section.* Accessed 15 July 2009 at: http://www.dnr.state.mn.us/ecs/222M/index.html

Minnesota Pollution Control Agency. (2009a). *Air Quality in Minnesota: Emerging Trends - 2009 Report to the Legislature.* Minnesota Pollution Control Agency: St. Paul, MN. Available at: http://www.pca.state.mn.us/publications/reports/lr-airqualityreport-2009.html

Minnesota Pollution Control Agency. (2009b). *Environmental Data Access: Surface Water Monitoring Station Viewer*. Minnesota Pollution Control Agency: St. Paul, MN. Accessed 20 November 2009 at: http://pca-gis04.pca.state.mn.us/website/eda/edawqstation/viewer.htm?ActiveLayer=0&Query=ORG_ID='MNPCA1' percent20and percent20ID_CODE='S000-422'&QueryZoom=Yes

Minnesota Pollution Control Agency. (2009c). *Minnesota's Impaired Waters and TMDLs: Impaired Waters Viewer.* Accessed 10 December 2009 at: http://www.pca.state.mn.us/water/tmdl/tmdl-maps.html

Morey, G.B. (1976). *Geologic Map of Minnesota - Bedrock Geology.* Minnesota Geological Survey, State Map Series M-24, scale 1:3168000

National Assessment Synthesis Team. (2001). *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change.* Cambridge University Press: Cambridge, U.K. Available at: http://www.usgcrp.gov/usgcrp/nacc/

Nuzzo, V.A. (1986). *Extent and Status of Midwest Oak Savanna: Presettlement and 1985*. Natural Areas Journal 6: 6-36.

Rich, T.D.; Beardmore, C.J.; Berlanga, H.; Blancher, P.J.; Bradstreet, M.S.W.; Butcher, G.S.; Demarest, D.W.; Dunn, E.H.; Hunter, W.C.; Inigo-Elias, E.E.; Kennedy, J.A.; Martell, A.M.; Panjabi, A.O;. Pashley, D.N.; Rosenberg, K.V.; Rustay, C.M.; Wendt, J.S.; and Will, T.C. (2004). *Partners in Flight, North American Landbird Conservation Plan*. Cornell Lab of Ornithology: Ithaca, NY. pp. 84

Ringelman, J.K., Ed. (2005). *Prairie Pothole Joint Venture: 2005 Implementation Plan*.

Ryan, M.G.; Archer, S.R.; Birdsey, R.; Dahm, C.; Heath, L.; Hicke, J.; Hollinger, D.; Huxman, T.; Okin, G.; Oren, R.; Randerson, J.; and Schlesinger W. (2008). *Land Resources. In: The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Department of Agriculture, Washington, DC, pp. 75-120.

Schneider, S.H. and Root, T.L. (2002). *Wildlife Responses to Climate Change: North American Case Studies*. Island Press. Washington, D.C.

Scott, M., Griffith, B., Adamcik, B., Ashe, D., Czech, B., Fischman, R., Gonzales, P., Pidgorna, A. (2009). *Managing to Accommodate Change: Climate Change and the National Widlife Refuge System.* A PowerPoint presentation given at the 2009 FWS National Planners Conference.

Sullivan, Janet. (1994). *Conifer bog. In: Fire Effects Information System*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Accessed 24 February 2010 at: http://www.fs.fed.us/database/feis/

Swanson, G.H. (2008). *Prescribed Fire Use for Oak Savanna Restoration at Crane Meadows National Wildlife Refuge*. (Unpublished)

United Health Foundation. (2006). *America's Health Rankings: A Call to Action for People and Their Communities (2006 Edition)*. United Health Foundation: Minnetonka, MN. Available at: http://www.unitedhealthfoundation.org/ahr2006/2006ahr.pdf

U.S. Census Bureau. (2009). *American Fact Finder.* Data derived from Population Estimates, Census of Population and Housing, Small Area Income and Poverty Estimates, State and County Housing Unit Estimates, County Business Patterns, Non-employer Statistics, Economic Census, Survey of Business Owners, Building Permits, Consolidated Federal Funds Report. Accessed 20 July 2009 at: http://quickfacts.census.gov/qfd/states/27/27097.html

U.S. Environmental Protection Agency. (2009). *National Emission Inventory Database.* Accessed 27 July 2009 at: http://www.epa.gov/air/data/repsst.html?st~MN~Minnesota.

U.S. Environmental Protection Agency & U.S. Department of Agriculture. (1999). *Unified National Strategy for Animal Feeding Operations*. Washington, D.C.

U.S. Department of the Interior. (2004). *News: Bush Administration Creates New Wildlife Refuge in Minnesota 35,000 Acre Glacial Ridge National Wildlife Refuge to Preserve Tallgrass Prairie and Wetlands in Northwest Minnesota.* Accessed 24 February 2010 at: http://www.interior.gov/news/04_News_Releases/041012d.htm

U.S. Department of the Interior. (2005). *Administrative and Enforcement Procedures for FWS Easements: Wetland, Grassland, Habitat, Tallgrass, and FmHA.* Regions 3 and 6: Twin Cities, MN and Denver, CO.

U.S. Department of Agriculture; Natural Resources Conservation Service. (2009). *Soil Survey Geographic (SSURGO) Database for Morrison County, MN - Online Series Descriptions*. Accessed 7 August 2009 at: http://soildatamart.nrcs.usda.gov

U.S. Department of Agriculture; Natural Resources Conservation Service. (2008). *Rapid Watershed Assessment: Platte-Spunk (MN) HUC 7010201*. Available at: http://www.mn.nrcs.usda.gov/technical/rwa/Assessments/reports/platte_spunk.pdf

U.S. Fish and Wildlife Service. (1990). *Regional Wetlands Concept Plan (Region 3)*. Emergency Wetlands Resources Act. pp. 55

U.S. Fish and Wildlife Service, Region 3. (1992). *Crane Meadows National Wildlife Refuge: Final Environmental Assessment*. Region 3 Division of Realty and Ascertainment: Fort Snelling, MN. pp. 63

U.S. Fish and Wildlife Service, Region 3. (2002). *Fish and Wildlife Resource Conservation Priorities, Version 2.0.* Fort Snelling, MN. pp. 34

U.S. Fish and Wildlife Service. (2004). *Classification of Wetlands and Deepwater Habitats of the United States: National Wetlands Inventory.* U.S. Department of the Interior: Washington, D.C.

U.S. Fish and Wildlife Service. (2005). *Why Save Endangered Species*. Endangered Species Program, Arlington, VA. Available at: http://www.fws.gov/Endangered/pdfs/Why_Save_End_Species_July_2005.pdf

U.S. Fish and Wildlife Service. (2006). *Strategic Habitat Conservation: Final Report of the National Ecological Assessment Team*. July. pp. 45

U.S. Fish & Wildlife Service. (2008a). *Strategic Habitat Conservation: An Operational Response to the Changing Conservation Landscape / A Summary Briefing Prepared for Ecological Services Assistant Regional Directors*. PowerPoint presentation given October 21, 2008. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. (2008b). *Strategic Habitat Conservation Handbook: A Guide to Implementing the Technical Elements of Strategic Habitat Conservation, Version 1.0.* National Technical Assistance Team. February. pp. 22

U.S. Fish and Wildlife Service. (2009- IN PROGRESS). *Rising to the Urgent Challenges of a Changing Climate: Strategic Plan for Responding to Accelerating Climate Change in the 21*st *Century*.

U.S. Fish and Wildlife Service. (2009a). *Putting Science in the Right Places: National Geographic Framework for Landscape Conservation.* Available online at: http://www.fws.gov/midwest/climate/documents/SHCNationalGeographicFrameworkEmployee090809nomaps.pdf

U.S. Fish and Wildlife Service; Environment Canada, Canadian Wildlife Service. (1986). *North American Waterfowl Management Plan: A Strategy for Cooperation*.

U.S. Forest Service. (2009). *Ecological Subregions of the United States*. Accessed 15 July 2009 at: http://www.fs.fed.us/land/pubs/ecoregions/toc.html

U.S. Geological Survey. (2003). *National Land Cover Database (NLCD)*. Earth Science Information Center: Sioux Falls, SD.

U.S. Office of the Surveyor General. (1852). Land *Survey Field Notes: T40,R31 and T39,R31*. Property of the Minnesota Historical Society: St. Paul, MN.

University of Minnesota. (2007). *2000 Morrison county Land Cover and Impervious Surface Area*. University of Minnesota: St. Paul, MN. Accessed 17 July 2009: http://land.umn.edu/maps/tmp/Land_2000_Morrison_County.pdf

Ustipak, R. (1983). *Wild rice initiative*. Minnesota Waterfowl Association News, Jan/Feb, Page 7.

Valppu, S.H. (2000). *Paleoethnobotanical investigations at the Big Rice Site: Laurel culture use of wild rice (Zizania aquatica L.) and associated radiocarbon dates*. Pages 27-39 *in* Proceedings of the Wild Rice Research and Management Conference. Great Lakes Indian Fish and Wildlife Commission, 7-8 July 1999, Carlton, Minnesota, USA.

Wovcha, D.S., Delaney, B.C., and Nordquist, G.E. (1995). *Minnesota's St. Croix River Valley and the Anoka Sandplain: A guide to native habitats*. University of Minnesota Press: Minneapolis, MN.

Wright, H.E., Jr,. (1972). *Quaternary History of Minnesota*, in Sims, P.K., and Morey, G.B., eds., Geology of Minnesota: A Centennial Volume. Minnesota Geological survey: St. Paul, MN.

Appendix J: List of Preparers and Contributors

Preparers

Sherburne/Crane Meadows NWR Complex

- Anne Sittauer – Refuge Manager
- Paul Soler – Wildlife Refuge Specialist
- Lizzy Berkley – Biologist
- Nancy Haugen – Park Ranger

Midwest Region, Regional Office, Division of Conservation Planning

- Jared Bowman – Wildlife Biologist / Refuge Planner
- Jane Hodgins – Technical Writer/Editor

Minnesota DNR – Little Falls Area Wildlife Office, Section of Wildlife

Beau Liddell – Area Wildlife Supervisor

Acknowledgements:

Contributions to the CCP were made by the following individuals:

- Bob Russell, Nongame Biologist (Region 3 Regional Office, Division of Migratory Birds)
- David Kluth, Regional Archaeologist (Region 3 Regional Office, NWRS)
- Maggie O'Connell, Chief of Visitor Services and Outreach (FWS, Region 3 Regional Office, NWRS)
- Pat Heglund, Chief of Biological Resources (Region 3 Regional Office, NWRS)
- Josh Eash, Hydraulic Engineer/Hydrologist (Region 3 Regional Office, Division of Facilities, Management, and Budget)

Guidance and assistance were provided during the planning process by the following individuals:

- Charlie Blair, Refuge Manager (Minnesota Valley NWR)
- Jeanne Holler, Wildlife Refuge Specialist (Minnesota Valley NWR)
- Sue McDonald, Supervisory Park Ranger (DeSoto National Wildlife Refuge)
- Hannah Texler, Regional Plant Ecologist (Minnesota DNR, Central Region Division of Ecological Resources)
- Liz Harper, Nongame Wildlife Specialist (Minnesota DNR, Central Region Division of Ecological Resources)
- Eric Altena, Area Supervisor (Minnesota DNR, Little Falls Area Fisheries Office)
- Todd Holman, Central Minnesota Program Director (The Nature Conservancy)
- Bill Faber, Professor of Natural Resource Management (Central Lakes College, Brainerd Campus)

Planning support was provided by:

- Sherburne-Crane Meadows NWR Complex
- Region 3 Regional Office, Division of Conservation Planning
- Friends of Crane Meadows NWR

Thanks to all members of the public who contributed comments during the planning process!

Appendix K: Crane Meadows NWR CCP Communications List

Elected Federal Officials

- U.S. Senator Amy Klobuchar
- U.S. Senator Al Franken
- U.S. Congressman Jim Oberstar (8th District)

Elected State Officials

- Governor Tim Pawlenty
- Senator Paul Koering (District 12)
- Representative Al Doty (District 12B)

Federal Agencies

- U.S. Fish and Wildlife Service
- Twin Cities Ecological Services Field Office
- Service Historic Preservation Officer
- National Training Conference Center
- Planning Offices, Regions 1-9
- U.S.D.A. Natural Resource Conservation Service – Morrison County

Tribal Representatives

- Mille Lacs Band of the Ojibwe Tribe

State Agencies

- Minnesota Department of Natural Resources
- Division of Ecological Resources
- Division of Fish and Wildlife
- Division of Forestry
- Division of Lands and Minerals
- Division of Waters
- Shallow Lakes Program
- Minnesota Historical Society - State Historic Preservation Officer
- Board of Water and Soil Resources
- Soil and Water Conservation District – Morrison County
- National Guard – Camp Ripley Environmental Office

Morrison County

Commissioners:

- Thomas Wenzel
- Jeffrey Schilling
- Richard Collins
- Donald Meyer
- Duane Johnson

- Planning and Zoning
- Engineer
- Sheriff
- Auditor
- GIS
- Historical Society
- Recreational Trails Association

City of Little Falls

- City Government Office
- Convention and Visitors Bureau

Schools

- Northwest University –Institute for Policy Research
- St. Cloud State University – Department of Biological Sciences
- Central Lakes College
- Mary of Lourdes School

- Pierz School
- Swanville Public Schools
- Upsala School
- Royalton High School
- Royalton Elementary
- Little Falls Community Schools
- Holy Trinity School

Public Libraries

- Little Falls City Library
- Pierz Public Library
- Royalton Public library
- Swanville Public Library
- Upsala Public Library

Organizations – Regional and National

- National Wildlife Federation – Great Lakes Field Office
- Sierra Club – Midwest Office
- Audubon Society
- Defenders of Wildlife
- National Trappers Association, Inc.
- National Wildlife Refuge Association
- Public Employees for Environmental Responsibility
- The Conservation Fund
- The Humane Society of the United States
- The Wilderness Society
- Wilderness Watch

Organizations – Local

- Central Minnesota Audubon
- Minnesota Waterfowl Association
- The Nature Conservancy
- Minnesota Land Trust
- Ducks Unlimited
- Minnesota Deer Hunters Association
- Morrison County Birding Club
- Friends of Crane Meadows National Wildlife Refuge
- National Wild Turkey Federation
- Lindberg Historic Site
- Morrison Pheasants Forever
- Trust for Public Land
- Minnesota Trappers Association
- Franciscan Sisters of Little Falls
- Quality Deer Management Association
- Great River Greening
- East Central Landscape Committee
- Morrison County Agricultural Society
- Disabled American Veterans
- Morrison County Animal Humane Society
- Morrison County Volunteer Network
- Minnesota Fishing Museum
- Eastern Morrison County Four Wheelers Club, Inc.
- Little Falls Sno Dogs Inc. Snowmobile Club
- Buckman Trail Blazers
- Rice Area Sportsmen's Club
- Randall Sportsman's Club
- Little Falls Sportsman's Club
- Harding Sportsman's Club
- Cushing (Big Lake) Sportsman's Club
- Pinnacle Hunt Club
- Wheelin' Sportsmen
- Eastern Morrison County Sportsman Club
- 20 Gun Club
- Royalton Gun Club
- Royalton Sportsmen's Club

Media

- Outdoor News
- St. Cloud Times
- Brainerd Dispatch
- Morrison County Record
- Little Falls Radio

Businesses and Individuals

- American Farms, Inc.
- B and B Properties LLP
- Leidenfrost Farms LLP
- Sloughhole, Inc.
- All neighbors within one-half mile of the Refuge
- All individuals who submitted comments, participated in open houses, attended planning meetings, or requested they be added to the CCP mailing list

Appendix L: Oak Savanna Definition

Working Definition of "Savanna" for Restoration Efforts at Crane Meadows NWR

General Definition of Southern Dry Savanna:

Savanna habitat at Crane Meadows NWR, like savanna across its range, is a fire-dependent, dynamic community characterized by scattered trees or groves of trees, mostly comprised of oaks (*Quercus sp.*) with a canopy cover ranging from 10–70%, but more typically between 25-50%; and a basal area (BA) of 5-50 sq ft / acre. A wide range is used because canopy cover is not the most important characteristic that defines savanna and also because savanna ecosystems are dynamic and are associated with a natural range of variation through space and time. In addition, canopy cover can also vary at a small-scale (stand level), where areas of both scattered trees and areas with groves of trees are present within a stand. Essential variables when defining savanna habitat include tree species, tree size and shape, the presence and abundance of native savanna forbs and graminoids, shrub density, light penetration, and disturbance regimes. At Crane Meadows NWR on the Anoka Sandplain in Central Minnesota, bur oak (*Quercus macrocarpa*) and black oak are typically the dominant tree species interspersed with jack pine (*Pinus banksiana*), red oak (*Quercus rubra*),or northern pin oak (*Quercus elipsoidalis*) (or a hybrid of the two) (Buchanan 1996, Law et al. 1994, Minnesota Department of Natural Resources 2005).

Savannas are mosaic communities with variation of open, closed, and partially shaded areas. Thus, an important component when defining savanna is the composition of the understory vegetation. Savanna understory consists of a mosaic of both heliophiles typical of prairie as well as species well adapted to shaded environments under trees, shifting as the tree canopy becomes more open or closed. Herbaceous species typical of prairie and forest co-occur; in addition to a set of very specific savanna species (see lists below) that have high fidelity to this community type (Texler Personal commun., Drobney Personal commun. (Buchanan 1996). This spatial variation within the understory is a function of the varying degrees of species tolerance to shade and sun. Forbs are an essential component of the understory. Another important component of savanna understory is the shrub layer. The understory of savanna on the Anoka Sandplain, including those at Crane Meadows NWR, can be present with or without shrubs. The extent of shrub density is dependent on the subtype savanna classification and the frequency of fire (Law et al. 1994, Swanson 2008, Minnesota Department of Natural Resources 2005).

Along with shrubs, the presence of saplings and pole trees (consisting of canopy tree species) is important to maintain in some areas in the subcanopy layer or as a single-canopy area within a stand. Saplings and pole trees ultimately replace mature trees in the overstory that age and eventually drop out of the canopy. Thus, in order to maintain oak savanna in perpetuity, it is important to consider maintaining or managing areas for regeneration. Because it is difficult to manage for savanna habitat described above and maintain sapling and pole trees, different management scenarios should be implemented throughout the Refuge to maintain both mature trees in savanna habitats as well as areas varying in age classes (including saplings and pole trees). Areas managed for regeneration should maintain a range of 100-200 saplings and pole trees / acre and a minimum threshold of 40 saplings and pole trees/ acre to insure regeneration. There may

also be natural regeneration when a tree-fall gap is created in the canopy which allows for light penetration and localized regeneration within a stand.

Barrens Oak Savanna

There are many subtypes of oak savanna habitat that have been classified by the Minnesota Department of Natural Resources (2005). A common savanna type on sandy soils of the Anoka Sandplain is barrens oak savanna; a relatively open community with scattered or clustered (10-70% canopy cover, but more typically 25-50%), stunted (15-35 feet tall), open-grown bur oak and black oak trees, often interspersed with jack pine, and with grass-dominated herbaceous ground layer (Wovcha et al. 1995, Minnesota DNR 2005). The understory vegetation is sparse or patchy with both native grasses (25-100%) and forbs (5-50%) (MNDNR 2005). Northern pin oak is sometimes present as a secondary tree species in the overstory or in the shrub layer. The density of shrubs is less than 30% in high quality occurrences (Dunevitz 1993).

Measurement Scale:

Post assessments of oak savanna restoration activities must be measured and quantified to evaluate whether management is producing the desired outcome and the Refuge oak savanna habitats comply with this definition. The scale used to evaluate savanna restoration efforts at Crane Meadows NWR will include both the designated Fire Management Units (FMU) and the land most suitable for oak savanna restoration as defined by the Comprehensive Conservation Plan (CCP).

For more details, refer to "Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province" pgs. 89 and 289; and/or "Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats" pg. 68-77.

Oak Savanna Native Plant Species for Crane Meadows NWR: Target species for management

Barrens Oak Savanna (Wovcha et al. 1995, Minnesota DNR 2005 Ups14a)

Canopy

Bur oak (*Quercus macrocarpa*)

Black oak (*Quercus velutina*)

Northern pin oak (*Quercus ellipsoidalis*)

Jack pine (*Pinus banksiana*)

Shrub Layer

Chokecherry (*Prunus virginiana*)

Oak (*Quercus sp.*)

New Jersey tea (*Ceanothus americanus*)

Prairie willow (*Salix humilis*)

Smooth sumac (*Rhus glabra*)

American hazelnut (*Corylus americana*)

Ground Layer

WOODY SPECIES

Leadplant (*Amorpha canescens*)

Poison ivy (*Toxicodendron radicans*)

Prairie rose (*Rosa arkansana*)

FORBS

Western ragweed (*Ambrosia coronopifolia*)

Hairy puccoon (*Lithospermum caroliniense*)

White sage (*Artemisia ludoviciana*)

Gray goldenrod (*Solidago nemoralis*)

Hairy golden aster (*Heterotheca villosa*)

Horseweed (*Conyza canadensis*)

Large-flowered beard-tongue

(*Penstemon grandiflorus*)

Purple prairie clover (*Petalostemum purpureum*)

Silky prairie clover (*Petalostemum villosum*)

Ground-cherry (*Physalis virginiana*)

Missouri goldenrod (*Solidago missouriensis*)

Prairie bird-foot violet (*Viola pedatifida*)

Prairie larkspur (*Delphinium virescens*)

Rough blazing-star (*Liatris aspera*)

Rigid sunflower (*Helianthus rigidus*)

GRAMINOIDS

Junegrass (*Koeleria pyramidata*)

Porcupine grass (*Stipa spartea*)

Hairy grama (*Bouteloua hirsuta*)

Little bluestem (*Schizachyrium scoparium*)

Big bluestem (*Andropogon gerardii*)

Sand reedgrass (*Calamovilfa longifolia*)

Panic-grass (*Panicum sp.*)

Umbrella sedge (*Cyperus schweinitzii*)

Pennsylvania sedge (*Carex pensylvanica*)

Characteristic Plant Species

Sand reedgrass (*Calamovilfa longifolia*)

Sea-beach needlegrass (*Aristida tuberculosa*)

False heather (*Hudsonia tomentosa*)

Muhlenberg's sedge (*Carex muhlenbergii*)

Silky prairie clover (*Petalostemon villosum*)

Old field toadflax (*Linaria canadensis*)

Geyer's spurge (*Euphorbia geyeri*)

Cream gentian (*Gentiana alba*)

Kitten-tails (*Besseya bullii*)

Kalm's brome grass (*Bromus kalmii*)

Rare Plant Species

Small-leaved pussytoes (*Antennaria parvifolia*)

Sea-beach needlegrass (*Aristida tuberculosa*)

Rhombic-petaled evening primrose (*Oenothera rhombipetala*)

James' polanisia (*Polanisia jamesii*) – SE

Tall nut-rush (*Scleria triglomerata*) – SE

False heather (*Hudsonia tomentosa*)

Kitten-tails (*Besseya bullii*) – ST

Blunt sedge (*Carex obtusata*)

Hill's thistle (*Cirsium hillii*)

* SE = State Endangered

* ST = State Threatened