Draft Comprehensive Conservation Plan and Environmental Assessment

National Elk Refuge

Wyoming

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Contents

Summary XI
Abbreviations XVII

CHAPTER 1—Introduction 1

1.1 Purpose and Need for the Plan 3
The Decision to be Made 3

1.2 The U.S. Fish and Wildlife Service and the National Wildlife Refuge System 3
U.S. Fish and Wildlife Service 3
National Wildlife Refuge System 4

1.3 National and Regional Mandates 5

1.4 Refuge Contributions to Regional and National Plans 5
Conserving the Future 5
Partners in Flight 6
North American Waterbird Conservation Plan 6
North American Waterfowl Management Plan 6
Recovery Plans for Federally Listed Threatened or Endangered Species 6
Wyoming State Wildlife Action Plan 7
Wyoming Greater Sage-Grouse Conservation Plan 7
Bison and Elk Management Plan 8
Greater Yellowstone Coordinating Committee 8
Responding to Accelerating Climate Change 8

1.5 Landscape-Scale Conservation 9
Strategic Habitat Conservation 9
Landscape Conservation Cooperatives 9

1.6 The Planning Process 9
Coordination with the Public 11
State Coordination 11
Tribal Coordination 12
Teton County Coordination 13
Results of Scoping 13
Selecting an Alternative 13

CHAPTER 2—The Refuge 15

2.1 Establishment, Acquisition, and Management History 15
Establishment 15
Acquisition History 15
Management History 17

2.2 Purposes 21

2.3 Vision 21

2.4 Goals 22
Habitat and Wildlife Management Goal 22
Cultural Resources Goal 22
Visitor Services Goal 22
Visitor and Employee Safety and Resource Protection Goal 22

Administration Goal 22

2.5 Special Values 22
Intact Ecosystem 22
High Scenic Quality 22
Undeveloped Habitat 23
Quality Water Resources 23
Variety and Abundance of Wildlife 23
Abundant Visitor Opportunities 24
Rich Cultural History 25

2.6 Planning Issues 26
Unknown Effects of Climate Change 26
Landscape-Scale Conservation Needs 26
Big Game Management Effects on Wildlife Habitat 26
Invasive Plants Replacing Native Habitat 27
Flat Creek Enhancement 27
Conserving Wide-Ranging Wildlife 27
Managing Habitat for Migratory Birds 28
Wildlife Disease 28
Insufficient Research, Inventory, and Monitoring 28
Human–Wildlife Conflicts 29
Hunting Management 29
Increasing Demand for Environmental Education and Interpretation 30
Operational Efficiency of the Jackson Hole and Greater Yellowstone Visitor Center 30
Management of Other Uses 30
Access 31
Public Outreach Opportunities 32
Miller House Restoration 32
Lack or Resources to Administer the Refuge 32
Stronger Programs Through Partnerships 33
Refuge Management Effects on the Jackson Economy 33
Issues Outside the Scope of the CCP 33

CHAPTER 3—Refuge Resources and Description 35

3.1 Alternatives Development 35

3.2 Alternatives Considered but Eliminated from Detailed Study 36

3.3 Elements Common to All Alternatives 36
Laws and Regulations 36
Invasive Species 36
Bison and Elk Management Plan 36
Wildlife Disease 36
Access for Boating 36
Research 36
Refuge Uses 37
Landowner Coordination 37
Partnerships 37

3.4 Description of Alternatives 37

3.5 Alternative A (Current Management)—No Action 37
Climate Change 37
Landscape-Scale Conservation 38
Habitat 38
Wildlife 39
Federally and State-Listed Species 40
Research and Monitoring 40

Cultural Resources 40
Visitor Services 41
Visitor and Employee Safety and Resource Protection 44
Administration 44

3.6 Alternative B (Enhance Public Use and Intensive Resource Management) 46
Climate Change 46
Landscape-Scale Conservation 47
Habitat 47
Wildlife 48
Federally and State-Listed Species 48
Research and Monitoring 48
Cultural Resources 48
Visitor Services 49
Visitor and Employee Safety and Resource Protection 53
Administration 53

3.7 Alternative C (Emphasize Intact Ecosystems and Promote Natural Processes) 54
Climate Change 55
Landscape-Scale Conservation 55
Habitat 55
Wildlife 56
Federally and State-Listed Species 56
Research and Monitoring 57
Cultural Resources 57
Visitor Services 57
Visitor and Employee Safety and Resource Protection 58
Administration 58

3.8 Alternative D (Promote Natural Habitats and Balance Public Use)—Proposed Action 59
Climate Change 59
Landscape-Scale Conservation 59
Habitat 59
Wildlife 60
Federally and State-Listed Species 60
Research and Monitoring 60
Cultural Resources 60
Visitor Services 60
Visitor and Employee Safety and Resource Protection 61
Administration 61

3.9 Comparison of Alternatives and Consequences 61

CHAPTER 4—Affected Environment 97

4.1 Physical Environment 97
Climate 98
Land Features 98
Soils 98
Water Resources 100
Air Quality 102
Visual Resources 107

4.2 Biological Resources 107
Plant Communities 107
Wildlife 115
Federally and State-Listed Species 129

4.3 Management Tools 132
Irrigation 132
Farming 132

Fencing 132
Wildland Fire Management 132

4.4 Human History and Cultural Resources 134
Indigenous People of Western Wyoming 134
Historical Euro-Americans 135
Ethnographic Resources 135
Archaeological Resources in Jackson Hole 135
Cultural Resources on the Refuge 136

4.5 Special Management Areas 138
Wilderness Review 138
Important Bird Area 138

4.6 Visitor Services 138
Hunting 139
Fishing 140
Wildlife Observation and Photography 141
Environmental Education and Interpretation 141
Jackson Hole and Greater Yellowstone Visitor Center 142
Other Uses 142
Access 142

4.7 Socioeconomic Environment 144
Population, Ethnicity and Education 144
Regional Employment and Income 144
Economic Contributions of the Refuge 147

4.8 Operations 148
Funding and Staff 148
Facilities 148
Elk Refuge Road 149
Partnerships 150

CHAPTER 5—Refuge Resources and Description 153

5.1 Analysis Methods 154

5.2 Effects Common to All Alternatives 154
Regulatory Effects 154
Environmental Justice 154
Geology and Soils 154
Bison and Elk Plan 155
Migratory Birds 155
Wildland Fire Management 155
Antler Collecting 156
Access for Boating 156
Cumulative Impacts 156

5.3 Climate Change Effects 157

5.4 Air Quality Effects 159

5.5 Landscape-Scale Conservation Effects 159

5.6 Habitat Effects 160
Native Grasslands and Sagebrush Shrublands 161
Wetlands 161
Riparian Woodlands and Aspen Woodlands 162
Flat Creek 163
Invasive Species 164

5.7 Wildlife Effects 164

Migratory Birds . . . 164
Aquatic Species . . . 165
Disease Management . . . 166

5.8 Federally and State-Listed Species Effects . . . 167

5.9 Research and Monitoring Effects . . . 168

5.10 Cultural Resources Effects . . . 169

5.11 Visitor Services Effects . . . 170
Hunting . . . 170
Fishing . . . 171
Wildlife Observation and Photography . . . 172
Environmental Education and Interpretation . . . 174
Jackson Hole and Greater Yellowstone Visitor Center . . . 175
North Highway 89 Pathway . . . 176
North Park . . . 177
Special Uses . . . 177
General Access and Elk Refuge Road . . . 178
Access to the National Forest . . . 178
Public Outreach . . . 179

5.12 Safety Effects . . . 180

5.13 Resource Protection Effects . . . 180

5.14 Administration Effects . . . 181
Funding and Staff . . . 181
Facilities . . . 183
Elk Refuge Road . . . 184
Partnerships . . . 186

5.15 Socioeconomic Effects . . . 189
Impacts from Refuge Revenue Sharing . . . 190
Effects of Refuge Personnel Salary Spending within the Local Economy . . . 190
Effects of Refuge Purchases of Goods and Service within the Local Economy . . . 191
Effects of Visitor Expenditures . . . 192
Summary of Economic Effects . . . 195

CHAPTER 6—Implementation of the Proposed Action (Draft Plan) . . . 197

6.1 Management Focus . . . 198

6.2 Overview of Goals and Objectives . . . 198

6.3 Climate Change . . . 199
Climate Change Objective 1 . . . 199
Climate Change Objective 2 . . . 199
Climate Change Objective 3 . . . 199

6.4 Landscape-Scale Conservation . . . 200
Landscape-Scale Conservation Objective 1 . . . 200
Landscape-Scale Conservation Objective 2 . . . 200
Landscape-Scale Conservation Objective 3 . . . 200
Landscape-Scale Conservation Objective 4 . . . 201
Landscape-Scale Conservation Objective 5 . . . 201

6.5 Habitat and Wildlife Goal . . . 201
Native Grasslands Objective . . . 201
Sagebrush Shrublands Objective 1 . . . 202
Sagebrush Shrublands Objective 2 . . . 202
Wetlands Objective 1 . . . 202
Wetlands Objective 2 . . . 203

Wetlands Objective 3 203
Riparian Woodlands and Aspen Woodlands Objective 1 203
Riparian Woodlands and Aspen Woodlands Objective 2 204
Riparian Woodlands and Aspen Woodlands Objective 3 204
Flat Creek Enhancement Objective 1 205
Flat Creek Enhancement Objective 2 205
Flat Creek Enhancement Objective 3 206
Invasive Species Objective 1 206
Invasive Species Objective 2 206
Migratory Birds Objective 206
Aquatic Species Objective 208
Disease Management Objective 1 208
Disease Management Objective 2 208
Disease Management Objective 3 209
Federally and State-Listed Species Objective 1 209
Federally and State-Listed Species Objective 2 209
Research and Monitoring Objective 209

6.6 Cultural Resources Goal 210
Cultural Resources Objective 210

6.7 Visitor Services Goal 210
Hunting Objective 1 210
Hunting Objective 2 214
Hunting Objective 3 214
Hunting Objective 4 215
Fishing Objective 1 215
Fishing Objective 2 215
Fishing Objective 3 215
Wildlife Observation and Photography Objective 1 216
Wildlife Observation and Photography Objective 2 216
Environmental Education and Interpretation Objective 1 217
Environmental Education and Interpretation Objective 2 217
Visitor Center Objective 1 218
Visitor Center Objective 2 218
North Park Objective 218
Other Uses Objective 219
Special Use Permit Objective 1 219
Special Use Permit Objective 2 220
Public Outreach Objective 221

6.8 Visitor and Employee Safety and Resource Protection Goal 221
Visitor and Employee Safety Objective 1 221
Visitor and Employee Safety Objective 2 221
Visitor and Employee Safety Objective 3 222
Visitor and Employee Safety Objective 4 222
Resource Protection Objective 1 222
Resource Protection Objective 2 223

6.9 Administration Goal 223
Funding and Staff Objective 1 223
Funding and Staff Objective 2 223
Facilities Objective 1 223
Facilities Objective 2 224
Elk Refuge Road Objective 1 224
Elk Refuge Road Objective 2 224
Elk Refuge Road Objective 3 225
Partnerships Objective 225

6.10 Staff 225
6.11 Stepdown Management Plans 226
6.12 Monitoring and Evaluation 226
6.13 Plan Amendment and Revision 227

GLOSSARY 229

BIBLIOGRAPHY 279

APPENDIXES

Appendix A
Key Legislation and Policy 235
Appendix B
Preparers and Contributors 239
Appendix C
Public Involvement 241
Appendix D
Species Lists 245
Appendix E
Compatibility Determinations 265

FIGURES

Figure 1. Vicinity map of the National Elk Refuge, Wyoming 2
Figure 2. The strategic habitat conservation process 9
Figure 3. Map of the Great Northern Landscape Conservation Cooperative in North America 10
Figure 4. Process steps for comprehensive planning and associated environmental analysis 11
Figure 5. Base map of the National Elk Refuge, Wyoming 16
Figure 6. Map of land tracts composing the National Elk Refuge, Wyoming 19
Figure 7. Map of areas and feedgrounds on the National Elk Refuge, Wyoming 20
Figure 8. Map of waterfowl flyways in North America 25
Figure 9. Map of management units and surface hydrology of the National Elk Refuge, Wyoming 101
Figure 10. Map of plant communities on the National Elk Refuge, Wyoming 109
Figure 11. Map of irrigated areas on the National Elk Refuge, Wyoming 133
Figure 12. Map of visitor services on the southern end of the National Elk Refuge, Wyoming 211
Figure 13. Map of the elk hunting program on the National Elk Refuge, Wyoming 212
Figure 14. Map of the bison hunting program on the National Elk Refuge, Wyoming 213
Figure 15. The adaptive resource management process 227

TABLES

Table 1. Summary of the comprehensive conservation planning process for the National Elk Refuge, Wyoming 12
Table 2. Land acquisition history for the National Elk Refuge, Wyoming 17
Table 3. Current staff positions at the National Elk Refuge, Wyoming 45

TABLES (CONTINUED)

Table 4. Summary of the alternatives and their environmental consequences for the comprehensive conservation plan for the National Elk Refuge, Wyoming. 62

Table 5. Average values of selected water quality factors in or near the National Elk Refuge, Wyoming, 1996–2002 103

Table 6. Water rights owned by the National Elk Refuge, Wyoming 104

Table 7. Plant community types on the National Elk Refuge, Wyoming. 107

Table 8. Estimates of forage production on the National Elk Refuge, Wyoming 113

Table 9. Noxious weed species on the National Elk Refuge, Wyoming. 114

Table 10. Winter elk population objectives and actual population estimates for the Jackson elk herd and wintering areas from 2011–2013. 115

Table 11. Small mammals that occur in various habitats on the National Elk Refuge, Wyoming. 123

Table 12. State and county population estimates 144

Table 13. State and county income, unemployment, and poverty statistics. 145

Table 14. Employment by sector, 2011, in Teton County, Idaho, and Teton County, Wyoming 146

Table 15. Annual impacts of Refuge Revenue Sharing payments for all alternatives 190

Table 16. Annual impacts of salary spending 190

Table 17. Breakdown of current purchases of goods and services 191

Table 18. Annual impacts of purchases of goods and services 191

Table 19. Estimated annual refuge visitation activity by alternative 192

Table 20. Annual impacts of nonlocal visitor spending by alternative 194

Table 21. Current and proposed staff at the National Elk Refuge, Wyoming 226

Table 22. Stepdown management plans for the National Elk Refuge, Wyoming 226

Summary

Tony Hough / FWS

Elk

The National Elk Refuge in northwestern Wyoming is nestled in the valley known as Jackson Hole and is one of the oldest national wildlife refuges—established in 1912 as a "winter game (elk) reserve." Over the years, its purpose has been broadened to include "refuges and breeding grounds for birds, other big game animals, the conservation of fish and wildlife, and the protection of natural resources and conservation of threatened or endangered species." As the United States Fish and Wildlife Service, we manage this 24,777-acre national wildlife refuge as part of the National Wildlife Refuge System.

We are developing a comprehensive conservation plan for the refuge that will provide long-term guidance for management decisions; support achievement of the goals needed to accomplish the purposes of the National Elk Refuge including the enhancement of Flat Creek; and describe our best estimate of future needs. We will use the comprehensive conservation plan, along with the Bison and Elk Management Plan (2007), as guidance for managing the National Elk Refuge over the next 15 years.

The Planning Process

Our planning team started meeting in August 2010. The team is primarily staff from the National Elk Refuge and the Region 6 Division of Refuge Planning, with contributors from other Service divisions, the Wyoming Game and Fish Department, Teton County, and the National Park Service. We invited thirteen tribal councils to participate and kept them informed throughout the planning process.

BJ Baker / FWS

Red-winged Blackbird

Analysis and Public Involvement

The planning team identified and reviewed current programs, compiled and analyzed relevant data from the refuge and surrounding areas, and identified the purposes of the refuge. Public scoping started with a notice of intent to prepare a draft comprehensive conservation plan and environmental assessment, which we published in the Federal Register in October 2010. The planning team prepared a mailing list of more than 90 names—private citizens; local, regional, and State government representatives and legislators; other Federal agencies; and interested organizations. We distributed information through news releases, issuance of a planning update, a project Web page, and a public meeting. The public gave us ideas and comments at the meeting, in writing, and through our Web page comment form.

The planning team used the public comments to develop a final list of issues. After scoping, the team crafted the draft vision and goals for the refuge that, along with the refuge purposes, led to the development of a range of management alternatives to address the issues. The planning team evaluated the alternatives, and the Service identified one of the alternatives as the proposed action for the draft plan. Specific objectives in the draft plan describe how we would manage the refuge to meet its purposes, vision, and goals

The Decision

After the public reviews and provides comments on the draft plan and environmental assessment, the planning team will present this document along with a summary of all substantive public comments to our Regional Director. The Regional Director will consider the environmental effects of each alternative and will choose a preferred alternative for management of the refuge including the enhancement of Flat Creek.

Issues

The issues for the National Elk Refuge are a compilation of concerns and comments raised by Service staff and the public.

Climate Change and Landscape-Scale Conversion

A broad issue is that the effects of climate change are unknown and may affect habitats throughout landscape, or geographic area. Furthermore, to successfully and effectively manage habitat and wildlife on the refuge, we need to work within a framework of conservation efforts throughout the landscape—at the level of Jackson Hole and even larger.

Habitat and Wildlife

Conserving and restoring native habitat is as important to the refuge's namesake—elk—as it is for bison, migratory birds, federally and State-listed plants and animals, and many other species. Invasive plants are replacing native habitat in some areas, and big game and amphibians are at risk of disease in some places. Our ability to make informed management decisions for the refuge is sometimes hampered by a lack of information about the condition of habitat and wildlife, their interactions, and their responses to climate, humans, and management activity.

Visitor Services

The outstanding scenery, natural resources, and easily visible herds of elk and bison bring multitudes of visitors to Jackson Hole. There is a high and increasing public demand for information and experiences on the refuge, as well as the adjacent Grand Teton National Park and Bridger-Teton National Forest. We have an increasing need for more outreach, education, and interpretation with the public to explain our "wildlife first" mission and associated management, along with the opportunities a national wildlife refuge brings. Hunting and fishing are not only compatible public uses, they are important management activities that help us meet elk and bison herd objectives and reduce nonnative fish. As refuge staff continues to work closely with the other land management agencies, managing public access onto and through the refuge continues to be a challenge.

Administration and Partnerships

With an increasing demand for services, we are finding that we lack the staff, facilities, and money to safely and effectively meet the demand while carrying out critical habitat and wildlife management. We need to set up the interagency visitor center operation to function more efficiently. The refuge could not provide many of the visitor services we do without our dedicated volunteers and strong partnerships with nongovernmental groups as well as other government agencies.

FWS

Uinta Ground Squirrel

The Refuge

The National Elk Refuge was established in response to severe elk starvation in Jackson Hole. The development of the town of Jackson and settlement of the valley by cattle ranchers substantially reduced historical elk winter range and led to massive elk starvation during the winters of 1909 and 1910. At the request of the State of Wyoming, the U.S. Congress first appropriated $20,000 on March 4, 1911, for "feeding, protecting and removing elk in Jackson Hole and vicinity."

Habitat

The refuge lies in the Greater Yellowstone Ecosystem, which is one of the last remaining nearly intact ecosystems in the northern temperate zone. The Gros Ventre River is the largest watercourse on the refuge and is among the river segments designated as wild and scenic by the Craig Thomas Snake Headwaters Legacy Act of 2008.

Flat Creek and its associated marshlands are integral for the natural recruitment of native trout for the Snake River watershed. Flat Creek Marsh is also an important migratory stopover for waterfowl and shorebird species in the Pacific flyway and breeding habitat for trumpeter swans and other waterfowl.

The core population area for the Jackson greater sage-grouse (defined by Wyoming Executive Order 2011–5) overlaps the refuge.

Wildlife

The grizzly bear is federally listed as threatened under the Endangered Species Act and the greater sage-grouse is a candidate for listing; we have documented both species on the refuge. Refuge grassland and sagebrush shrubland communities support breeding populations of Wyoming species of greatest conservation need, including long-billed curlew and Brewer's sparrow.

The refuge is the terminus of seasonal migrations for three celebrated large mammal species. Portions of the Jackson elk herd migrate from their summer

range in Yellowstone National Park to winter on the refuge. The refuge hosts the Jackson bison herd during the winter months, one of only three remaining free-roaming bison herds in North America. Pronghorn summer on the refuge and winter south of Pinedale, Wyoming, making it part of the second-longest mammal migration in the Western Hemisphere.

Flat Creek on the refuge provides a native fishery of Snake River cutthroat trout.

Visitation

The National Elk Refuge is considered one of the "crown jewels" of the Refuge System because of its spectacular scenery, closeness to two iconic national parks (Grand Teton and Yellowstone), and large charismatic populations of seasonal wildlife—especially elk and bison—that people want to stop and watch. The most prominent view of the refuge, which is seen by several million visitors annually as they drive to and from the town of Jackson on U.S. Highway 26/89, is the expansive Flat Creek wetland. Flat Creek's proximity to town, its easy access, and the large average fish size makes it a popular Wyoming creek and nationally recognized fishery.

The Miller House, built in 1898, was one of the early homesteads in the valley. Listed on the National Register of Historic Places in 1969, much of the original house has been restored to period standards and aesthetics, and it is open for tour by the public during the summer.

Our visitor services staff offers year-round programs to incorporate wildlife viewing, photography, interpretation, and environmental education into the visitor experience.

Vision Statement

Nestled below the majestic Teton Range, adjacent to the historic gateway town of Jackson, the National Elk Refuge provides crucial big game wintering habitat in the Greater Yellowstone Ecosystem. Across the refuge's grassland, wetland, woodland, and sagebrush shrubland communities, visitors view wintering elk and other wildlife populations that are balanced with their habitats. The public enjoys quality hunting and fishing as well as year-round interpretative opportunities. Effective outreach and strong public and private partnerships ensure understanding and protection of refuge resources for future generations.

Goals

We are developing a comprehensive conservation plan to address management of the refuge. The draft plan and environmental assessment gives the public a chance to review and comment on our evaluation of management alternatives to meet the following refuge goals.

BJ Baker / FWS

Miller House

Habitat and Wildlife Management Goals

Adaptively manage bison, elk, and other wildlife populations and habitats as outlined in the Bison and Elk Management Plan. Contribute to the conservation of healthy native wildlife populations and their habitats. Restore and sustain a native fishery that provides quality fishing opportunities.

Cultural Resources Goal

Preserve and interpret cultural resources in a way that allows visitors to connect to the area's rich history and conservation heritage.

Visitor Services Goal

Enable a diverse audience to understand and appreciate the refuge's wildlife conservation role in Jackson Hole, while safely enjoying year-round opportunities for wildlife-dependent recreation.

Visitor and Employee Safety and Resource Protection Goal

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge.

Administration Goal

Provide facilities and effectively use and develop staff resources, funding, partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge.

Alternatives

We developed four alternatives for managing the refuge, starting with no action (alternative A). Our proposed action to best manage the refuge is alternative D.

Alternative A

This no-action alternative represents the current management of the refuge.

This provides the baseline against which to compare the other alternatives. Programs would follow the same direction, emphasis, and intensity as they do now. The refuge would not expand current habitat and wildlife practices that benefit bison, elk, migratory birds, or other wildlife.

Alternative B

The focus would be balanced public use and intensive resource management.

We would limit public use to compatible wildlife-dependent uses—hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Visitors would have more opportunities to experience the refuge through expanded wildlife-dependent uses. We would intensively manage habitats and uses to meet the refuge objectives for habitat and wildlife populations.

Alternative C

The focus would be emphasizing intact ecosystems and promoting natural processes.

We would preserve intact native plant communities, maintain the long-distance ungulate (hoofed mammal) migrations, and maintain a full suite of large native carnivores. Visitor services would emphasize outreach, interpretation, and education and would provide more experiences off the refuge.

Alternative D

Our proposed action would promote natural habitats and enhance visitor services.

We would strike a balance between allowing natural processes and conducting planned management actions. Keeping some areas undeveloped and returning some areas to a natural state, we would increase development in other areas to enhance visitor services. In many cases, visitor services would emphasize outreach, interpretation, and education.

Abbreviations

Bison and Elk Management Plan	Bison and Elk Management Plan: National Elk Refuge, Grand Teton National Park, and John D. Rockefeller, Jr. Memorial Parkway
B.P.	Before present
CCP	Comprehensive conservation plan
CFR	United States Code of Federal Regulations
EA	Environmental assessment
FTE	Full-time equivalent (position)
FWS	United States Fish and Wildlife Service
GIS	Geographic Information System
GPS	Global Positioning System
GL	General Schedule classification and pay system for law enforcement officers
GS	General Schedule classification and pay system
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
LIDAR	Light detection and ranging
NPS	National Park Service
Refuge System	National Wildlife Refuge System
Region 6	Mountain-Prairie Region of the U.S. Fish and Wildlife Service
RRS	Refuge Revenue Sharing Act
Service	United States Fish and Wildlife Service
Trumpeter Swan Management Plan	Pacific Flyway Management Plan for the Rocky Mountain Population of Trumpeter Swans (Subcommittee on Rocky Mountain Trumpeter Swans 2012)
U.S.	United States
U.S.C.	United States Code
USDA Forest Service	United States Department of Agriculture, Forest Service
USGS	United States Geological Survey

visitor center	Jackson Hole and Greater Yellowstone Visitor Center
WG	Wage Grade classification and pay system
WGFD	Wyoming Game and Fish Department

A glossary of these and other terms follows chapter 6.

Chapter 1—Introduction

FWS

Bison

As the United States (U.S.) Fish and Wildlife Service, we manage the National Elk Refuge in northwestern Wyoming (see figure 1). This 24,777-acre national wildlife refuge is nestled in the valley known as Jackson Hole and is part of the National Wildlife Refuge System (Refuge System). The refuge lies centrally in the Greater Yellowstone Ecosystem, a mosaic of Federal, State, and private lands totaling 18 million acres that encompass the largest concentration of wild ungulates (hoofed mammals) and large carnivores in the lower 48 States.

We are developing a comprehensive conservation plan (CCP) to provide a foundation for the management and use of the National Elk Refuge. To address the long-term management of the refuge, we have developed a draft CCP and environmental assessment (EA) for the public to review our evaluation of management alternatives.

The draft CCP specifies the necessary actions to achieve the purposes and vision of the refuge. Wildlife and habitat are the primary priorities in refuge management, and public use (including wildlife-dependent recreation) is allowed and encouraged as long as it is compatible with the purposes of the refuge.

When finalized, the CCP will serve as a working guide for management programs and activities throughout the National Elk Refuge over the next 15 years. Although this document contains management direction for the refuge, detail will be provided in stepdown management plans as part of implementing the final CCP.

This chapter introduces the process for development of the CCP, including descriptions of our involvement and that of the State of Wyoming, the public, and others. Chapter 1 also describes the con-

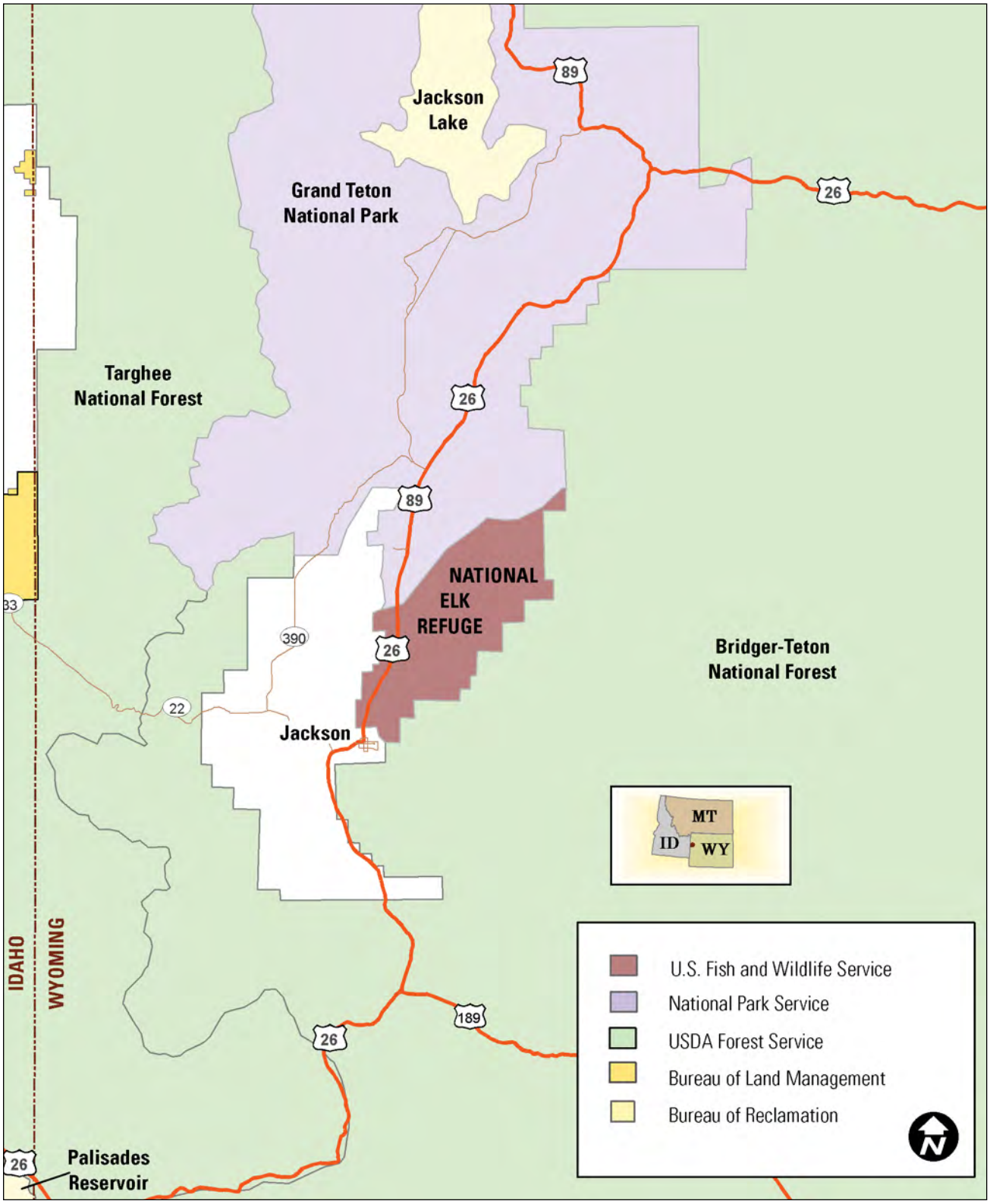

Figure 1. Vicinity map of the National Elk Refuge, Wyoming.

servation issues and the national, regional, State, and local plans that affect the refuge.

The remaining chapters contain the information we used and the results of our analysis that are the foundation of the draft plan:

- Chapter 2 describes the refuge purposes and vision and the planning issues.
- Chapter 3 sets out the alternatives, including the proposed action, for management of the refuge.
- Chapter 4 describes the physical, biological, and social environment that the alternatives would affect.
- Chapter 5 explains the expected consequences of carrying out each of the alternatives.
- Chapter 6 describes objectives and strategies for the proposed action, which represents the draft CCP.

1.1 Purpose and Need for the Plan

The purpose of the draft CCP is to describe the role that the National Elk Refuge would play in support of the mission of the Refuge System and to provide long-term guidance for managing programs and activities. The CCP is needed to help us achieve the following:

- communication with the public and other partners in efforts to carry out the mission of the Refuge System
- a clear statement of direction for managing the refuge
- an understanding by neighbors, visitors, and government officials of our management actions on and around the refuge
- management actions on the refuge that are consistent with the mandates of the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act)
- management of the refuge that is consistent with Federal, State, and county plans
- a basis for development of budget requests for the refuge's operation, maintenance, and capital improvement needs

In addition, the draft CCP and EA incorporates an analysis of the Flat Creek enhancement project, a large effort to improve the creek's habitat and the fishery it supports, as proposed under alternative D.

Sustaining the Nation's fish and wildlife resources is a task that can be accomplished only through the combined efforts of governments, businesses, and private citizens.

The Decision to be Made

The Regional Director for the Mountain-Prairie Region of the Service will choose a preferred alternative for management of all refuge programs; this alternative will guide completion of the final CCP. The management direction in the final CCP will not conflict with management approved in the Bison and Elk Management Plan.

1.2 The U.S. Fish and Wildlife Service and the Refuge System

The U.S. Fish and Wildlife Service is the principal Federal agency responsible for fish, wildlife, and plant conservation, and the National Wildlife Refuge System is one of the our major programs.

U.S. Fish and Wildlife Service

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

In the late 19th and early 20th centuries, America's fish and wildlife resources were declining at an alarming rate, largely because of unrestricted market hunting. Concerned citizens, scientists, and hunting and fishing groups came together and generated the political will for the first significant conservation measures taken by the Federal Government. These actions included the establishment of the Bureau of Fisheries in the 1870s and, in 1904, passage of the first Federal wildlife law—the Lacey Act—which prohibited interstate transportation of wildlife taken in violation of State laws. Beginning in 1903, President Theodore Roosevelt created more than 50 national wildlife refuges across the Nation.

Over the next three decades, the United States ratified the Migratory Bird Treaty with Great Britain, and Congress passed laws to protect migratory birds, establish new refuges, and create a funding source for refuge land acquisition. In 1940, the U. S. Fish and Wildlife Service was created within the U.S. Department of the Interior, and existing Federal wildlife functions including law enforcement, fish management, animal damage control, and national wildlife refuge management were combined into a single organization for the first time.

Today, we enforce Federal wildlife laws, manage migratory bird populations, restore nationally significant fisheries, conserve and restore vital wildlife habitat, protect and recover endangered species, and help other governments with conservation efforts. In addition, we administer a Federal aid program that distributes hundreds of millions of dollars to States for fish and wildlife restoration, boating access, hunter education, and related programs across the United States.

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 the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

In 1903, President Theodore Roosevelt designated the 5.5-acre Pelican Island in Florida as the Nation's first national wildlife refuge for the protection of native nesting birds. This was the first time the Federal Government had set aside land for wildlife. This small but significant designation was the beginning of the National Wildlife Refuge System.

One hundred years later, the Refuge System has become the largest collection of lands in the world specifically managed for wildlife, encompassing more than 150 million acres within 560 refuges and more than 3,000 small areas for waterfowl breeding and nesting. Today, there is at least one refuge in every State including Puerto Rico and the U.S. Virgin Islands.

Mission

The Improvement Act established a clear mission for the Refuge System:

The Improvement Act states that each national wildlife refuge (meaning every unit of the Refuge System including wetland management districts and conservation areas) must be managed to do the following:

- fulfill the mission of the Refuge System
- fulfill the individual purposes of each refuge
- consider the needs of fish and wildlife first
- support the biological integrity, diversity, and environmental health of the Refuge System
- recognize that wildlife-dependent recreation activities including hunting, fishing, wildlife observation, photography, environmental education, and interpretation are legitimate and priority public uses
- retain the authority of refuge managers to determine compatible public uses
- fulfill the requirement of developing a CCP for each unit of the Refuge System and fully involve the public in preparation of these plans

In addition to the mission for the Refuge System, the wildlife and habitat vision for each unit of the Refuge System supports the following principles:

- Wildlife comes first.
- Ecosystems, biodiversity, and wilderness are vital concepts in refuge management.
- Habitats must be healthy.

- Growth of refuges must be strategic.

The Refuge System serves as a model for habitat management with active participation from other interested parties. Following passage of the Improvement Act, the Service immediately began to carry out the direction of the new legislation including preparation of CCPs for all national wildlife refuges and wetland management districts. Consistent with the Improvement Act, the Service prepares CCPs in conjunction with public involvement.

People and the Refuge System

The Nation's fish and wildlife heritage contributes to the quality of American lives and is an integral part of the country's greatness. Wildlife and wild places have always given people special opportunities to have fun, relax, and appreciate the natural world.

Whether through birdwatching, fishing, hunting, photography, or other wildlife pursuits, wildlife recreation contributes millions of dollars to local economies. In particular, money generated from a tax on the sale of sporting arms and ammunition and the sale of fishing equipment that is authorized by the Pittman-Robertson and Dingell-Johnson Acts, respectively, has generated tens of millions of dollars. Distributed by us, this money has been used by States to manage wildlife and fish populations, expand habitat, and provide education for hunters across the Nation. Approximately 35 million people visited the Refuge System in 2006, mostly to observe wildlife in their natural habitats (Caudill and Henderson 2005). Visitors are most often accommodated through nature trails, auto tours, interpretive programs, and hunting and fishing opportunities. Substantial economic benefits are being generated for the local communities that surround refuges and wetland management districts. Economists report that Refuge System visitors contribute more than $1.7 billion annually to local economies.

1.3 National and Regional Mandates

Refuge System units (national wildlife refuges, wetland management districts, and conservation areas) are managed to achieve the mission and goals of the Refuge System along with the designated purpose of the refuges as described in establishing legislation, Executive orders, or other establishing documents. The key concepts and guidance for the Refuge System are in the National Wildlife Refuge System Administration Act of 1966, Title 50 of the U.S. Code of Federal Regulations (CFR), the "Fish and Wildlife Service Manual," and the Improvement Act.

The Improvement Act amends the Refuge System Administration Act by providing (1) a unifying mission for the Refuge System, (2) a new process for determining compatible public uses on refuges and districts, and (3) a requirement that each refuge and district be managed under a CCP. The Improvement Act states that wildlife conservation is the priority on Refuge System lands and that the Secretary of the Interior will make sure that the biological integrity, diversity, and environmental health of refuge lands are maintained. Each refuge must be managed to fulfill the Refuge System's mission and the specific purposes for which the unit was established. The Improvement Act requires the Service to monitor the status and trends of fish, wildlife, and plants in each national wildlife refuge and wetland management district.

A detailed description of these and other laws and Executive orders that may affect the CCP or the Service's implementation of the CCP is in "Appendix A—Key Legislation and Policy." Service policies for planning and day-to-day management of refuges and districts are in the "Refuge System Manual" and the "Fish and Wildlife Service Manual."

1.4 Refuge Contributions to Regional and National Plans

The National Elk Refuge contributes to the conservation efforts outlined in the various State and national plans described here.

Conserving the Future

Conserving the Future: Wildlife Refuges and the Next Generation lays out 24 recommendations that 9 implementation teams are charged with fulfilling. The implementation of these recommendations are currently underway and can be followed online (FWS 2011).

Conserving the Future will deliver on three outcomes: articulate the important work and future of the Refuge System in a vision document, raise the awareness of conservation on refuges, and foster new leaders for us and the Refuge System as well as for the conservation community.

Partners in Flight

The Partners in Flight program began in 1990 with the recognition of declining population levels of many migratory bird species. The challenge is to manage human population growth while maintaining functional natural ecosystems in the face of human population growth. To meet this challenge, Partners in Flight worked to identify priorities for landbird species and habitat types. Partners in Flight activity has resulted in 52 bird conservation plans covering the continental United States.

In 2001, participants in Wyoming Partners In Flight, the State working group of Partners In Flight, developed the Wyoming Bird Conservation Plan as part of the international Partners In Flight effort. Bird species found in Jackson Hole that are designated as level 1 (conservation action) and confirmed on the National Elk Refuge follow: Brewer's sparrow, greater sage-grouse, trumpeter swan, long-billed curlew, peregrine falcon, bald eagle, and Franklin's gull.

North American Waterbird Conservation Plan

The North American Waterbird Conservation Plan (Kushlan et al. 2002) provides a contiguous framework for conserving and managing colonial-nesting waterbirds including 209 species of seabirds, coastal waterbirds (gulls, terns, and pelicans), wading birds (herons and ibises), and marshbirds (certain grebes and bitterns). The geographic scope of the plan covers 28 countries from Canada to Panama as well as islands and near-shore areas of the Atlantic and Pacific Oceans, the Gulf of Mexico, and the Caribbean Sea. As with Partners in Flight and other migratory bird plans, the North American Waterbird Conservation Plan has a goal to establish conservation action and exchange information and expertise with other bird conservation initiatives. The plan also calls for establishment of "practical units for planning" for terrestrial habitats; the National Elk Refuge is located within the Intermountain West.

North American Waterfowl Management Plan

Written in 1986, the North American Waterfowl Management Plan (FWS and Canadian Wildlife Service 1986) envisioned a 15-year effort to achieve landscape conditions that could sustain waterfowl populations. Specific plan objectives are to increase and restore duck populations to the average levels of the 1970s: 62 million breeding ducks and a fall flight of 100 million birds (FWS and Canadian Wildlife Service 1986). Recognizing the importance of waterfowl and wetlands to North Americans and the need for international cooperation to help in the recovery of a shared resource, the United States and Canadian Governments developed a strategy to restore waterfowl populations through habitat protection, restoration, and enhancement. The plan is innovative because of its international scope and its implementation at the regional level.

The plan's success depends on the strength of partnerships called joint ventures, which involve Federal, State, provincial, tribal, and local governments; businesses; conservation organizations; and individual citizens. Joint ventures are regional, self-directed partnerships that carry out science-based conservation through a wide array of community participation. Joint ventures develop implementation plans that focus on areas of concern identified in the plan.

The National Elk Refuge lies within the Intermountain West Joint Venture. Throughout the planning process, we considered the North American Waterfowl Management Plan and the supporting efforts of the Intermountain West Joint Venture, which the CCP supports and promotes.

Recovery Plans for Federally Listed, Threatened, or Endangered Species

One species that is federally listed as threatened, grizzly bear, and one candidate species, greater sage-grouse, have been documented at the National Elk Refuge. To make sure that the conservation of listed and candidate species are adequately considered in this document, we conducted a biological evaluation of their actions per section 7 of the Endangered Species Act.

If, during the life of this CCP, listed species are discovered on the refuge or new species are listed, we will make sure that the refuge takes part in any approved recovery plans. We will also conduct an Intra-Service Section 7 Consultation on refuge management activities that might affect the listed or candidate species.

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Canada Goose Gosling

Wyoming State Wildlife Action Plan

The Wyoming Game and Fish Commission adopted the State's Comprehensive Wildlife Conservation Strategy in 2005. The Wyoming Game and Fish Department (WGFD) revised the strategy in 2010 (WGFD 2010a), at which time it became known as the Wyoming State Wildlife Action Plan. The action plan is a broad strategy designed to coordinate efforts to maintain the health and diversity of wildlife in Wyoming and to prevent future listings under the Endangered Species Act. The Wyoming State Wildlife Action Plan is part of a national framework of plans that are required by each State to receive State Wildlife Grant money, which is a program enacted by Congress in 2001 and that we administer.

The 2010 State wildlife action plan identifies 180 "species of greatest conservation need" in Wyoming: 56 birds, 46 mammals, 30 fish, 8 amphibians, 21 reptiles, 5 crustaceans, and 14 mollusks. Many of these species are nongame species that have received little conservation attention in the past and for which species data may be unavailable. The action plan describes the modeled distribution and abundance of these species and uses a three-tier system to rank them according to conservation priority.

In addition to species of greatest conservation need, the Wyoming State Wildlife Action Plan identifies five leading conservation challenges in the State: (1) rural subdivision and development; (2) energy development; (3) invasive species; (4) climate change; and (5) the disruption of natural disturbance regimes. Additionally, the action plan identifies and makes conservation recommendations for 11 terrestrial habitat types and 6 aquatic basins in Wyoming in terms of the species of greatest conservation need that may be found there. Important habitat types in Jackson Hole identified in the action plan include wetlands, riparian areas, aspen and deciduous forests, foothill shrublands, montane and subalpine forests, mountain grasslands, and sagebrush shrublands.

Important terrestrial species of greatest conservation need found in Jackson Hole are peregrine falcon, long-billed curlew, Lewis's woodpecker, black tern, white-faced ibis, merlin, Caspian tern, harlequin duck, bald eagle, trumpeter swan, big brown bat, fringed myotis, little brown myotis, long-eared myotis, long-legged myotis, boreal toad, moose, wolverine, Canada lynx, dwarf shrew, and vagrant shrew. Important aquatic species of greatest conservation need found in Jackson Hole are bluehead sucker, mountain sucker, mountain whitefish, and Snake River cutthroat trout.

Wyoming Greater Sage-Grouse Conservation Plan

On March 5, 2010, we concluded that the greater sage-grouse warrants protection under the Endangered Species Act, but listing is precluded by the need to take action on other species facing more immediate and severe extinction threats. In 2008, we adopted the Wyoming Greater Sage-Grouse Conservation Plan (WGFD 2008) and provide the framework for local working groups to guide management efforts directed at halting long-term population declines. Our refuge staff takes part in local working group meetings, and we consider the recommended management practices in the plan when developing management practices and plans on the refuge.

The National Elk Refuge lies within the core population area of the Jackson greater sage-grouse as designated by the State of Wyoming Greater Sage-Grouse Core Area Protection Executive Order (2011–5), signed by Governor Dave Freudenthal in

August 2010. The State established core population areas, in addition to stipulations for development on lands within those core areas, to build a statewide strategy to conserve the greater sage-grouse across Wyoming and to prevent the species from being listed for protection under the Endangered Species Act.

Bison and Elk Management Plan

Approved in 2007, the "Bison and Elk Management Plan: National Elk Refuge, Grand Teton National Park, and John D. Rockefeller, Jr. Memorial Parkway" (FWS and NPS 2007a) is referred to throughout this document as the Bison and Elk Management Plan. The purpose of the plan is to provide managers with goals, objectives, and strategies for managing elk and bison on the National Elk Refuge and in Grand Teton National Park. Goals and strategies were developed for the following:

- habitat conservation
- sustainable populations
- numbers of elk and bison
- disease management

In general, the plan moves elk and bison management toward reduced reliance on supplemental feeding and, at some future time, total reliance on natural forage. Management actions taken to date have focused on disease monitoring, reducing elk and bison herd sizes through public hunting, and increasing natural, standing winter forage through expanded irrigation. Management goals and actions approved in the Bison and Elk Management Plan apply to the National Elk Refuge, and we refer to them throughout the draft CCP and EA. Because the CCP will supplement the Bison and Elk Management Plan, we do not repeat the plan's objectives in the CCP.

Greater Yellowstone Coordinating Committee

The refuge has been a member of the Greater Yellowstone Coordinating Committee since 2002. Members include national wildlife refuge managers, national park superintendents, and national forest supervisors for units within the ecosystem. A memorandum of understanding provides a vehicle for cooperation and coordination in the management of Federal lands in the Greater Yellowstone Ecosystem. The committee's land managers periodically identify resource management issues where coordination across the Greater Yellowstone Ecosystem is desirable.

Responding to Accelerating Climate Change

We expect that accelerating climate change may have profound effects on the Nation's fish, wildlife, and plant resources. While many species will continue to thrive, some may decline and in some instances go extinct. Others will survive in the wild only through direct and continuous intervention by managers. In 2010, we finalized a strategic plan (FWS 2010) to address climate change for the next 50 years. This strategic plan employs three key strategies: adaptation, mitigation, and engagement. In addition, the plan acknowledges that no single organization or agency can address climate change without allying itself with others in partnership across the Nation and around the world. This plan is an integral part of the U.S. Department of the Interior's strategy for addressing climate change as expressed in Secretarial Order 3289 (September 14, 2009).

We use the following guiding principles from this strategic plan in responding to climate change:

- Priority Setting—Continually evaluate priorities and approaches, make difficult choices, take calculated risks, and adapt to climate change.

- Partnership—Commit to a new spirit of coordination, collaboration, and interdependence with others.

- Best Science—Reflect scientific excellence, professionalism, and integrity in all our work.

- Landscape Conservation—Emphasize the conservation of habitats within sustainable landscapes, applying our strategic habitat conservation framework.

- Technical Capacity—Assemble and use state-of-the-art technical capacity to meet the climate change challenge.

- Global Approach—Be a leader in national and international efforts to meet the climate change challenge.

1.5 Landscape-Scale Conservation

In the face of escalating challenges such as land use conversion, invasive species, water scarcity, and refuge complex issues that have been amplified by accelerating climate change, our ecosystem approach of thinking about conservation has evolved to developing a broader vision—strategic habitat conservation. Landscape conservation cooperatives will facilitate how we carry out strategic habitat conservation.

Strategic Habitat Conservation

A cooperative effort between us and the U.S. Geological Survey culminated in a report by the National Ecological Assessment Team (USGS 2006). The report outlines a unifying adaptive resource management approach for conservation at a landscape scale for the entire range of a target species or suite of species. This is strategic habitat conservation—a way of thinking and doing business by incorporating biological goals for target species populations, by making strategic decisions about the work needed, and by constantly reassessing (figure 2).

We used this framework as the basis to locate the first generation of landscape conservation cooperatives. These cooperatives are conservation-science partnerships between us and other Federal agencies, States, tribes, nongovernmental organizations, universities, and others. Designed as fundamental units for planning and science, the cooperatives have the capacity to help us carry out the elements of strategic habitat conservation—biological planning, conservation design and delivery, and monitoring and research. Coordinated planning and scientific information strengthens our strategic response to accelerating climate change.

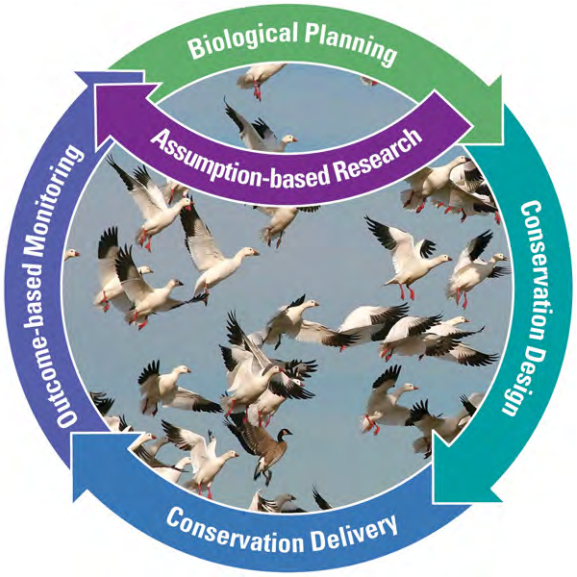

Figure 2. The strategic habitat conservation process.

Landscape Conservation Cooperatives

Strategic habitat conservation is a means of applying adaptive resource management across large landscapes. The National Elk Refuge lies within the Service's Great Northern Landscape Conservation Cooperative (figure 3). This landscape conservation cooperative covers the mountain and transitional habitats in Montana, Idaho, Wyoming including the upper Green River Basin in southern Wyoming and small parts of Colorado and Utah, and parts of the Interior Columbia Plateau reaching into Oregon and Washington westward to the Cascade Range. The Great Northern Landscape Conservation Cooperative also covers the international landscapes of interior British Columbia and Alberta, Canada, and covers the entirety of the northern Rocky Mountains and midcontinent lowlands of the Interior Northwest.

Figure 3. Map of the Great Northern Landscape Conservation Cooperative in North America.

The landscape conservation cooperative has identified the following priority species: bull trout, grizzly bear, Lewis's woodpecker, trumpeter swan, westslope cutthroat trout, Arctic grayling, wolverine, willow flycatcher, greater sage-grouse, burrowing owl, and Columbia spotted frog. Two of these species, trumpeter swan and greater sage-grouse, use the refuge.

As the Great Northern Landscape Conservation Cooperative continues to develop, an overarching priority is to serve as a convening body to bring together partners to address existing and future issues related to climate change and landscape-scale conservation.

1.6 Planning Process

The Improvement Act requires us to develop a CCP for each national wildlife refuge. The final plan for the National Elk Refuge is scheduled for comple-

Figure 3. Map of the Great Northern Landscape Conservation Cooperative in North America.

tion in 2013 and will guide the management of the refuge complex for the next 15 years.

We prepared this draft CCP and EA in compliance with the Improvement Act and part 602 (National Wildlife Refuge System Planning) of the "Fish and Wildlife Service Manual." The actions described in the draft CCP and EA meet the requirements of the Council on Environmental Quality regulations that implement the National Environmental Policy Act of 1969.

Additional requirements and guidance are contained in the Refuge System's planning policy issued in 2000. The policy established requirements and guidance for refuge and district plans, including CCPs and stepdown management plans, to make sure that planning efforts follow the Improvement Act. The planning policy identified several steps of the CCP and environmental analysis process (figure 4).

We began the pre-planning process in August 2010 with the establishment of a planning team comprised primarily of staff from the National Elk Refuge and the Region 6 Division of Refuge Planning. Contributors included other Service divisions, the WGFD, Teton County, and the National Park Service (refer to "Appendix B—List of Preparers and Contributors"). During pre-planning, the team developed a mailing list and identified internal issues and the unique qualities of the refuge (refer to section "2.5 Special Values" in chapter 2). The planning team identified and reviewed current programs, compiled and analyzed relevant data, and identified the purposes of the refuge.

Public scoping started with a notice of intent to prepare the draft CCP and EA that we published in the Federal Register on October 22, 2010 (75 Federal Register 65370). We distributed information through news releases, issuance of the first planning update, and a public meeting held January 11, 2011, at Snow King Resort in Jackson, Wyoming, from 4 p.m. to 7 p.m.

The planning team encouraged public comment during the planning process through the development and release of the draft CCP and EA. This CCP project complies with public involvement requirements of the National Environmental Policy Act, and the planning team incorporated public input throughout the planning process. During the planning process, the team collected available information about the resources of the refuge and surrounding areas. This information is summarized in "Chapter 4—Affected Environment." Table 1 lists the specific

steps in the planning process to date for the preparation of the draft CCP and EA.

Coordination with the Public

We prepared a mailing list of more than 90 names during pre-planning. The mailing list has private citizens; local, regional, and State government representatives and legislators; other Federal agencies; and interested organizations (refer to "Appendix C—Public Involvement"). The first planning update was distributed through refuge email mailing lists and at the public scoping meeting in January 2011. Information was provided on the history of the refuge and the CCP process and included an invitation to attend the public scoping meeting being held in January. The planning update contained information on how to be placed on the CCP mailing list, and the planning update provided opportunities for submitting comments.

The Service held a public scoping meeting January 11, 2011. Forty people attended the meeting, which was an open-house format with stations set up around and our staff attending each station to provide information and answer questions. We encouraged attendees to ask questions and offer comments. We recorded verbal comments and gave each attendee a comment form to submit other thoughts or questions in writing.

Written comments were due February 10, 2011. We received more than 230 comments orally and in writing during the scoping process. There were letters from eight organizations (Concerned Citizens for the Elk, Defenders of Wildlife, Friends of Pathways, Greater Yellowstone Coalition, Jackson Hole Chamber of Commerce, Jackson Hole Conservation Alliance, Jackson Hole Public Art Initiative, and The Wildlife Society) and four agencies (National Park Service, Teton Conservation District, Teton County, and WGFD). The planning team considered all of the comments throughout the planning process.

State Coordination

At the start of the planning process, our Regional Director (Region 6) sent a letter to WGFD, inviting them to join in the planning process. Two representatives from the WGFD are participating on the planning team.

Figure 4. Process steps for comprehensive planning and associated environmental analysis.

Table 1. Summary of the comprehensive conservation planning process for the National Elk Refuge, Wyoming.

Date	*Event*	*Outcome or purpose*
August 4–5, 2010	Preplanning meeting	We discussed the initial planning team list, started the mailing list, and discussed the planning schedule and data needs.
October 22, 2010	Notice of intent	We published our notice of intent to prepare a CCP in the Federal Register.
December 10, 2010	Planning team invitations	The Regional Director invited tribal nations, National Park Service, USDA Forest Service, WGFD, and Teton County to join the planning team.
January 11–12, 2011	CCP kickoff and vision and goals meeting	The planning team reviewed the refuge purposes, identified refuge qualities and issues, and developed a draft vision statement and goals for the refuge.
March 14, 2011	Work plan	We completed the work plan of planning tasks.
January 2011	Planning update	We sent Planning Update 1 to people and organizations on the mailing list. The update described the planning process and announced the upcoming public scoping meeting.
January 11, 2011	Public scoping meeting	We held a public meeting in Jackson. The public had an opportunity to learn about the CCP process and provide comments.
February 1–June 7, 2011	Five planning team conference calls	The planning team summarized public comments, identified issues to be addressed in the planning process, and began developing a range of management alternatives for the refuge.
December 13–15, 2011	Alternatives development meeting	The planning team met in Jackson, Wyoming, to discuss management alternatives.
March 19–21, 2012	Environmental consequences and selection of proposed action workshop	The planning team met in Jackson to review the environmental consequences for the alternatives and select a proposed action alternative.
June 19–21, 2012	Objectives and strategies work session	The planning team began writing objectives and strategies for the proposed action alternative.
September 2012–July 2013	Draft plan preparation	The planning team prepared the draft CCP and EA.
December 2013	Draft plan internal review	The planning team and other staff reviewed the draft CCP and EA and provided comments to help clarify the analyses and provide consistency.

We sent Planning Update 1 to the offices of the U.S. Representative Cynthia Lummis and U.S. Senators John Barrasso and Mike Enzi to tell them about the planning process and invite them to attend a public scoping meeting and provide comments on issues to be addressed during the planning process. In addition, we sent the planning updates to Wyoming Governor Matt Mead; Wyoming State Senators Leland Christensen and Dan Dockstader; and Wyoming State representatives Keith Gingery, Ruth Petroff, and Jim Roscoe. In addition, we made phone calls during the scoping period inviting the elected officials to attend the upcoming scoping meeting for the CCP; three local elected officials attended the meeting at the Snow King Resort in Jackson, Wyoming, on January 11, 2011.

Tribal Coordination

Early in the planning process, our Regional Director (Region 6) sent a letter to tribes identified as possibly having a cultural and historical connection to the area in which the National Elk Refuge is located. The letters went to the following tribal councils: Assiniboine and Sioux Tribes of Fort Peck, Cheyenne and Arapaho, Cheyenne River Sioux, Crow Creek Sioux, Lower Brule Sioux, North Arapaho, Northern Cheyenne, Oglala Sioux, Rosebud Sioux, Santee Sioux, Shoshone, Shoshone-Bannock, and Standing Rock Sioux. The tribal councils did not submit responses to the Region 6 letter; nevertheless,

Lori Iverson / FWS

Flat Creek Marsh

we gave the councils opportunities to comment throughout the planning process.

Teton County Coordination

At the start of the planning process, our Regional Director (Region 6) sent a letter to the Teton County Board of Commissioners inviting them to join in the planning process. A representative of Teton County and the City of Jackson is participating on the planning team.

Results of Scoping

We used the comments, collected from scoping meetings and correspondence, in the development of a final list of issues that are addressed in the draft CCP and EA. We decided which alternatives could best address these issues. The planning process ensures that we resolve or give priority to issues with the greatest effect on the refuge resources and programs over the life of the final CCP. Chapter 2 contains the issues we identified, along with a discussion of effects on resources. In addition, we considered suggested changes to current refuge management presented by the public and other groups.

Selecting an Alternative

After the public reviews and provides comments on the draft CCP and EA, the planning team will present this document along with a summary of all substantive public comments to our Regional Director. The Regional Director will consider the environmental effects of each alternative including information gathered during the public review. The Regional Director will choose a preferred alternative for management of the refuge. If the Regional Director finds that no significant impacts would occur, the Regional Director's decision will be disclosed in a finding of no significant impact included in the final CCP. If the Regional Director finds a significant impact would occur, an environmental impact statement would be prepared. If approved, the actions in the preferred alternative will compose the final CCP.

After the planning team prepares the final CCP for publication, we will publish a notice of availability in the Federal Register, and we will send copies of the final CCP or accompanying summary to individuals on the mailing list. Subsequently, we will implement the CCP with help from partner agencies, organizations, and the public.

The CCP will provide long-term guidance for management decisions; support achievement of the goals, objectives, and strategies needed to accomplish the purposes of the National Elk Refuge; and describe our best estimate of future needs. We will use the CCP along with the Bison and Elk Management Plan as guidance for managing the National Elk Refuge.

Chapter 2—The Refuge

Ann Hough / FWS

Trumpeter Swans

This chapter explains the establishment, management history, purposes, and special values of the National Elk Refuge in northwestern Wyoming along with the proposed vision and goals and a discussion of the planning issues.

2.1 Establishment, Acquisition, and Management History

The following section describes the refuge's establishment, acquisition, and management history.

Establishment

The National Elk Refuge is one of the oldest refuges in the Refuge System (see figure 5). It was established in 1912 as a "winter game (elk) reserve," but over the years, its purpose has been broadened to include "refuges and breeding grounds for birds, other big game animals, the conservation of fish and wildlife, and the protection of natural resources and conservation of threatened or endangered species."

Acquisition History

When the U.S. Congress appropriated $20,000 on March 4, 1911, for "feeding, protecting and removing elk from the Jackson Hole and vicinity," it also assigned E.A. Preble, scientist for the Bureau of Biological Survey, the task of making a preliminary investigation of the Jackson Hole elk situation. Preble was assisted by D.C. Nowlin (who became the first refuge manager) in assessing the Jackson elk herd and its needs.

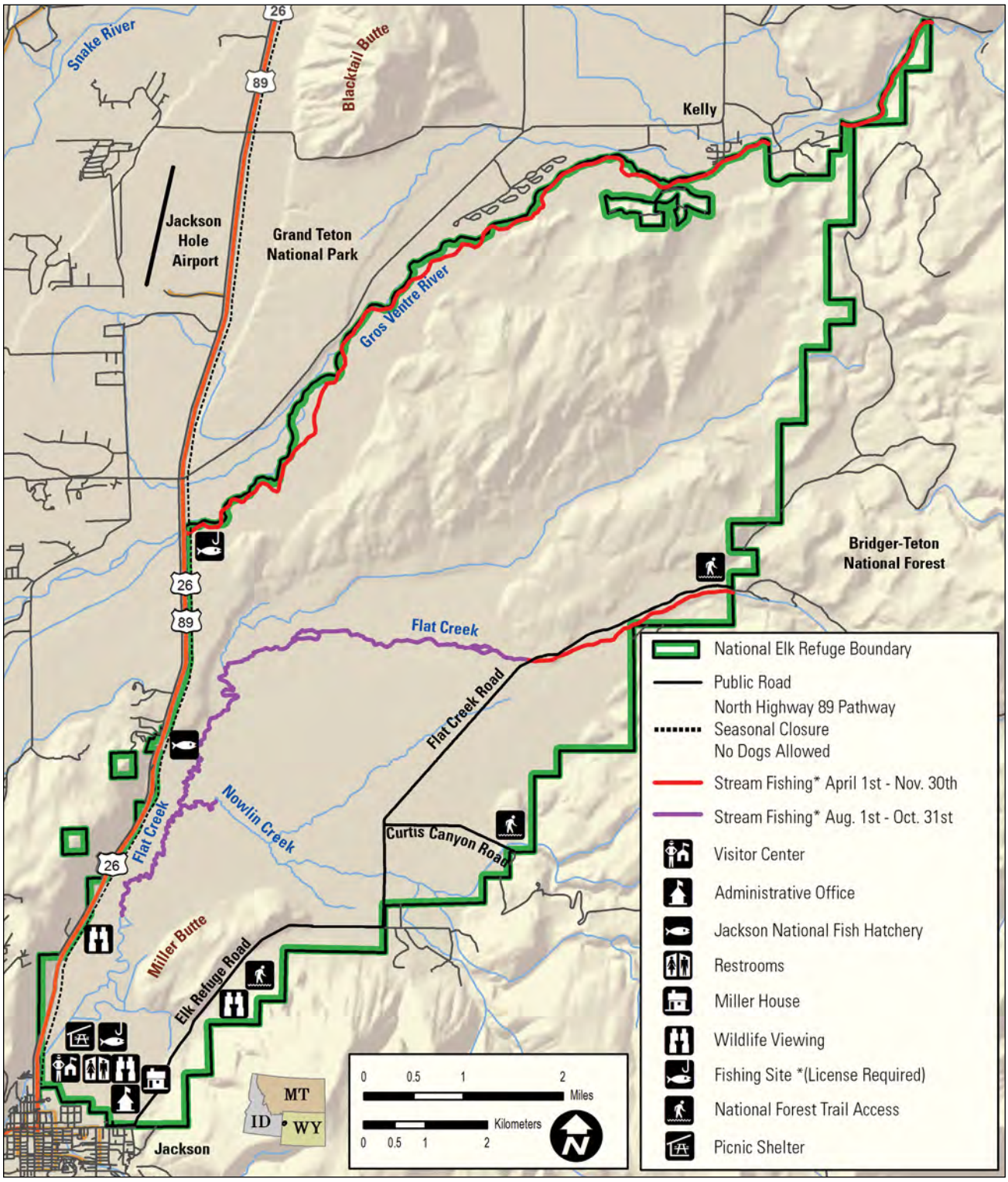

Figure 5. Base map of the National Elk Refuge, Wyoming.

Preble and Nowlin conducted an evaluation of that part of the Snake River Valley known as Jackson Hole, which extends from Jackson Lake on the north to the mouth of the Hoback River on the south. They also evaluated the Buffalo River and Gros Ventre River valleys. Preble and Nowlin's population estimate was 20,000 elk with an estimated winter mortality of 2,000–2,500. Preble concluded his report with the statement, "The Biological Survey looks on the establishment of one or more winter refuges as the best solution of the problem of properly caring for the elk in winter." He recommended winter elk refuges either in the Gros Ventre River valley or in the Snake River Valley near the town of Jackson. Residents in Jackson strongly opposed the Gros Ventre River valley site but generally supported a location near their town.

On August 10, 1912, the U.S. Congress appropriated $45,000 to buy lands and pay for maintenance of a "winter game (elk) reserve" (37 Stat. 293). The first tract for the National Elk Refuge was bought in 1914. Since that time, we have acquired land primarily through purchase with a few tracts obtained through exchange, donation, or condemnation. Several noteworthy acquisitions have occurred. In 1927, the Isaac Walton League of America donated 1,757 acres, which increased the size of the refuge at that time by 30 percent. The top-priority acquisition listed in our 1965 refuge master plan was an 80-acre tract that occupied a 2.75-mile-long area along the eastern side of State Highway 89. We acquired this tract to prevent any commercial or residential development next to the refuge that would "block and disfigure" the "breathtaking view of the land."

By 1950, the refuge had expanded in size to 23,001 acres. More acquisitions occurred in 1978 and 1986 to prevent the completion of the adjacent Teton Highlands and Teton Ranch subdivisions. Land values in Teton County, especially next to the refuge, began to skyrocket in the 1990s and reached multiple millions of dollars per acre by 2007. These exorbitant land values have prevented all fee-title land acquisition since 1992. Today, the refuge has completely filled its approved acquisition boundary and is 24,778 acres in size. Table 2 summarizes the history of land acquisition for the refuge, and figure 6 shows locations of the land tracts. The refuge is bounded by the town of Jackson on the south, the Gros Ventre River on the north, Highway 89 on the west, and the Bridger-Teton National Forest on the east. Because much of the refuge was comprised from homesteads, areas of the refuge have retained some of these historical names, as shown on figure 7.

Management History

The National Elk Refuge was established in response to severe elk starvation in Jackson Hole. The development of the town of Jackson and settlement of the valley by cattle ranchers substantially reduced historical elk winter range and led to massive elk starvation during the winters of 1909 and 1910. At the request of the State of Wyoming, the U.S. Congress first appropriated $20,000 on March 4, 1911, for "feeding, protecting and removing elk in Jackson Hole and vicinity."

Feeding hay to elk wintering in Jackson Hole was one of the first management activities to occur on what is now the National Elk Refuge. No-feeding years have occurred irregularly and infrequently.

Table 2. Land acquisition history for the National Elk Refuge, Wyoming.

Date of acquisition	*Tract number*	*Final acres*	*Means of acquisition*
3/16/1914	9e, 9f, 9g	1,205.25	Purchase
4/21/1915	1	4,322.27	Primary withdrawal
10/18/1915	121	360	Purchase
10/22/1915	118	160	Purchase
9/26/1927	119, 119a	1,757.38	Donation
7/20/1936	59	240	Purchase
7/21/1936	39	802.74	Purchase
7/23/1936	52	140	Purchase
7/23/1936	68	796	Purchase
7/23/1936	30, 30–I	470.13	Purchase
7/30/1936	7	279.82	Purchase
7/30/1936	58	240	Purchase
7/30/1936	61	160	Purchase

Table 2. Land acquisition history for the National Elk Refuge, Wyoming.

Date of acquisition	*Tract number*	*Final acres*	*Means of acquisition*
10/31/1936	54	320	Purchase
10/31/1936	117	320	Purchase
11/7/1936	56	320	Purchase
1/14/1937	24	237.36	Purchase
4/2/1937	9, 9a, 9b, 9c, 9d	1,471.03	Purchase
4/13/1937	27, a, a–1, a–2, b, c, e	825.97	Purchase
4/28/1937	22	400	Purchase
5/11/1937	25	438.56	Purchase
5/12/1937	44	143.3	Purchase
5/17/1937	72	320	Purchase
5/17/1937	116	160	Purchase
5/17/1937	53, 53a, 53b	800	Purchase
5/24/1937	8	320	Purchase
5/24/1937	40	120.12	Purchase
6/7/1937	58a	160	Purchase
6/8/1937	28	640	Purchase
7/9/1937	34	160	Purchase
12/27/1937	8a	678.64	Condemnation
12/271937	113	160	Condemnation
1/5/1938	11	626.12	Purchase
6/9/1938	120	0.98	Purchase
7/25/1938	36	80	Purchase
11/3/1938	55	230	Purchase
11/21/1939	31, 31a, 31c	42.38	Donation
6/11/1940	2	320	Purchase
11/15/1941	51	220	Purchase
12/16/1949	206, 206a	2,712.97	Donation
2/6/1959	42	160	Land exchange
3/17/1965	122a	460	Land exchange
2/7/1972	123	80.12	Purchase
12/20/1974	124, 124a	111.51	Purchase
8/26/1975	124b	26.07	Purchase
4/18/1977	132	10.31	Purchase
11/16/1978	137	11.78	Purchase
12/14/1978	133, a, b, c, d	245.17	Purchase
9/6/1979	143	16.97	Purchase
7/21/1980	128	5.18	Purchase
2/8/1986	131	5.01	Purchase
3/28/1986	122b	354.26	Primary withdrawal
5/2/1986	154	41.03	Purchase
10/1/1986	130	5	Purchase
10/22/1986	125	50	Purchase
8/5/1991	155	20	Purchase
9/2/1992	124c	10	Purchase
10/1/1992	156	3.87	Purchase

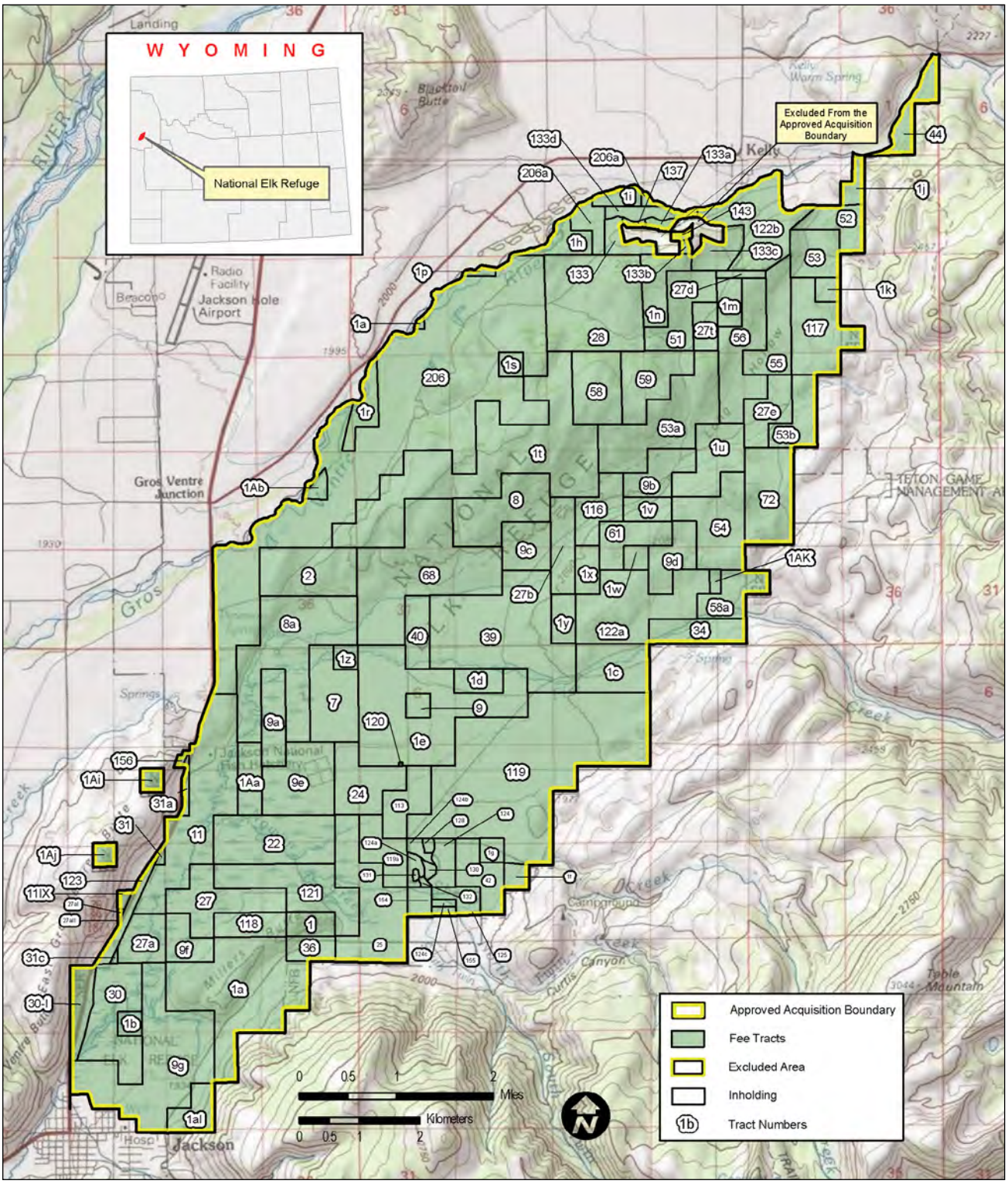

Figure 6. Map of land tracts composing the National Elk Refuge, Wyoming.

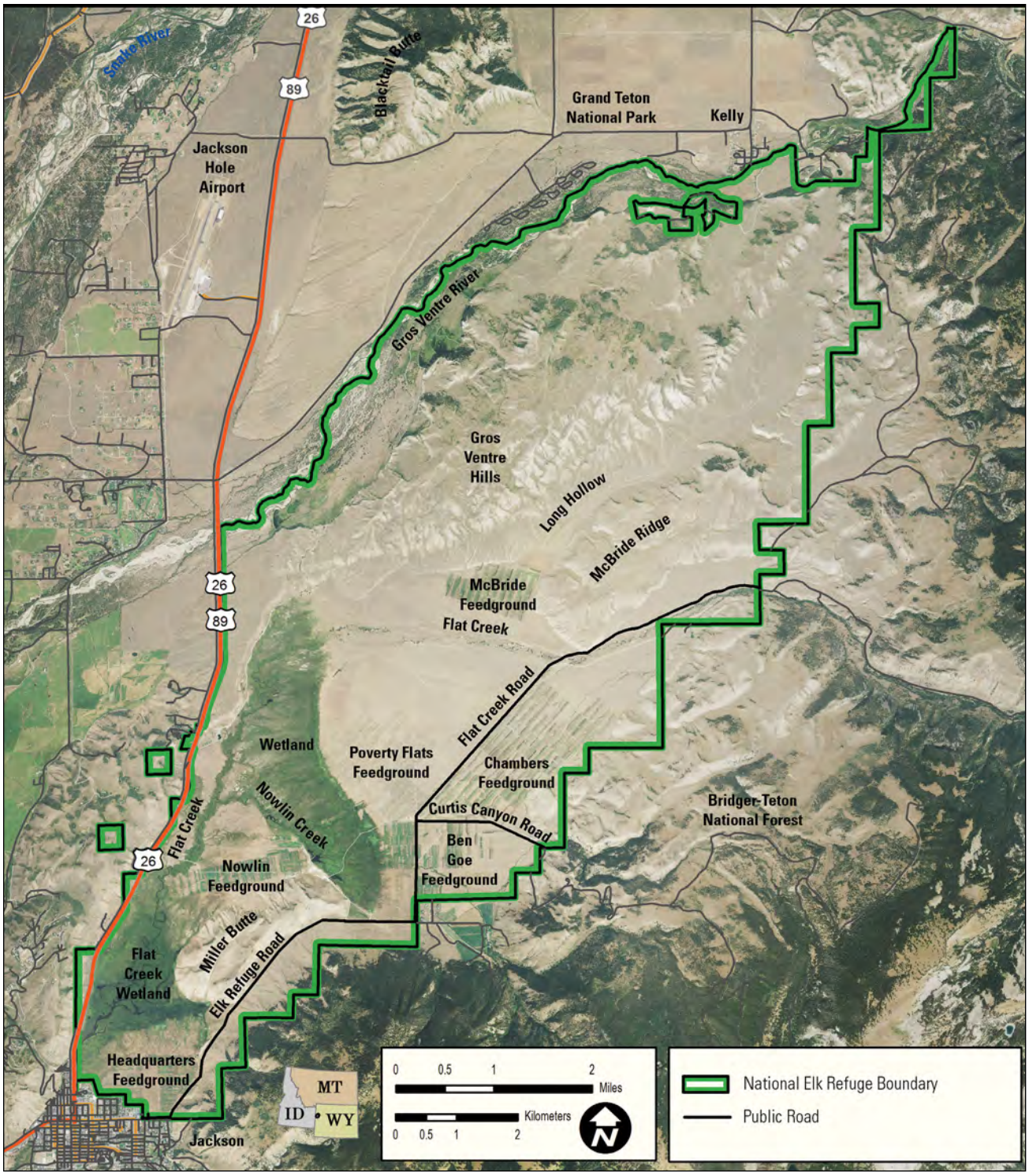

Figure 7. Map of areas and feedgrounds on the National Elk Refuge, Wyoming.

Since the refuge was established in 1912, there have been 9 years when no feeding was provided. The last such winter was in 1980–81. The length of the supplemental winter feeding program has ranged from no feeding to a maximum of 147 days; elk are fed an average of 70 days annually. We have fed hay to elk during at least a part of most winters from 1912 to 1975. In 1975, after several years of testing, we made a switch to alfalfa pellets (Smith and Robbins 1984).

Hunting is the primary management tool used to control the size of the Jackson elk herd. The first hunting season on the National Elk Refuge was in 1943, but hunting did not become an annual event until 1955.

Members and descendants of a small display herd of bison that escaped from Grand Teton National Park in the late 1960s discovered the refuge's winter supplemental feeding program in 1980. This source of winter nutrition enabled the bison herd size to increase almost exponentially to 1,250 animals by the fall of 2007. To reduce herd size to objective levels in the Bison and Elk Management Plan, bison hunting became an annual activity on the refuge in 2007 and has been the primary tool used to control the size of the Jackson bison herd.

2.2 Purposes

Every national wildlife refuge has a purpose for which it was established. The purpose is the foundation on which to build all refuge programs—from biology and public use to maintenance and facilities. No action that we or the public undertake may conflict with this purpose. The refuge purposes are found in the legislative acts or executive actions that provide the authorities to either transfer or acquire a piece of land for a refuge. Over time, an individual refuge may contain lands that have been acquired under various transfer and acquisition authorities, giving the refuge more than one purpose.

The goals, objectives, and strategies proposed in the draft CCP (refer to chapter 6) are intended to support the individual purposes for which the National Elk Refuge was established:

- The National Elk Refuge was established in 1912 as a "winter game (elk) reserve" (37 Stat. 293, 16 United States Code [U.S.C.] 673).

- In 1913, the U.S. Congress designated the area "a winter elk refuge" (37 Stat. 847).

- In 1921, all lands included in the refuge or that might be added in the future were reserved and set apart as "refuges and breeding grounds for birds" (Executive Order 3596), which was affirmed in 1922 (Executive Order 3741).

- In 1927, the refuge was expanded to provide "for the grazing of, and as a refuge for, American elk and other big game animals" (44 Stat. 1246, 16 U.S.C. 673a).

These purposes apply to all or most of the lands now within the refuge. Several parcels have been added to the refuge specifically for the conservation of fish and wildlife (Fish and Wildlife Act of 1956), opportunities for recreational development oriented to fish and wildlife, the protection of natural resources, and the conservation of threatened or endangered species (Refuge Recreation Act of 1962, 16 U.S.C. 460k–l).

2.3 Vision

A vision is a concept, including desired conditions for the future, that describes the essence of what we are trying to accomplish at a refuge. The following vision for the National Elk Refuge is a future-oriented statement designed to be achieved through refuge management throughout the life of the CCP and beyond:

Nestled below the majestic Teton Range, adjacent to the historic gateway town of Jackson, the National Elk Refuge provides crucial big game wintering habitat in the Greater Yellowstone Ecosystem. Across the refuge's grassland, wetland, woodland, and sagebrush shrubland communities, visitors view wintering elk and other wildlife populations that are balanced with their habitats. The public enjoys quality hunting and fishing as well as year-round interpretative opportunities. Effective outreach and strong public and private partnerships ensure understanding and protection of refuge resources for future generations.

A goal is a descriptive, broad statement of desired future conditions that conveys a purpose but does not define measurable units. The goals direct efforts toward achieving the vision and purposes of the refuge and outline approaches for managing refuge resources. We developed five goals for the refuge based on the Improvement Act, the purposes of the refuge, and information developed during planning.

Habitat and Wildlife Management Goal

Adaptively manage bison, elk, and other wildlife populations and habitats as outlined in the Bison and Elk Management Plan. Contribute to the conservation of healthy native wildlife populations and their habitats. Restore and sustain a native fishery that provides quality fishing opportunities.

Cultural Resources Goal

Preserve and interpret cultural resources in a way that allows visitors to connect to the area's rich history and conservation heritage.

Visitor Services Goal

Enable a diverse audience to understand and appreciate the refuge's wildlife conservation role in Jackson Hole, while safely enjoying year-round opportunities for wildlife-dependent recreation.

Visitor and Employee Safety and Resource Protection Goal

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge.

Administration Goal

Provide facilities and effectively use and develop staff resources, funding, partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge.

2.5 Special Values

Early in the planning process, our planning team and the public identified the outstanding qualities or special values of the National Elk Refuge. These special values are characteristics and features of the refuge that make it special to the public, valuable for wildlife, and worthy of refuge status. It was important to identify and describe the special values of the refuge to recognize its worth and to make sure they are conserved, protected, and enhanced through the planning process. These special values can be unique biological resources as well as something as simple as a quiet place to see a variety of birds and enjoy nature.

Intact Ecosystem

The refuge lies in a nearly intact ecosystem. The Greater Yellowstone Ecosystem is one of the last remaining nearly intact ecosystems in the northern temperate zone. As human population pressure and development degrade natural systems worldwide, large nearly intact areas such as the Greater Yellowstone Ecosystem sustain some of the last remaining populations of large carnivores, support some of the longest ungulate migrations in North America, and contain some of the largest areas of undeveloped wilderness in the lower 48 States. A contiguous system of national park, national wildlife refuge, and national forest lands has conserved the relative integrity of the Greater Yellowstone Ecosystem.

High Scenic Quality

The National Elk Refuge is considered one of the "crown jewels" of the Refuge System because of its spectacular scenery, closeness to two iconic national parks (Grand Teton and Yellowstone), and large charismatic populations of seasonal wildlife—especially elk and bison—that people want to stop and watch.

The refuge, along with vast expanses of undeveloped national forest and national park land surrounding the refuge, offers spectacular scenic views of the Teton and Gros Ventre Ranges, the Sleeping Indian (Sheep Mountain), Jackson Peak, Cache Peak, Snow King Mountain, East Gros Ventre Butte, and the

Lori Iverson / FWS

Tagging elk is a regular and necessary activity.

Gros Ventre Hills in the northern part of the refuge. The refuge's location along a heavily traveled highway leading to and from the Grand Teton and Yellowstone National Parks and its vast expanses of scenic open space are integral to the visual experiences of visitors. The visual appearance of a landscape is often the first thing to which a viewer responds. The most prominent view of the refuge, which is seen by several million visitors annually as they drive to and from Jackson on U.S. Highway 26/89, is the expansive Flat Creek wetland.

Undeveloped Habitat

"Habitat" is a species-specific concept that refers to the resources necessary to sustain populations of a given species or communities of species. Each wildlife organism has particular space, food, water, and thermoregulation needs that influence whether that species can exist in an area, and these requirements define the habitat of that species.

The National Elk Refuge represents one of the last undeveloped low-elevation areas in Jackson Hole. The refuge provides important habitat for species that depend on limited snow cover, open grasslands, sagebrush shrublands, or wetlands. Important refuge habitats include (1) winter range for elk, bison, moose, and bighorn sheep; (2) breeding habitat for grassland birds such as long-billed curlew; (3) wintering and breeding habitat for greater sage-grouse; and (4) wetland habitat for trumpeter swans, amphibians, and cutthroat trout.

Quality Water Resources

The Gros Ventre River drains approximately 600 square miles of eastern Jackson Hole and the adjacent Gros Ventre Range to the east. The river is the largest watercourse on the refuge and is among the river segments designated as wild and scenic by the Craig Thomas Snake Headwaters Legacy Act of 2008.

The refuge experiences a relatively natural, annual hydro-regime (waterflows occur without substantial human-constructed controls or alterations), which promotes healthy aquatic ecosystem processes, supports robust populations of aquatic invertebrates (animals without a backbone), and sustains native Snake River cutthroat trout populations. The diversion of irrigation water from the Gros Ventre River into Flat Creek is sustaining higher than normal summer flows and is not a "natural, annual hydro-regime." The Gros Ventre River irrigation diversion is conveyed through a ditch dug across the glacial moraine complex separating the river from Flat Creek. The lowermost portion of this ditch failed catastrophically in 1932, producing a massive erosion event in the moraine material. A deep gully developed, which delivered a large amount of sediment to the valley floor and directly to Flat Creek.

Water-level contours show that ground water from higher elevations flows to the southwest through the valley toward the Snake River. Data for the valley aquifer (permeable rock storing underground water) indicate excellent water quality, supporting use for drinking water supplies, recreation, and other commercial uses.

Variety and Abundance of Wildlife

The National Elk Refuge harbors a wide variety of wildlife. Unlike most national wildlife refuges, it is the abundance of big game animals, including the refuge's namesake, rather than birds that makes the refuge biologically unique. The refuge habitat is critical to sustain regional populations of these species, supporting unparalleled hunting and wildlife-viewing opportunities in Jackson Hole.

Federally and State-Listed Species

The National Elk Refuge is home to Federal and State species of concern. The grizzly bear is federally listed as threatened under the Endangered Species Act and the greater sage-grouse is a candidate for listing; we have documented both species on the refuge. We have only incidental grizzly bear use documented on the northern parts of refuge. However, recent observations in the southern part of Grand Teton National Park bordering the refuge suggest that increased grizzly bear activity on the refuge may be likely in the near future. Greater sage-grouse use the refuge year-round, and successful breeding has been documented.

There is documented use of the refuge by 35 of Wyoming's species of greatest conservation need (refer to "Appendix D—Federally and State-Listed Plants and Animals"). We have documentation of breeding on the refuge for several of these species: trumpeter swan, bald eagle, redhead, lesser scaup, sandhill crane, long-billed curlew, Brewer's sparrow, bobolink, moose, bighorn sheep, and river otter. Refuge grassland and sagebrush shrubland communities support breeding populations of Wyoming species of greatest conservation need, including long-billed curlew and Brewer's sparrow. Undoubtedly, other Wyoming-designated species of greatest conservation need from certain taxonomic groups, such as bats and small mammals, are also present on the refuge, but we need more survey work to confirm their presence and use of the refuge.

Mammals

The refuge is the terminus of seasonal migrations for three celebrated large mammal species. Portions of the Jackson elk herd migrate up to 60 miles from their summer range in Yellowstone National Park to winter on the refuge. The refuge hosts the Jackson bison herd during the winter months, one of only three remaining free-roaming bison herds in North America. Pronghorn summer on the refuge and winter south of Pinedale, Wyoming (more than 70 miles away), making it part of the second-longest mammal migration in the Western Hemisphere.

Given the abundance of prey and the lack of human disturbance, the refuge has become a haven for large carnivores. Gray wolves have been active on the refuge since 1999 and have denned on the refuge in all but 1 year since 2005. Mountain lion activity occurs on Miller Butte and on the eastern part of the refuge. Black bears occasionally use the refuge, particularly during the fall season. Coyotes occur at high densities, particularly in the winter when they scavenge elk carcasses and occasionally kill weak and sick elk.

Migratory Birds

Parts of the refuge were established to protect and provide habitat for migratory birds that cross State lines and international borders; these bird species are by law a Federal trust responsibility. The refuge contains significant wetland and grassland communities that are important to migratory birds, and the value of these habitats is enhanced by the restricted human access, which prevents disturbance during nesting and other critical periods in their life cycle. The refuge contains one of the largest wetlands in northwestern Wyoming—Flat Creek Marsh—which is an important migratory stopover for waterfowl and shorebird species in the Pacific flyway (figure 8) and breeding habitat for trumpeter swans and other waterfowl.

Fish

Flat Creek, a spring-fed stream augmented by irrigation, originates north of the town of Jackson, runs through town, and ends at the Snake River south of town. This stream is integral to Jackson Hole and the natural recruitment of native trout for the Snake River. No stocking occurs in Flat Creek, making natural recruitment the only source of native Snake River cutthroat trout. The Gros Ventre River contains Snake River cutthroat, rainbow trout, and hybridized fish species.

Amphibians

The Gros Ventre River, Flat Creek, and Nowlin Creek riparian areas with their associated ponds and wetlands provide essential habitat for regional amphibian populations. Boreal chorus frogs are the most widespread species. Columbia spotted frogs are locally abundant in the Nowlin Creek drainage in two large breeding areas. In addition, boreal toads are locally abundant in two main breeding areas in the Nowlin Creek and Gros Ventre River drainages. Tiger salamanders, although common in the region, are thought to be rare on the refuge.

Abundant Visitor Opportunities

Visitor surveys conducted by the Jackson Hole Chamber of Commerce have consistently documented that 80–90 percent of valley tourists identify natural resource-based activities as their primary reason for visiting Jackson Hole. Hunting, fishing, wildlife observation, photography, environmental education, and interpretation are the six priority public uses (wildlife-dependent recreational uses) of the Refuge

System, and we provide opportunities for all of these activities on the National Elk Refuge.

We allow elk and bison hunting on the refuge to help meet herd management objectives and to provide recreational opportunities. Depending on which area hunters are in, we allow hunters to use a variety of weapons including rifles, archery equipment, and designated limited-range weapons such muzzle-loading rifles, shotguns with slugs, and handguns. The refuge accommodates hunters with disabilities and offers a special elk hunt for young people.

We manage Flat Creek as a trophy class fishery for Snake River cutthroat trout. This fish is a unique subspecies of cutthroat trout and is the only trout native to the area.

But, it is the spectacle of thousands of elk and hundreds of bison wintering on the refuge's grasslands that most intrigues the public and makes the refuge a national icon. Our visitor services staff offers year-round programs to incorporate wildlife viewing, photography, interpretation, and environmental education into the visitor experience. Thousands of people each year take the opportunity to view elk at close range on the refuge while participating in the sleigh ride program. Bison are popular with visitors and residents as a symbol of the West, and they are central to the culture and traditions of many American Indian tribes. Bison can often be viewed along the fence north of the Jackson Fish Hatchery and in the McBride area before the Flat Creek Road is closed seasonally in December. Other ungulates such as bighorn sheep can often be easily viewed from Elk Refuge Road and are a popular species for winter wildlife viewers. From November to May, bighorn sheep can be found on the eastern slopes of Miller Butte and in the northern parts of the refuge near Curtis Canyon. Moose, pronghorn, and mule deer also frequent the refuge.

Rich Cultural History

In prehistoric times, American Indians living on surrounding lands used this high-elevation valley primarily during the warm months, and no one tribe

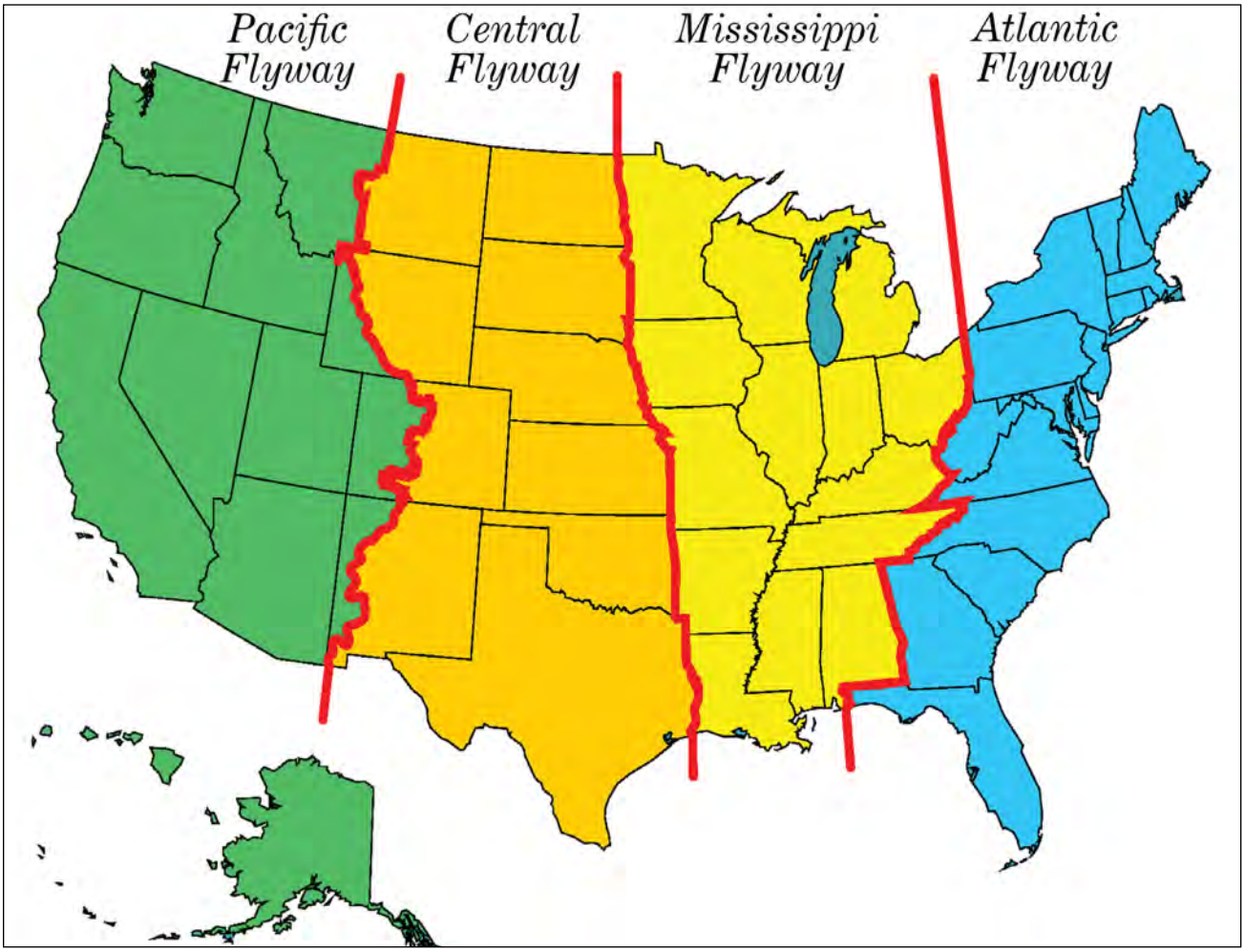

Figure 8. Map of waterfowl flyways in North America.

occupied Jackson Hole year-round. Traditional uses of the lands included hunting and fishing, collection of plants and minerals, and ceremonial activities. We have recorded eight prehistoric archaeological sites on the refuge, which include roasting pits, stone circles, and a bison kill site. Among the artifacts that have been discovered are bones from elk and bison, numerous flakes, choppers, scrapers, and projectile point pieces. Present-day activity includes the ceremonial bison hunt that the Shoshone-Bannock Tribes conduct on the refuge.

The Miller House, built in 1898, was one of the early homesteads in the valley. Later, it became one of the first land tracts to be bought for the refuge, and it was the original office for the refuge. Listed on the National Register of Historic Places in 1969, much of the original house has been restored to period standards and aesthetics, and it is open for tour by the public during the summer.

2.6 Planning Issues

We identified several key issues following the analysis of comments collected from refuge staff and the public and a review of the requirements of the Improvement Act and the National Environmental Policy Act. As described in chapter 1, section 1.6, we used a public meeting, news releases, presentations to local agencies and organizations, an announcement in the Federal Register, and planning updates to solicit public input on which issues the CCP should address. We considered the substantive comments (those that could be addressed within the authority and management capabilities of the Service) when formulating the alternatives for future management of the refuge. These key issues are summarized below.

Unknown Effects of Climate Change

Although climate change is a naturally occurring phenomenon and temperature and precipitation changes are anticipated, there are many unknowns. Consequently, we do not fully understand the potential impacts that climate change may have on terrestrial and aquatic habitats and the associated wildlife species. Several scientific studies show that, in the past century, the climate has become warmer and drier in northern Yellowstone National Park (Balling et al. 1992a, 1992b). If this warming trend continues, it could have far-reaching effects on the plants and animals of the Greater Yellowstone Ecosystem (Romme and Turner 1991), which includes the National Elk Refuge.

Analysis of precipitation records from 1921 to 2002 gathered at a National Oceanic and Atmospheric Administration weather station in Jackson, Wyoming, showed no significant trends, either increasing or decreasing (Smith et al. 2004). Although temperature readings from 1931 to 2002 increased, calculations using the 1949–2001 Keetch-Byram Drought Index values, which evaluate upper level soil moisture content, revealed a "minor decline in drought conditions" (Smith et al. 2004).

Landscape-Scale Conservation Needs

There is increasing residential, commercial, and energy development near the refuge and surrounding areas. Threats to wildlife associated with development include loss of habitat, habitat fragmentation, vehicle collision mortality, loss of pronghorn migration routes, poaching, and increased infestations of invasive plants, including noxious weeds. As towns, developments, farms, ranches, and roads spread across the region, wildland shrinks and is broken into smaller fragments. The land surrounding the refuge is mostly comprised of federally managed lands (Grand Teton National Park and Bridger-Teton National Forest) and the town of Jackson. The town of Jackson is already intensively developed, leaving little opportunity for further habitat protection in the immediate area. The National Elk Refuge, national parks, national forests, and State lands in the Greater Yellowstone Ecosystem preserve continuous tracts of important habitat and travel corridors for the area's wildlife and for the enjoyment of people.

Big Game Management Effects on Wildlife Habitat

Historical evidence suggests that the refuge once supported substantial willow, cottonwood, aspen, and mountain shrub communities. Because the refuge has consistently maintained artificially high numbers of elk through supplemental feeding for almost 100 years, browsing by elk has reduced the spatial extent and structural complexity of woody plant communities, particularly on the southern end of the refuge (Smith et al. 2004). As a result, habitat for species

that depend on these communities, such as beaver and breeding birds that nest in dense woody vegetation, has been drastically reduced. Furthermore, when the large concentrations of wintering elk and bison consume streamside woody vegetation, the streambanks become unstable and vulnerable to collapse into the stream, sending substantial amounts of sand and silt into the stream. Experiments suggest that these plant communities have the capacity to recover, but only if ungulate numbers are drastically reduced or they are excluded from browsing using fencing or other physical barriers.

Irrigation is a common habitat management tool that we use to increase both the quantity and quality of forage available to grazing wildlife. We have used irrigation to produce forage for many years on the National Elk Refuge as a technique to reduce wintering elk reliance on supplemental feeding. However, moving the irrigation system requires dragging the lines over the ground, and this activity can potentially have negative effects on the nests of birds such as the curlew, which is an important ground-nesting bird on the refuge as a bird of special concern to the State of Wyoming.

Invasive Plants Replacing Native Habitat

An invasive species is defined as a species that is nonnative to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (National Invasive Species Council 2008). Invasive plant species spread easily, replace native habitat, reduce diversity, and cause great expenditure of financial and human resources. Adjacent private lands are often the sources for invasive plants, including State-designated noxious weeds.

Common noxious weeds present on the refuge are musk thistle and spotted knapweed. There are many other invasive plant species on the refuge including the following:

- Bindweed Dalmatian toadflax
- Oxeye daisy
- Scotch thistle
- Black henbane
- Diffuse knapweed
- Perennial pepperweed
- Whitetop
- Bull thistle
- Houndstongue
- Russian knapweed
- Wooly mullein
- Canada thistle
- Marsh sow thistle
- Scentless chamomile
- Yellow toadflax
- Common tansy

Many invasive plant infestations on the refuge are a direct result of abandoned livestock-feeding areas and corrals, old homesites, and roadbeds. These species reduce the diversity and number of native plants and change habitats, such as replacing a grass community with a forb community. Studies in Montana report that bison and deer reduced their use of a particular habitat by 70–82 percent when it was invaded by leafy spurge. Elk forage in bunchgrass sites on the refuge was decreased by 50–90 percent after a spotted knapweed invasion (Teton County Weed and Pest District 2002).

Invasive grasses, forbs, and woody species are of concern because they diminish the quality and suitability of habitat and reduce its potential to support many native wildlife species. Invasive plants also fail to protect and hold soil because they generally have a shallow root system, leading to increased erosion and sedimentation in streams. This in turn affects water quality, reduces aquatic habitat, and may lead to decreases in fish production.

Flat Creek Enhancement

There is a need to improve the condition of Flat Creek to increase aquatic habitat for all age classes of the Snake River cutthroat trout. This creek is an iconic fixture in Jackson Hole for tourists, anglers, and the native cutthroat trout. Flat Creek on the refuge provides a walk-in opportunity for anglers to experience a trophy fishery of Snake River cutthroat trout. However, the refuge reach of Flat Creek has experienced direct and indirect alteration to its stream form and function from changes in hydrologic and sediment inputs, installation of instream structures and treatments, and nearby land management activities. With some enhancement work on Flat Creek done in 2013, we need to continue this work farther down the refuge reach of Flat Creek to improve habitat for cutthroat trout (Biota 2013a, b).

Conserving Wide-Ranging Wildlife

The refuge provides habitat for several wide-ranging wildlife species including elk, bison, bighorn

sheep, pronghorn, moose, gray wolf, and grizzly bear. The refuge supports the preservation of the large landscapes that these species require. With long-distance mammal migrations imperiled around the globe, the refuge's importance in sustaining these phenomena is critical. The success of wolf restoration in the Greater Yellowstone Ecosystem continues to be a major issue for many of the citizens of Wyoming. The National Elk Refuge provides an excellent location and ideal habitat for seasonal occupation by wolves and, in recent years, has hosted a denning pack of wolves during the winter, spring, and summer months. These wolves have a large home range that contains substantial amounts of nonrefuge Federal, State, and private lands, where they can come into conflict with privately owned livestock.

Managing Habitat for Migratory Birds

Protecting habitat and managing for a wide variety of migratory birds is a priority for the refuge. Waterfowl and other waterbirds, grassland songbirds, and riparian-dependent birds are some of the highest priority groups.

Wildlife Disease

The supplemental feeding program has maintained artificially high densities of elk for almost 100 years and artificially high densities of bison for more than 30 years. Feeding is a strategy designed to support elk population objectives and reduce damage to surrounding private lands, but it has unintended management and disease consequences. Although reduced reliance on supplemental feeding is an objective in the 2007 Bison and Elk Management Plan, feeding is often initiated earlier or terminated later than is biologically necessary to prevent the elk and bison from commingling with livestock on adjacent private lands. Feeding is used as a strategy to reduce brucellosis transmission from elk and bison to cattle; yet artificially concentrating elk and bison on feedgrounds also maintains higher brucellosis seroprevalence in elk and bison (Cross et al. 2007, 2010) and puts them at risk for other density-dependent diseases (Smith 2001). As a result, density-dependent ungulate disease is a major concern for the refuge. Brucellosis, septicemic pasteurellosis, psoroptic mange, necrotic stomatitis, necrotizing pododermatitis (foot rot), and helminth and lungworm parasitism have been well documented in the Jackson elk herd. Similarly, brucellosis and density-associated parasitism have been well documented in the Jackson bison herd.

Although the population level effects of these diseases have been minimal for elk and bison, their prevalence at the refuge suggests that substantial population reductions and other negative wildlife health effects are possible if more serious ungulate diseases were introduced to the refuge. For example, chronic wasting disease, bovine tuberculosis, malignant catarrhal fever, and foot-and-mouth disease have not been documented in the Jackson elk herd, but could have serious negative population effects at current elk densities. Likewise, bovine tuberculosis, bovine paratuberculosis, malignant catarrhal fever, and foot-and-mouth disease could pose significant threats to bison populations on the feedgrounds if these diseases were introduced.

During routine monitoring of cutthroat trout in 2003, tissue samples sent to the WGFD lab tested positive for *Myxololus cerebralis*, the parasite that causes whirling disease. Infection levels were low and no declines in the cutthroat trout population have been documented.

Amphibian monitoring on the refuge occurs at a finer temporal and spatial scale than other amphibian monitoring in the region (Patla 2009). As a result, amphibian monitoring functions as an early warning system for declines in amphibian populations and disease outbreaks. These monitoring efforts are particularly important given the detection of chytridiomycosis (chytrid disease) on the refuge. Chytrid disease is a fungal skin disease that has been implicated in amphibian population declines worldwide. A boreal toad collected on the refuge in 2000 was the first documented occurrence of the disease in northwestern Wyoming. Unlike infected amphibian populations in other areas, amphibians in northwestern Wyoming have not experienced catastrophic declines. However, the effects could be chronic and, therefore, continued monitoring is necessary to evaluate the effects of the disease on regional populations.

Insufficient Research, Inventory, and Monitoring

Artificial concentrations of high densities of elk and bison, because of supplemental feeding and habitat enhancement, provide unique opportunities to evaluate the effects of these management activities on vegetation, ungulate habitat use, breeding bird populations, and wildlife diseases.

The refuge facilitates regionally important cooperative research and monitoring including amphibian

population monitoring, greater sage-grouse habitat use and demography, mountain lion research, bighorn sheep habitat selection and migration, and invasive plant monitoring. Given potential threats associated with climate change and invasive species, more inventory work is necessary to assess the baseline presence and abundance of certain taxonomic groups including invertebrates, rodents, bats and owls.

Members of the public, representatives from nonprofit conservation organizations, and staff from other agencies have expressed concern that inventory and monitoring efforts are insufficient to evaluate the effects of current and proposed management activities. Principle concerns are related to (1) the irrigation system expansion and its effects on hydrology, amphibians, and ground-nesting birds; (2) development of a multi-use pathway next to Highway 89 and its potential impacts on ungulate migration, invasive plant species introduction, and disturbance of breeding birds; and (3) the ongoing effects of the supplemental feeding program on breeding bird habitat and wildlife diseases. These are valid concerns that would require more staff and money to effectively monitor the effects of these management activities over time.

Human–Wildlife Conflicts

Wildlife that winter on the refuge can cause human–wildlife conflicts when they venture off the refuge and into the developed Jackson area. Of greatest concern are bison, which are large and sometimes bold animals that can exhibit aggressive behavior and be a serious threat to human safety and property. Elk have left the refuge in the past: in January 2006, a radio-collared elk left the refuge and went to a livestock feedline. Elk can create conflicts, mostly as a traffic hazard as they cross heavily used highways or pathways when moving onto the refuge, although they can also cause property damage and threaten human safety in certain situations.

Hunting Management

Although hunting is the primary means of meeting herd objectives, the need was identified to consider the negative visual effect of hunters killing elk and seeing dead elk as they are transported off the refuge. Some individuals expressed a desire to prohibit hunting on the refuge, and others desire a limited waterfowl hunt for population control of resident Canada geese. Some people would like the CCP to include monitoring the use of lead shot for waterfowl hunting (if it were allowed) and the subsequent impacts on bald eagles. However, mandatory State regulations already require the use of lead-free ammunition."

BJ Baker / FWS

Miller Ranch in the morning.

Increasing Demand for Environmental Education and Interpretation

The refuge cannot meet the high public demand for environmental education and interpretation programs with the current staff level. We need more interpretative staff and public facilities with adequate program areas.

Operational Efficiency of the Jackson Hole and Greater Yellowstone Visitor Center

During the peak summer season, visitation can reach 2,400 people per day, or roughly 3.6 visitors per minute, at the Jackson Hole and Greater Yellowstone Visitor Center (visitor center). With only one staff member assigned to the facility, staff levels are not adequate to maintain, run, and staff the busy visitor center. Rather than seasonally increasing Government staff or hiring employees funded through nongovernmental sources to enhance public use programs, the refuge solely relies on residential volunteers to provide interpretive and educational services. It is important to have adequate permanent refuge staff at the visitor center to guarantee consistent service, to recruit and manage volunteers, and to provide interpretive programming. In addition, the current building is old and needs to be replaced to meet the customer service demand and to be compliant with the Architectural Barriers Act Accessibility Standard (United States Access Board 2013). Previous condition assessments identified many of the visitor center's features as poor or unsafe.

Management of Other Uses

There are several other public uses that demand extensive time by our refuge staff to coordinate and carefully manage to protect refuge resources and keep the public safe.

North Highway 89 Pathway

The North Highway 89 Pathway provides an opportunity for the public to enjoy the beauty of the National Elk Refuge and observe much of the wildlife that makes Jackson Hole so special. Some of the public would like us to extend the use of the bike path by eliminating or modifying the seasonal closure. However, the seasonal closure is part of the agreement with Jackson Hole Community Pathways to mitigate for wildlife disturbance and is believed to be an essential requirement for this activity to be compatible with the refuge purposes.

Public Use of North Park

The refuge's North Park provides a shelter and picnic facilities to support wildlife-dependent recreation at the refuge, for use on a first-come, first-served basis. North Park is a small area on the refuge that is so close to town that it appears to be part of Jackson. In fact, we have a memorandum of understanding with Jackson to maintain the lawn, picnic table, and shelter. The memorandum of understanding also allows Jackson to conduct a reservation system for private use of the shelter for weddings and other events; Jackson charges a fee for the reserved use and keeps the fee. However, these uses do not support wildlife-dependent recreation, and reserving the area may hinder the experience of people visiting the refuge for activities such as wildlife observation.

Special Use Permits

Because of the refuge's location in the scenic, highly visited Jackson Hole, the staff receives a high volume of requests for special uses of the refuge. The refuge issues approximately 40 special use permits annually. Most of these permits are issued to wildlife auto-tour companies, fishing outfitters and guides, and commercial filmmakers and photographers.

The refuge receives an extensive amount of local, regional, national, and international media attention, especially during the winter season. Media coverage includes print, electronic, and video and film venues. Because the area is a focus of media attention and millions of people visit this area each year, the National Elk Refuge has the opportunity to embody our mission as an ambassador for the Refuge System.

The refuge staff has an extensive workload to properly evaluate, process, and monitor special use permits and filming requests. Because of the volume of requests the refuge receives for activities such as special access and photography in closed areas, discretion must be used to accommodate a request even if the activity is compatible. When considering a special use request, the refuge staff must decide not only if the single activity can be accommodated, but whether or not it is feasible if multiple parties make the same request. Furthermore, there is a need to set standards for consistent evaluation of the special use

requests that we allow and to give groups equal opportunities to gain permits.

Swimming

At the northeastern corner of the refuge, there is a feature known as the Gros Ventre River "jump cliff." Here swimmers jump off of cliff rocks in Grand Teton National Park into the Gros Ventre River and into the jurisdiction of the refuge. Technically, when the diver hits the water, they are trespassing onto the refuge and participating in an activity that we have not determined as a compatible use of the refuge. A further complication is that the public does not clearly understand the boundary between the park and the refuge. Swimming is not a wildlife-dependent recreational use.

Access

The refuge has high demand for various types of access as described below.

General Access

There is a concern that only hunters and anglers are allowed access to the refuge, with birdwatcher and other user groups not having equal opportunity to use the refuge for other wildlife-dependent purposes such as birding and wildlife observation. The need to provide free access to the refuge for other user groups was identified.

Elk Refuge Road

Elk Refuge Road is the primary access to the refuge and the only legal entrance to the refuge for the public. The refuge struggles with management of traffic on Elk Refuge Road because of its mixed use by pedestrians, vehicles, service trucks, and large equipment. Because of the ease of access to the refuge and its proximity to town, local residents use Elk Refuge Road extensively for walking, jogging, and bicycling. Many pedestrians walk several abreast or do not move to the side of the road when vehicles are present, causing drivers to move into the oncoming lane to pass.

A regulation panel at the refuge entrance and literature available to the public states that stopping or parking a vehicle on Elk Refuge Road is prohibited; however, many cars, vans, and trucks park in the road when wildlife is present near the roadway rather than using the turnouts. In some cases, traffic traveling in both directions stop on the road, obstructing the free movement of other vehicles and creating safety hazards. Furthermore, roadway congestion is a safety concern in bad weather when there may be icy road conditions or limited visibility because of fog, rain, or snow.

Access for Boating

Public comment received during the CCP scoping process requested that boat use be allowed on Gros Ventre River segment upstream from the town of Kelly. The northern boundary of the refuge is the Gros Ventre River, and the northeastern corner of the refuge is used as a takeout point by boaters floating downstream from Slide Lake. Less frequently, boat traffic continues downstream to the town of Kelly. However, the refuge and the Grand Teton National Park consider this part of the Gros Ventre River to be closed to boating. The segment of the river from the Jump Rock takeout site to the town of Kelly was recently designated as scenic under the Craig Thomas Snake Headwaters Legacy Act of 2008. The act requires the refuge and the park to create a comprehensive river management plan to guide the management of each segment designated as wild, scenic, or recreational to protect the "outstandingly remarkable values" of the river.

The proposed use of boating was reviewed during development of the Snake River Headwaters Comprehensive River Management Plan. The prohibition against boating on the portion of the Gros Ventre River that serves as the common boundary between the refuge and the park will be retained.

Access to the National Forest

Because the Bridger-Teton National Forest lies adjacent to the refuge, some users want to access the forest through the refuge. Open portions of Elk Refuge Road allow the public seasonal access to national forest lands, including designated routes to reach the forest on foot or by vehicle. Allowing limited access to the national forest, either by road or trail, shows good cooperation between two Federal agencies and extends a convenience to forest users.

Presently, the refuge allows antler hunters to park and camp overnight on Elk Refuge Road on April 30 to await the lifting of the national forest closure (for wintering wildlife) where the public enter the forest to collect antlers. At 8 a.m. on May 1, refuge staff caravans 100 or more vehicles through the refuge to the boundary of the national forest. The overnight parking creates some resource damage, requires us to increase our law enforcement presence, costs us a significant amount of money to manage, and may be an incompatible use of the refuge.

Public Outreach Opportunities

The National Elk Refuge is featured in many newspapers, Web sites, and other publications each year. These articles are reviewed for accuracy whenever possible; when the media does not directly speak to a refuge staff member, or when staff resources are insufficient to meet or speak with the media contact, erroneous information is common.

People living in or visiting Jackson Hole are easily confused about the differences among Federal land management agencies and how their missions and public use opportunities can greatly vary. Neighboring Grand Teton National Park and Bridger-Teton National Forest are areas with many more non-wildlife-dependent recreational opportunities for the public such as boating, mountain biking, swimming, and hiking. Conflicts can arise when a public use is denied or restricted on the refuge, especially when the same recreational opportunity is allowed under another nearby Federal jurisdiction. Consequently, the National Elk Refuge can seem excessively restrictive without a better understanding of its mission and the prominence of its "wildlife first" guiding principle.

The National Elk Refuge has made it a public outreach goal to continue to write articles, conduct interviews, and use other sources to share information about refuge projects or management issues. Staff limitations and workloads limit this specific type of outreach and have precluded incorporating new technologies into information dissemination. The visitor services staff bought software to produce short video segments, but allocating work time for training and production has not yet been a priority.

Miller House Restoration

The historic Miller Ranch has three main structures: the house, the barn, and the USDA Forest Service cabin. Other than a 2-week rehabilitation project in the summer of 2007, no substantial work has been completed on any of the structures. The upper floor of the barn has outstanding potential for use as an interpretive site and location for programs and events, but the foundation has experienced substantial settling and cracking. Stabilization and restoration would be necessary before the building could be used as a site for interpretive programs. We would need to find funding opportunities other than the refuge's base funding to restore the historic structure and prevent further deterioration of the structure.

Lack or Resources to Administer the Refuge

Money and staff are not sufficient to fulfill the purposes and meet the goals of the refuge. In addition, visitor numbers and associated demands are expected to increase in coming years. Consequently, less will get done with a corresponding decline in programs, infrastructure, and facilities. The refuge has 10.5 permanent full-time equivalent (FTE) positions, a measure indicating the amount of available workforce on the refuge, and approximately 0.5 seasonal FTE. Refuge staff needs to identify and set priorities for unfunded needs to be able to compete effectively for more money within our agency and from partners and other sources. Creative partnerships and volunteer assistance, although helpful, are not a complete or reliable solution and require sub-

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Bald Eagle

stantial staff time. With additional resources, we could accomplish more of the goals and objectives in the CCP.

Stronger Programs Through Partnerships

The National Elk Refuge has many opportunities for partnerships because of the popularity of Jackson Hole and the many nongovernmental organizations, tourism operators, and interested public in the area. Furthermore, there are several governmental agencies—Teton County, National Park Service, and USDA Forest Service—that have land management responsibilities around the refuge. Maintaining a strong partnership network including private landowners, public agencies, and nonprofit organizations is integral to accomplishing our mission of conservation. Partners provide financial assistance, technical assistance, and help with planning and implementation. Partnerships and management coordination with public and private partners is important because refuge operations can have substantial impacts on surrounding lands.

The refuge shares the responsibility of managing wildlife with the State of Wyoming. Close coordination with WGFD enables refuge programs to complement the State's wildlife goals and objectives. This is especially critical in the management of the migratory elk and bison herds. Collaboration with WGFD on harvest goals, permits and licenses, law enforcement, and disease monitoring are important for the effective management of these herds.

To enhance Flat Creek for native cutthroat trout (Biota 2013a, b), the refuge is collaborating with several organizations: Jackson Hole Trout Unlimited, Rocky Mountain Elk Foundation, and Snake River Fund.

The town of Jackson shares its boundary with the refuge and both are located within Teton County. Regular communication with elected officials from the town and county helps diffuse ongoing residential development and public service expansion pressures. Refuge management actions must consider the residential water facilities for the town and a multi-use, nonmotorized pathway for Teton County that are located on the refuge.

Winter sleigh ride interpretive tours are conducted through the Grand Teton Association by a private concessionaire. The visitor center and sleigh rides are integral to wildlife observation, photography, interpretation, and environmental education programs and generate revenue used to enhance these programs.

The refuge has enjoyed a 55-year partnership with the Jackson District Boy Scouts. In addition to clearing much of the refuge of antlers that are a hazard to refuge vehicles, 75 percent of the proceeds of the annual Boy Scouts of America Elk Antler Auction are returned to the refuge for habitat management-related expenses.

Refuge Management Effects on the Jackson Economy

Employment and nonsalary refuge expenditures (maintenance and operations) benefit the local community, county, and State in the form of income, jobs, taxes, and personal spending. The refuge plays an active, albeit small, role in economic development in the local economy. The National Elk Refuge attracts many visitors and tourist dollars to the local community of Jackson. The national prominence of the refuge and its proximity to Jackson ensures that many Jackson Hole visitors either directly or indirectly use the refuge, but actual dollars generated from the refuge are minor. However, any changes to refuge management are perceived by some people to affect the economy of Jackson.

Issues Outside the Scope of the CCP

Although the public identified elk and bison management as an issue during scoping for the CCP, the issue is outside the scope of this CCP process. Managing elk and bison in this area was recently addressed in an interagency process following the National Environmental Policy Act that had extensive public involvement; the resulting Bison and Elk Management Plan was completed in 2007. The plan has goals, objectives, and strategies for managing elk and bison on the National Elk Refuge and Grand Teton National Park. Supplemental winter feeding of the elk herd is addressed in the Bison and Elk Management Plan.

Some people felt the State of Wyoming should manage the National Elk Refuge instead of our agency. Divestiture of a national wildlife refuge requires an act of Congress; therefore, this would be outside the scope of the CCP.

Chapter 3—Alternatives

Lori Iverson / FWS

The National Elk Refuge is a good place to watch predators in action, mountain lions and coyotes are just two of them.

The purpose of this chapter is to describe the management alternatives considered for the National Elk Refuge. Alternatives are different approaches to management that are designed to achieve the refuge purposes, vision, and goals; the mission of the Refuge System; and the mission of the U.S. Fish and Wildlife Service. We develop alternatives to address the key issues, concerns, and problems identified by during public scoping and throughout the development of the draft CCP.

3.1 Alternatives Development

We developed four alternatives that represent different approaches for permanent protection and restoration of fish, wildlife, plants, habitats, and other resources. We assessed the planning issues identified in chapter 2, the existing biological conditions described in chapter 4, and external relationships affecting the refuge. This information contributed to the development of alternatives; as a result, each alternative presents different approaches for meeting long-term goals.

We evaluated each alternative according to how well it would advance the vision and goals of the refuge and the Refuge System and how it would address the planning issues. Table 4 in section 3.9 at the end of this chapter summarizes the alternatives' actions and associated consequences. Details about the consequences are in "Chapter 5—Environmental Consequences."

3.2 Alternatives Considered but Eliminated from Detailed Study

There were no alternatives considered but eliminated from detailed study.

3.3 Elements Common to All Alternatives

There are some consistencies among the four alternatives. This section identifies the following key elements that will be included regardless of the alternative chosen for the final CCP.

Laws and Regulations

We will make sure that management of the refuge complies with all Federal laws and regulations that provide direction for managing units of the Refuge System.

Invasive Species

We will work to control invasive species through an integrated pest management approach that includes biological, cultural, chemical, and mechanical treatment methods. The extent and type of treatment varies by alternative.

Bison and Elk Management Plan

We will carry out the goals, objectives, and strategies in the "Management Direction" chapter of the Bison and Elk Management Plan that are specific to the National Elk Refuge.

For the cultivated, irrigated fields on the refuge, we will manage to meet the objectives in the Bison and Elk Management Plan for elk and bison grazing (pages 130–33).

In addition, the following elk and bison management actions were covered and analyzed in the Bison and Elk Management Plan (page 13):

- We will work to lower the risk of brucellosis transmission to livestock by concentrating elk and bison on the refuge and keeping them separated from livestock during the critical period of potential transmission (February–March).
- We will conduct winter feeding activities in ways that may reduce brucellosis transmission within the elk and bison herds.
- We will continue our herd-health monitoring program.
- We will inform the public about the disease status of elk and bison on the refuge and recommended handling practices.
- We will cooperate with WGFD on a monitoring program for chronic wasting disease.
- We will develop a contingency plan for chronic wasting disease.
- We will immediately euthanize and remove animals with suspected chronic wasting disease.

Wildlife Disease

There will be surveillance, as needed, for key wildlife diseases such as botulism and West Nile virus. The specific management actions vary by alternative.

Access for Boating

Boating would be prohibited on all refuge waters. Because of the potential wildlife and habitat effects and our compliance with the Snake River Headwaters Comprehensive River Management Plan, we would continue to prohibit hand-propelled boating along the Gros Ventre River, Flat Creek, and ponds. Motorized boating would be prohibited because of the small size and shallow nature of refuge waterbodies.

Research

We will conduct research efforts internally (with in-house staff) or generate external research (such as

through universities) to help us meet the management objectives. The focus of research varies by alternative.

Refuge Uses

We will continue to prohibit the following public uses on the refuge because they are not compatible uses: weddings, antler collecting, geocaching, boating, and swimming.

We will continue to prohibit pets and horses on the North Highway 89 Pathway.

Landowner Coordination

Our actions will not adversely affect any adjacent landowners without a mutual agreement and adequate compensation.

Partnerships

We will promote strong and diverse partnerships to help us meet objectives and achieve the refuge goals. The focus and type of partnerships varies by alternative

3.4 Description of Alternatives

We considered four alternatives to achieve the proposed vision and goals and to address the issues:

- Alternative A, the no-action alternative, describes the current, ongoing management activities throughout the refuge. This alternative may not be able to meet all the CCP goals, but it is provided as a basis for comparison with the other alternatives.
- Alternative B is a balance of public use with intensive resource management.
- Alternative C has an emphasis on intact ecosystems and promoting natural processes.
- Alternative D, our proposed action, promotes natural habitats and enhances public use. This alternative reflects the draft CCP and is further described in chapter 6.

The following sections 3.5–3.8 describe each alternative's focus and provide details about how the alternatives would meet the refuge goals:

3.5 Alternative A (Current Management)—No Action

This is the no-action alternative, which represents the current management of the refuge. This alternative provides the baseline against which to compare the other alternatives. It also fulfills the requirement in the National Environmental Policy Act that a no-action alternative be addressed in the analysis process.

Our management activity would remain the same. The Jackson elk and bison herds and their habitat are adaptively managed with an emphasis on improving winter and transitional range on refuge lands, while at the same time ensuring that the biotic integrity and environmental health of the resources are sustained over the long term. A dynamic framework for decreasing the need for supplemental feeding on the refuge is developed and carried out in close coordination with WGFD and is based on existing conditions, trends, new research findings, and other changing circumstances. Population management, vegetation restoration, ongoing monitoring, and public education are integral parts of this framework.

We would not develop any new management, restoration, or visitor services programs at the refuge. Current habitat and wildlife practices benefitting elk, bison, migratory birds, and other wildlife would not be expanded or changed. Staff would continue monitoring, inventory, and research activities at their current level. Funding and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis, and intensity as they do now.

Climate Change

The refuge would continue baseline monitoring of habitat conditions that could potentially be related to the effects of climate change. Staff would continue to collaborate with the U.S. Geological Survey and other partners to obtain climate-related information.

Staff would use information generated by the Great Northern Landscape Conservation Cooperative to understand climate change impacts locally. Refuge staff is not directing efforts toward inventorying, monitoring, and analyzing climate change effects. Activities that apply to climate change would be sporadic and opportunistic.

The refuge would strive to carry out actions in the Greater Yellowstone Area climate action plan (Fiebig 2011) to become carbon neutral by 2020. We are taking steps to reduce the carbon footprint of existing facilities: weatherproofing of facilities and upgrading furnaces, doors, and windows. We would use more webinars and other virtual meeting devices to reduce the carbon footprint from travel.

Landscape-Scale Conservation

The primary objective of landscape-scale conservation is to link existing protected areas, preserve wildlife corridors, and protect large, intact, functioning ecosystems while maintaining the rural character of northwestern Wyoming. The refuge is an active member of, and would continue to participate in, the Greater Yellowstone Coordinating Committee, which was formed to allow representatives from the National Park Service, USDA Forest Service, and our agency to pursue opportunities of mutual cooperation and coordination in the management of over 14 million acres of Federal lands in the Greater Yellowstone Ecosystem.

Private land development projects are subject to a review and approval process by the Teton County Planning Commission. Refuge staff periodically would provide comments, as requested, on proposals that might negatively affect refuge resources or the ability for wildlife to use these resources.

Habitat

Our focus would be protection of limited habitat resources.

Native Grasslands and Sagebrush Shrublands

The refuge would do minimal management other than fire suppression and invasive plant control; therefore, there would be little use of motorized vehicles in these areas.

We would maintain the native structure and composition of grassland and sagebrush shrubland communities and protect them from degradation or allow them to recover, especially areas used by greater sage-grouse and other grassland- and sagebrush-dependent species. We would define the desired structural and compositional characteristics in a habitat management plan and maintain these conditions over time, but our emphasis would be to protect the dense, mature sagebrush stands from disturbance.

Wetlands

To benefit trumpeter swans and other wildlife, we would maintain existing artificial ponds and natural wetlands. The refuge would continue a low level of monitoring and treatment of noxious weeds in wetlands.

Riparian Woodlands and Aspen Woodlands Areas

Woody vegetation in riparian areas would recover as existing ungulate populations allow, and we would evaluate restoration techniques for riparian areas along Flat Creek. The refuge would continue to cooperate with the National Park Service on the Gros Ventre River hydrological assessment and would continue to evaluate the jackstraw technique to promote willow regeneration. The refuge would manage that segment of the Gros Ventre River east of the town of Kelly, consistent with the recently completed Snake River Headwaters Comprehensive River Management Plan.

Flat Creek Enhancement

The refuge would monitor 1 mile of construction work on Flat Creek (removal of ineffective structures) and associated removal of reed canarygrass that was completed in 2013 (FWS 2013). Monitoring is a critical aspect of restoration and habitat enhancement projects because it helps project proponents to assess project success.

Invasive Species

Staff would continue to control new and existing invasive plant infestations, including noxious weeds, using the integrated pest management strategies of biological control, mechanical control, grazing, and herbicides with cooperators and partners.

The refuge would continue to prevent new infestations of noxious weeds, nonnative grasses, and aquatic invasive species by preventing the artificial transportation of invasive plant seeds and other materials onto the refuge through efforts like (1) pub-

lic education, (2) weed-free-hay rules, and (3) the cleaning of all excavation and angling equipment before entering the refuge. Invasive plant species (some of which are classified as noxious by the State of Wyoming) are major contributors to the loss of quality wildlife habitat and rangeland, second in scope only to land development.

Examples of invasive plants that are not noxious weeds are crested wheatgrass, reed canarygrass, meadow foxtail, cheatgrass, and yellow sweet clover. Many of the nonnative plant species on the refuge do not provide quality elk forage or wildlife habitat. Although none of the following aquatic invasive animals and plants are known to occur here, refuge habitat potentially could be at risk from species such as these: zebra mussel, quagga mussel, Asian carp, hydrilla, Asian clam, Eurasian watermilfoil, and flowering rush.

Wildland Fire Management

For all habitat types at the National Elk Refuge, current wildland fire management is to fully suppress all wildfires. Potential benefits are not considered in the management strategy for a wildfire. Even though prescribed fire has occurred on the refuge in the past, prescribed fires have not been conducted since 2003. Therefore, prescribed fire is not currently being used as a management tool.

Wildlife

The emphasis would be on following the Bison and Elk Management Plan and managing for migratory birds, aquatic species, and wildlife disease.

Elk and Bison

We will manage the elk and bison herds as described in the Bison and Elk Management Plan. In some cases we developed complementary actions, which are more specific, that we describe under the habitat sections below.

Migratory Birds

To reduce disturbance to breeding bird populations, the refuge would maintain areas closed to public access during the breeding bird season of April–August in addition to closures during the winter.

Aquatic Species

The refuge would continue to work cooperatively with WGFD for fisheries management services. WGFD would continue to conduct various fisheries surveys including presence and absence, abundance, spawning, and angler surveys. The surveys would focus on the native Snake River cutthroat trout populations present in the Gros Ventre River, Flat Creek, and Nowlin Creek; WGFD also would conduct limited surveys in some of the artificial ponds on the refuge for presence and absence of native and nonnative fish species. WGFD would remove nonnative trout from these waters during all surveys. Brook trout in Flat Creek would be targeted for removal during their fall spawning period using electrofishing and fish trapping techniques. WGFD would house all survey data, manage for short- and long-term trends, and manage harvest regulations in cooperation with the refuge.

Mike Nordell / FWS

River Otter

Disease Management

The refuge would work cooperatively with WGFD and Grand Teton National Park to conduct the disease management actions in the Bison and Elk Management Plan. The refuge would cooperate with WGFD to detect sick or dead bighorn sheep, and collected sheep would be tested for disease. We could continue to monitor amphibian populations at a level sufficient to detect negative effects of chytrid disease on amphibian populations. There would be no systematic surveillance to detect diseases in birds, but we would do opportunistic testing of sick and dead birds should abnormal levels of mortality become apparent.

The refuge would attempt to reduce brucellosis transmission from elk and bison to livestock by concentrating elk and bison on the refuge during the critical period of potential transmission (February–March). Given these constraints, we would conduct winter-feeding activities in a way that reduces brucellosis transmission within elk and bison herds.

We would complete a contingency plan for chronic wasting disease. The refuge would continue its herd-health monitoring program in cooperation with our Wildlife Health Office and continue to cooperate with WGFD on its monitoring program for chronic wasting disease. The refuge's current protocol to euthanize and remove animals that exhibit symptoms of chronic wasting disease would continue. We would continue to haze elk and bison off the refuge after the end of supplemental feeding to reduce the amount of time elk and bison are exposed to disease.

Federally and State-Listed Species

The refuge would continue to monitor greater sage-grouse, trumpeter swan, and long-billed curlew populations as resources allow. Based on this monitoring, the refuge would maintain areas closed to public access and limit refuge management activities to prevent unnecessary disturbance of species of concern.

Refuge biological staff would continue to participate in the local greater sage-grouse working group and coordinate with WGFD on its core area strategy for refuge management activities that might affect greater sage-grouse habitat.

Based on the population monitoring information, refuge management activities may need to be limited in trumpeter swan and long-billed curlew breeding areas. In addition, we would share the swan monitoring data with the Greater Yellowstone Trumpeter Swan Working Group. When trumpeter swan nests were threatened by flooding, eggs would be salvaged, hatched in captivity, and cygnets returned to breeding territories.

Research and Monitoring

The refuge would design research and monitoring to inform resource management objectives related to the following:

- whether we are meeting the objectives of the Bison and Elk Management Plan
- population data for Federal threatened and endangered species and State species of concern
- modeling and decision-support tools
- effects of public use and other refuge programs on habitat and wildlife to adaptively adjusting management and public use programs

We would still rely on other agency and nonprofit partners to conduct some monitoring.

Cultural Resources

Staff would continue to document and protect new cultural resources as they are discovered. Staff would also protect existing known resources from vandalism, theft, and destruction. We would maintain and preserve sites with historical significance. As part of our implementation of the National Historic Preservation Act, we would identify cultural resources through archaeological surveys and consultation before starting ground-disturbing projects. Should archaeological resources be discovered during any construction, work would stop in that location until the resources were properly recorded by the Service and evaluated. Measures either to avoid further resource impacts or to mitigate the loss or disturbance of the resources would be implemented.

The refuge would continue to limit access to known archaeological sites to avoid loss or disturbance. We would allow public access only under supervised visits that have a specific purpose for viewing the sites.

The refuge's visitor services staff would continue to seasonally open the historic Miller Ranch to the

public as an interpretive site, relying on a large volunteer workforce as the sole means to staff and run the interpretive site. Volunteers would offer programs each summer at the Miller House, especially to youth groups. The Miller Barn would not be open to the public; the barn requires attention to ensure its preservation including foundation stabilization, improved drainage, repair of split or loose battens in the walls, and possible roof repairs.

Visitor Services

In addition to managing the wildlife-dependent recreational uses, the refuge would continue to administer other uses and refuge access and to provide public outreach.

Hunting

The refuge provides elk and bison hunting consistent with the Bison and Elk Management Plan, including (1) adaptively modifying elk and bison hunting regulations to achieve herd-size objectives, (2) extending accommodations for hunters with disabilities, and (3) offering a special elk hunt for young people during the elk season.

The refuge would continue to allow (1) elk and bison retrieval from hunt unit 80 on the Bridger-Teton National Forest to Elk Refuge Road south and west of the Twin Creek subdivision, (2) allow a ceremonial tribal bison hunt with annual harvest of up to five bison, (3) prohibit the hunting of any wildlife species other than elk and bison, and (4) promote voluntary use of lead-free ammunition. In addition, we would allow guided hunting under special use permit to increase harvest success, which would support the herd size objectives.

Fishing

The refuge would provide fishing opportunities during daylight hours as a compatible wildlife-dependent recreation opportunity. The current fishing access along Highway 89 would be maintained along with the parking turnouts on upper Flat Creek. Traditionally, access gates to lower Flat Creek are unlocked the night of July 31. A few anglers have used these accesses as early as midnight on the August 1 opener.

The Gros Ventre River, upper Flat Creek, lower Flat Creek, lower Nowlin Creek, and Sleeping Indian Pond would be open to fishing according to season dates and regulations set by the WGFD. We would keep closed to fishing all other refuge ponds, Flat Creek downstream from the old Crawford Bridge site, and Nowlin Creek upstream from the posted fishing boundary. The refuge would issue special use permits for guided fishing on Flat Creek only.

Wildlife Observation and Photography

The refuge would maintain access to existing turnouts, trails, and other observation sites. The primary viewing turnouts and designated observation sites follow:

- The upper viewing platform on the second story of the visitor center.
- The Burt Raynes Boardwalk and remote-viewing platform on the eastern side of the visitor center lawn.
- A turnout north of the visitor center and the Flat Creek Bridge, which has a viewing platform and National Elk Refuge sign. The turnout is plowed in winter, thus providing year-round access to the turnout.
- A turnout along Highway 89 north of Jackson, which has a kiosk and interpretive panel about the purpose of the fence and elk "jumps" (refer to "Fencing" in chapter 4, section 4.3). The turnout is plowed in winter by the Wyoming Department of Transportation, giving travelers on Highway 89 a safe place to pull over and view wildlife. However, the plowed snow is piled up on the northern end of the turnout, blocking access to the kiosk and interpretive panel.
- Approximately 10 turnouts are available on Elk Refuge Road. They are plowed during winter to encourage vehicles to move off the road to view wildlife.
- The Jackson Hole Community Pathways completed the refuge's North Highway 89 Pathway in 2011.

Although no designated auto tour route exists, Elk Refuge Road and Flat Creek Road would continue to remain open to the public for wildlife observation and access to national forest lands from May 1 through November 30. During winter months, 3.5 miles of Elk Refuge Road (from the refuge entrance to the Twin Creek subdivision) would continue to remain open (December 1–April 30) to provide access to the national forest and wildlife-viewing opportunities. Refuge staff would continue to coordinate with the Bridger-Teton National Forest on a winter clo-

sure of Elk Refuge Road beyond the Twin Creek subdivision. Closure of the road to the public beyond the subdivision is part of a larger area wildlife closure, which was established to protect and reduce the stress of wintering animals and to reduce wildlife conflicts with users during the winter.

Wildlife-touring companies would continue to be allowed on the refuge through a special use permit that outlines specific conditions for operation, including required safety mitigation. This addresses potential safety issues that could affect visitors or general traffic and congestion along the Elk Refuge Road. The visitor services staff would continue year-round communication with the wildlife-touring companies to provide them with current information about management practices, operations, and issues.

The refuge would continue to support a contracted sleigh ride program to offer a unique opportunity for observing winter wildlife. This program would continue to be part of the marketing efforts of the Jackson Hole Chamber of Commerce.

The refuge would continue its use of a Web-based photo-sharing site for refuge photos. This photo collection would help the staff with the many requests the refuge gets from publications, Web sites, communication specialists, the media, our regional and national Service offices, and other groups for photos of various events and scenery. The pictures are accompanied by interpretive text, photo credits, and information about when the photo was taken.

Environmental Education and Interpretation

To meet the demand for environmental education during the school year, the refuge would continue to use funding through nongovernmental partnerships to hire seasonal (winter) naturalists. Environmental education programs in the spring would be offered when possible through the use of volunteers. Spring environmental education programs would be limited because they occur at the same time as the large volunteer staff is arriving for the season; therefore, staff time devoted to public programs would be superseded by checking in and training volunteers and other seasonal staff.

The visitor services staff would continue to rely on a large workforce of residential volunteers as the means of offering formal and informal interpretation during the summer months when visitor center visitation peaks. Volunteers would also continue to provide interpretation during the winter months, although residential housing for volunteers is very limited during the winter.

The refuge would engage the public at the visitor center and provide climate change brochures offered by the Grand Teton Association and literature we and the U.S. Department of the Interior produced.

Lori Iverson / FWS

Wildlife observation is a popular activity at the visitor center.

The refuge would continue to support a contracted interpretive sleigh ride program during the winter and would work closely with the contractor to provide quality education and interpretation through this unique wildlife-viewing opportunity.

Refuge signs are aging and some are outdated. The staff would assess priorities and replace signs as funding and staff time allow.

Jackson Hole and Greater Yellowstone Visitor Center

The refuge would continue to pay for most of the annual operational and maintenance costs for the Jackson Hole and Greater Yellowstone Visitor Center, a multi-agency visitor center. The refuge has one employee assigned to work full-time at the visitor center, which has high year-round visitation. Each partnering agency—Bridger-Teton National Forest, Grand Teton Association, Grand Teton National Park, and Jackson Hole Chamber of Commerce—would continue to provide minimal staff at the information desk.

Other Uses

The National Elk Refuge is managed as a closed refuge, which limits public use except the uses previously described and the following approved uses. We would evaluate other uses occurring or proposed on the refuge, including wildlife-dependent and non-wildlife-dependent uses other than the six priority uses, for their appropriateness and compatibility with the purposes of the refuge in accordance with our policies (Appropriate Refuge Uses Policy and Compatibility Policy).

North Highway 89 Pathway

We would allow nonmotorized and pedestrian use of the North Highway 89 Pathway with a designated seasonal closure from November 1 through April 30 (based on a variety of data collection methods to assess wildlife movement) for protection of wildlife. Refuge staff would continue working with Jackson Hole Community Pathways and other advocacy groups for consistent outreach and messaging on pathway use, and we would encourage use of the pathway as an alternative transportation route for workers and visitors to and from town to the Grand Teton National Park. We would continue to prohibit pets and horses on the pathway.

North Park

The town of Jackson would continue to manage North Park under a memorandum of understanding with us. Jackson would continue to collect garbage and provide lawn care at North Park as well as conduct the fee-reservation system for the group picnic shelter.

Special Use Permits

We would issue special use permits for appropriate activities such as guided hunting and fishing, hunting retrieval services, commercial wildlife-viewing tours, professional photography and videography, and research projects. Each permit would have special conditions required to reduce impacts to resources and other activities. Before issuing special use permits in the greater sage-grouse core area, we would make sure to comply with Wyoming Executive Order 2011–5 and apply appropriate stipulations.

In many cases, permittees would be required to report use to the refuge at the end of the permit period, documenting the number of clients and trips onto the refuge. There would be no fees associated with special use permits. Staff availability would determine, case-by-case, if we would allow special access to closed areas of the refuge.

Commercial photographers would need to obtain special use permits to operate on the refuge. The special use permits stipulate special conditions such as access into areas not open to the public. This ensures when the permittee is out shooting, a refuge official, contractor, volunteer, or agency partner has a way to verify whether a particular activity has been authorized if the permittee is not accompanied by a staff member.

The refuge would deny requests for activities that are not appropriate and compatible uses of the refuge, such as weddings at Miller House, photographers on feed trucks, and journalists on law enforcement ride-alongs.

The refuge would restrict precedent-setting special access requests that would be cumbersome to the refuge. The refuge receives many requests from individuals and user groups to be allowed special access to areas and to accompany refuge staff during management operations and other activities that are not available to the public. The high visibility of the refuge has the potential for special-exceptions requests to become unmanageable. Other similar users groups or individuals may want the same exception or opportunity, and refuge staff would have to be able to articulate in an equitable and justifiable manner why one person or group was allowed to do an activity and another was not. Refuge staff would need to carefully consider the nature of a request and consider that multiple similar requests that could ensue.

In the past, commercial horseback trail riding has been occasionally permitted along a 1-mile section of the Gros Ventre River in the northeastern corner of the refuge. We have denied requests to conduct this non-wildlife-dependent commercial use on other parts of the refuge because the benefits it provides in support of the refuge goals are minimal. The refuge would continue to allow this use as resources to manage the activity allow, including staff to issue and review permits, provide law enforcement oversight for public safety, and monitor and control new invasive plant infestations. There would be no expansion of commercial horseback trail riding.

Access

Some people want access to the refuge for refuge activities and to access the adjacent Bridger-Teton National Forest.

General Access and Elk Refuge Road

Elk Refuge Road, Flat Creek Road, and the Curtis Canyon Road would be open to the public for wildlife observation and access to national forest lands from May 1 through November 30. During the winter months (December 1 through April 30), 3.5 miles of the Elk Refuge Road (from the refuge entrance to the Twin Creek subdivision) would be open to provide wildlife-viewing opportunities on the refuge and one access point to the national forest.

Access to the National Forest

We would continue to limit access across the refuge to the national forest through three existing locations: Crystal Butte, Dry Hollow, and Sheep Creek. Antler collectors have also crossed the refuge and private land in recent years to access the national forest from the Gros Ventre River "jump cliff" site; however, the refuge has not sanctioned crossings at this site. The refuge is currently in discussion with other adjacent landowners to discuss the future use of this access point. The refuge would need to evaluate the use of this site as an access point to the Bridger Teton National Forest.

We would continue to allow overnight parking on Elk Refuge Road on April 30 to accommodate antler hunters accessing the opening of the national forest winter range on May 1.

Winter users of the Goodwin Lake Ski Cabin on the Bridger-Teton National Forest would continue to have restricted access across the refuge (only a few hundred yards) on a designated trail to reach the national forest boundary. Refuge or visitor center staff would issue a permit with regulations such as a restricted travel route to the cabin, egress from national forest property that includes no trespass on private property, and dates when the activity is allowed. Refuge maintenance staff would plow a small parking area with room for two cars near the entrance to the Twin Creek subdivision.

Public Outreach

The purpose of public outreach is to build an understanding of our Service mission, natural elk and bison behavior, population fluctuations, and ecological relationships to other species, as well as refuge management practices.

Because of the refuge's high-profile location, the "flagship refuge" status, and the complexity and controversial nature of many of the management issues, the need for regularly occurring public outreach is critical. The refuge's visitor services staff would prepare and send out news releases about visitor opportunities and management activities as staff workload allowed. The staff would also prepare and distribute articles, as workload allowed, on refuge management operations, research, and visitor services for internal and external audiences to inform audiences about the scope and complexity of refuge activities. We would send out news releases, articles, and other refuge information via a current email contact list that has elected officials, Federal and State partners, nonprofit conservation and partner organizations, key community and business leaders, special use permittees, and regional and national contacts in our agency. In addition, the visitor services staff would keep current the refuge Web site and photo gallery and would develop and use other forms of electronic media as workload allowed.

The refuge has seen an increase in the number of requests for media interviews and filming for travel shows, publications, and documentaries. The refuge would continue to conduct media interviews and accommodate film crews for local, national, and international audiences as workload allowed.

Refuge leadership would continue to take an ambassadorial and leadership role in the community, including extensive involvement in a variety of partnerships.

Visitor and Employee Safety and Resource Protection

We would continue to emphasize visitor and employee safety in all operations on the refuge. Hunting regulations and program design would focus on the safety of the refuge user and surrounding community. Safety rules, procedures, job hazard analyses, reporting requirements, and regional safety office oversight would help to keep refuge employees safe while working to achieve station objectives. Law enforcement officers stationed at the refuge would continue to promote visitor and employee safety.

Law enforcement efforts on the refuge protect natural and cultural resources, refuge facilities, visitors, and employees. Resource protection programs would continue at a basic level and focus on hunting and fishing programs, antipoaching activities, boundary and signing activities, and enforcing the prohibition on collecting shed antlers. Present staff size would remain minimal, and the refuge would continue to rely on the Teton County Sheriff's Office, National Park Service, WGFD, and the Service's law enforcement officers throughout the year for basic law enforcement presence and call response.

Administration

To perform our responsibility to administer all aspects of the refuge, we rely on our Government-funded budget and the associated staff and facilities it supports. In addition, our partners often provide crucial support.

Funding and Staff

We would keep our current staff level of 10.5 FTE positions (refer to table 3 for a list of current staff

Table 3. Current staff positions at the National Elk Refuge, Wyoming.

Government-funded position	*Full time equivalent*
Wildlife Disease	1
Deputy refuge manager (GS–485–13)	1
Outdoor recreation planner (GS–0023–12)	1
Park ranger (GS–0025–9, visitor center manager and volunteer coordinator)	1
Wildlife biologist (GS–486–12)	1
Refuge land management officer (GL2–1801–9)	1
Office assistant (GS–0303–5)	0.5
Heavy mobile equipment mechanic (WG3–5803–11)	1
Maintenance mechanic (WG–4749–9)	1
Rangeland management specialist (GS–454–9)	1
Budget analyst (GS–0560–11 , business team)	1

[1] GS=General Schedule classification and pay system.
[2] GL= General Schedule classification and pay system for law enforcement officers.
[3] WG= Wage Grade classification and pay system.

positions). More staff would be hired as money became available through the Refuge Operations Needs System.

The refuge would continue to rely on volunteers and unpredictable nongovernmental money to hire seasonal employees needed to achieve critical refuge programs. An additional 12.5 FTEs of volunteer and seasonal staff assistance would be used to augment the Government-funded 10.5 FTEs of refuge staff. The volunteers and temporary, seasonal staff would be as follows:

- one volunteer for the biological program fieldwork
- eight seasonal irrigators
- one seasonal supplemental feed operator
- twenty volunteers to staff the visitor center and Miller House
- three winter naturalists to offer programs and staff the visitor center
- eight Service law enforcement officers to patrol during the May 1 opening of the winter range on the Bridger-Teton National Forest for antler collection
- two seasonal National Park Service law enforcement officers for hunting season enforcement

Facilities

"Operations and maintenance" consist of maintaining facilities, infrastructure, vehicles, and other equipment in good working condition through the use of annual and deferred maintenance funds to achieve management goals. Priorities would be set for the limited maintenance money to meet needs that affect key operational and visitor services infrastructure. The refuge would continue to provide some form of Government housing, which would help us recruit highly qualified staff and volunteers that would be able to afford our reasonably priced housing.

Elk Refuge Road

Elk Refuge Road provides safe, reasonable, uninterrupted access (ingress and egress) for our agency staff, the public, and private landowners year-round and is a popular winter wildlife-viewing area. Opening parts of the road would allow the public seasonal access to national forest lands.

We would continue to enforce a regulation for no stopping or parking on the roadway to prevent obstruction to other vehicular traffic using the road. Two nearby, heavily visited national parks allow frequent stopping in the road to take photographs or view wildlife. Many of the same visitors travel on Elk Refuge Road, bringing with them the same habits and viewing practices they exhibited in the national parks during their same vacation stay. Because visitors to the refuge do not pass through a designated entrance kiosk where they make a contact with a refuge employee, it is difficult to educate them about regulations about not stopping in road. Regulations pertaining to parking on the road would continue to

be listed at a wayside exhibit kiosk at the entrance to the refuge, but few visitors stop to thoroughly read through the information before proceeding onto Elk Refuge Road. A handout listing regulations, along with a map showing the turnouts, would continue to be available at the visitor center.

The county road easement would continue to be treated for dust abatement during summer months, which creates a bighorn sheep attractant (from the salt in the treatment) on and along the roadway. Magnesium chloride (salt)-treated water, used for dust abatement during the summer, would remain on the road surface throughout the year and serve as an attractant that draws bighorn sheep to the road surface during the winter. Large numbers of bighorn sheep would continue to gather on the road, creating a congested and sometimes fully obstructed roadway. The obstructed road is a safety issue, especially for through traffic (local residents, deliveries, refuge staff, and refuge feeding operations).

During the winter, we would continue to plow snow off the road's current 10 turnouts to encourage vehicles to move off the road to view wildlife.

Partnerships

Staff would work to maintain existing partnerships that address resource information needs, protect and enhance habitat (both public and private), and promote public use, education, and outreach. Current partners include local private landowners, governmental agencies, and nongovernmental organizations. The refuge involves local conservation organizations in supporting educational events and fosters partnerships with local communities for resource protection, and promotes continued grant development with partners seeking money to accomplish mutual goals.

The refuge would continue to work with State and county agencies to accomplish mutually beneficial projects. Examples of ongoing collaboration include habitat improvement projects for Flat Creek, documentation of habitat conditions through high-resolution aerial photography, invasive plant species control, wildlife and disease monitoring, and the monitoring and operation of a nonmotorized pathway along the western refuge boundary. We would coordinate with WGFD on various projects including greater sage-grouse habitat, particularly near occupied leks within core areas delineated by the State of Wyoming Greater Sage-Grouse Core Area Protection Executive Order 2011–5.

The refuge would continue to support and take part in multi-agency wildlife work groups such as the Jackson Cooperative Elk Studies Group, the Greater Sage-Grouse Working Group, and the Jackson Interagency Habitat Initiative (works on winter and transitional range improvements). We would collaborate with the Jackson Hole Weed Management Association to manage invasive species on the refuge and throughout the ecosystem.

Coordination with nongovernmental conservation organizations would continue to complete refuge projects that benefit wildlife such as the program for voluntary use of lead-free ammunition, which would provide benefits to wildlife beyond the refuge boundary.

The refuge would continue our close partnership with the Jackson District Boy Scouts that collect elk antlers on the refuge and conduct the Boy Scouts of America Elk Antler Auction each year, with most of the proceeds coming to the refuge to support our programs.

We would develop partnerships to find solutions and educational opportunities to resolve elk and bison conflicts on private and public land.

The refuge would continue to work in partnership with the Grand Teton Association to support visitor services programs that relate to interpretation, education, research and the operation of the multipartner Jackson Hole and Greater Yellowstone Visitor Center.

3.6 Alternative B (Enhance Public Use and Intensive Resource Management)

An important aspect of this alternative would be to limit public use to appropriate and compatible wildlife-dependent uses—hunting, fishing, wildlife observation, photography, environmental education, and interpretation—and shift away from non-wildlife-dependent uses. There would be increased development in some areas of the refuge to address increased public use at area-specific intensive use locations. Options to experience and observe would be enhanced.

The other emphasis would be to meet habitat and wildlife population objectives through intensive management actions. Because of increased public opportunities, refuge staff would focus more on intensive refuge-specific monitoring, rather than ecosystem monitoring, to gauge the effects of public use on habitat and wildlife.

Chuck Mulcahy / FWS

A chuck wagon located at the Miller House provides a unique learning opportunity.

Climate Change

Management actions would be the same as alternative A. In addition, staff would cooperate with the Great Northern Land Conservation Cooperative to conduct research and monitoring and carry out management as necessary to reduce adverse climate change effects on high-priority refuge resources. Efforts would focus on bison, elk, and Federal trust resources.

Landscape-Scale Conservation

Management actions would be the same as alternative A. In addition, we would consider partnership opportunities to build wildlife crossings for Highway 89—such as under-road tunnels, overpasses, or fences on the west side of the highway—to reduce collisions between vehicles and animals.

Habitat

The emphasis would be to meet habitat objectives through intensive management actions.

Native Grasslands and Sagebrush Shrublands

Management actions would be the same as alternative A. In addition, the refuge would develop and carry out habitat projects in coordination with the local greater sage-grouse working group and WGFD to meet desired conditions. Considering greater sage-grouse concerns, we would introduce prescribed fire to enhance the quantity and quality of forage for elk and bison.

Wetlands

Management actions would be the same as alternative A. In addition, the refuge would improve its ability to manage water levels in artificial ponds and would manage water levels to enhance habitat for trumpeter swans. In natural wetlands, the refuge would increase monitoring for and control of invasive species and use prescribed fire to enhance the quantity and quality of forage for elk and bison.

Riparian Woodlands and Aspen Woodlands Areas

Management actions would be the same as alternative A. In addition, the refuge would use the efficiencies in the irrigation system to keep more water in Flat Creek and improve riparian habitat. We would consider expanded techniques for regeneration of woody vegetation. In the Gros Ventre River drainage, the refuge would carry out recommendations from the hydrologic assessment conducted by the National Park Service, as appropriate.

Flat Creek Enhancement

Management actions would be the same as alternative A.

Invasive Species

Management actions would be the same as alternative A. In addition, there would be increased monitoring and rapid response for new infestations of invasive species, including aquatic plant and animal species. Refuge staff would also develop large-scale programs for invasive plant eradication where possible.

Wildland Fire Management

Actions would vary depending on the type of habitat.

Native Grasslands and Sagebrush Shrublands

Wildfire suppression same as Alternative A. Prescribed fire would be introduced to enhance the quantity and quality of forage for elk and bison, reinvigorate native species, and to reduce hazardous fuels.

Wetlands

Wildfire suppression same as Alternative A. Prescribed fire would be introduced to enhance the quantity and quality of forage for elk and bison, reinvigorate native species, and to reduce hazardous fuels.

Riparian Woodlands and Aspen Woodlands Areas

Wildland fire management in this habitat type would be the same as Alternative A.

Wildlife

The emphasis would be to meet wildlife population objectives through intensive management actions.

Elk and Bison

Management actions would be the same as alternative A.

Migratory Birds

Management actions would be the same as alternative A. In addition, we would increase monitoring to establish baseline information on the migratory bird species that occupy the refuge.

Aquatic Species

Management actions would be the same as alternative A.

Disease Management

Management actions would be the same as alternative A. In addition, the refuge would develop a comprehensive disease contingency plan in coordination with WGFD and Grand Teton National Park that focused on intervention where not constrained by the Bison and Elk Management Plan. As part of this process, the refuge would develop alternative strategies to dispose of diseased elk and bison carcasses.

Federally and State-Listed Species

Management actions would be the same as alternative A. In addition, the refuge would increase monitoring of other State species of greatest conservation need in coordination with WGFD. Where appropriate, the refuge would support the goals of recovery plans for federally listed species through management activities.

Staff would initiate intensive management actions to enhance trumpeter swan production on the refuge. The refuge would enhance swan habitat to meet objectives of the Pacific Flyway Management Plan for the Rocky Mountain Population of Trumpeter Swans (Subcommittee on Rocky Mountain Trumpeter Swans 2012), referred to as the Trumpeter Swan Management Plan. We would design these enhancements to maximize nesting and breeding areas visible to the public. For flooding situations, the refuge would (1) consider removing swan eggs and returning cygnets (young swans) to breeding sites after hatching, (2) use floating nest structures to mitigate for the effects of human disturbance and flooding, and (3) construct more managed ponds suitable to support nesting swans in appropriate areas.

Research and Monitoring

Management actions would be the same as alternative A. In addition, the refuge would increase research and monitoring of the effects of public use and other refuge programs on habitat and wildlife and adaptively adjust management and public use programs. We would increase all research and monitoring efforts to improve our confidence in the data gathered.

Cultural Resources

Management actions would be the same as alternative A. In addition, we would develop an interpretive trail around the Miller Ranch buildings, inviting visitors to explore the cultural as well as natural aspects of the refuge. We would seek money for per-

manent or seasonal interpreters to maintain and enhance programs at the Miller House.

Refuge staff would work with partners and our agency specialists to address the foundational deterioration and other structural issues at the Miller Barn. We would include in planning or rehabilitation work done on the barn the use of the structure for interpretive programs. The barn repair work would include foundation stabilization, improved drainage, repair of split or loose battens in the walls, and possible roof repairs. The barn is not open to the public now and would need to be inspected for items such as floor load capacity, safety, fire codes, and egress. Lighting would need to be installed. Refuge staff would need to apply for grants or other funding sources to pay for the Miller Barn restoration. Historic preservation specialists would have to be contracted to work with refuge staff to make sure preservation standards and protocols were met. The refuge would rehabilitate the other Miller Ranch buildings as needed.

Visitor Services

We would limit public use to appropriate and compatible wildlife-dependent uses.

Hunting

Management actions would be the same as alternative A. In addition, the refuge would expand hunting opportunities for young people. This may include working with partners to develop a hunter mentoring program and moving the existing hunting opportunity for young people to later in the season to provide more elk observation opportunities and increase the chances for successful harvest. Potential options would include designating a weekend in midseason for youth-only hunts or adding a weekend after the end of the elk season for a youth-only hunt.

Staff would develop regulations for proper storage of bear attractants and bear-deterrent practices when hunting on the refuge. We would encourage hunters to carry bear spray while on the refuge, and we would consider enacting a bear spray carry requirement. Staff would develop management tools for assessing hunter use—such as hunter checkpoints, hunter success surveys, and improved mandatory reporting of tag use—to better manage hunt program opportunities.

The refuge would consider and create more hunting opportunities. As the need arises, we would analyze and consider developing hunting opportunities for species other than elk and bison. Staff would coordinate with WGFD to develop specific refuge-hunting opportunities to meet population objectives in the Bison and Elk Management Plan. We would also work with WGFD to develop an antlered elk hunt on the refuge to provide more quality opportunities.

We would open the currently closed areas on the southern and western boundaries of the refuge to archery hunters to create more harvest opportunities and add access for archery hunters at the Jackson National Fish Hatchery. The refuge would explore the idea of adding access for bison hunters on the northern end of the refuge through the Teton Valley Highlands subdivision to either hunter retrieval road 6 or 7.

Fishing

Management actions would be the same as alternative A. In addition, besides sponsoring Kids' Fishing Day with the Jackson National Fish Hatchery and the WGFD, the refuge would like to start programs that attract more young people to the refuge for fishing opportunities, using volunteers or partners as instructors. Programs could include casting instruction, a fishing skills clinic, and a mentoring program for young anglers.

We would change the scheduled opening of the two access gates to lower Flat Creek, along Highway 89, to daylight (6 a.m.) on the August 1 season opening, which would be consistent with refuge regulations. This would be a change from the current situation; we would no longer open the gates the evening before the fishing season opening.

The Flat Creek fishery is managed for a native, wild and trophy-sized Snake River cutthroat trout population. Long-time devotees of Flat Creek report a decline in the opportunity to fish for large cutthroats. Recent fish surveys show that nonnative trout (brook, brown, and rainbow) account for almost half of the trout population of the stream. The typical Flat Creek anglers are avid flycasters that have adopted catch-and-release principles as their conservation ethic. There is a need for active management of this fishery to support the quality of the fishing experience. We would do more angler education about (1) nonnative trout (competition and hybridization) in the Snake River cutthroat trout fishery and (2) the importance of Flat Creek for the recruitment of Snake River cutthroat trout to the Snake River fishery.

Flat Creek is a popular fishing destination especially in August, and there are times when overcrowding affects the quality of the fishing experience. To control some of the future use of lower Flat Creek and make it easier to enforce permit requirements, the refuge would set a limit of 10 or fewer special use permits for commercial guided fishing. To limit the crowding from guided fishing, per-

Lori Iverson / FWS

Hunting is one of many wildlife-dependent activities available on the refuge.

mits would have quotas of two trips, two guides, and a maximum of two clients per day. An annual $100 fee for each commercial guide permit would provide financial support for the fishing program's administrative expenses, such as for access signage and the printing of fishing regulations. In addition, we would construct an accessible fishing platform to access Flat Creek.

We would require commercial guides to kill nonnative fish, such as brook, brown, and rainbow trout, as a condition of their special use permits. Nonnative trout are classified as game species, and we would require these fish to be included in an angler's daily possession, consistent with State regulations.

Staff would improve habitat and waterflow management for increased fishing opportunity, with a focus on native fish species. We would also work with partners to enhance fisheries management to encourage native species in the Gros Ventre River by using fish screens or a similar tool. Fish screens may be beneficial; however, we would carefully evaluate the need because installation and maintenance of fish screens can be very expensive. Fish screens on the Gros Ventre River might prevent migration of rainbow trout into the Flat Creek cutthroat population.

Fisheries habitat improvement and angler opportunity in Flat Creek would be greater than alternative A and similar to alternative A in the Gros Ventre River.

Wildlife Observation and Photography

Management actions would be the same as alternative A. In addition, the refuge would develop pathway pulloffs along the North Highway 89 Pathway and a more prominent access route, designed for accessibility, across the visitor center lawn to the existing remote-viewing platform. We would develop an accessible boardwalk through already disturbed wetland areas near the visitor center with a photo blind along the boardwalk for noncommercial photography. Using webcams on the refuge would provide wildlife-viewing opportunities such as observation of nesting swans. We would develop a wildlife checklist for the refuge.

Environmental Education and Interpretation

The refuge's education and interpretation programs would reflect refuge resource issues. We would use the existing North Highway 89 Pathway to interpret wetland values or other interpretive messages. The refuge would use public information to promote understanding of invasive species control and prescribed fire as a management tool. We would increase public education about the migratory birds using the refuge and the importance of keeping areas closed to the public during the bird breeding season. To allow the public to view nesting birds without disturbing them, we would use strategies such as webcams on the refuge and an online photo gallery. We would seek more money for permanent or seasonal

interpreters to improve programs at the visitor center, Miller House, and offsite areas.

The refuge would develop a self-guided, interpretive tour route on existing refuge roads on the eastern side of the refuge (Elk Refuge Road and Flat Creek Road). The route would have interpretive turnouts, signs, and possibly an accompanying brochure. We would need to update and replace interpretive signs with panels related to the tour route theme. The refuge would develop the tour route in three phases:

1. First phase (winter route)—Develop the route from Elk Refuge Road entrance to Twin Creek subdivision for approximately 3.5 miles.

2. Second phase (summer route)—Develop the route from Twin Creek subdivision to the McBride area; open May 1–December 1 with an interpretive kiosk at the McBride parking area.

3. Third phase—Increase traffic control signing from the McBride area to the eastern parking lot and include the traffic information in the brochure.

For Elk Refuge Road, the refuge would consider (1) developing an interpretive brochure that corresponds with numbered turnouts and has winter and summer information or (2) having standalone interpretive panels. We would consider mounting scopes at the turnouts to encourage people to get out of their vehicles. During busy periods, refuge naturalists would be on scene to present the educational component. In addition, we would need to address safety mitigation during critical times of the year such as during hunting season and when bison moved through the refuge. For summer use of the road, the refuge would implement a themed interpretive signing program, possibly answering the question "Where are all the elk?"

As a way to provide interpretive information to the public, the refuge would add special conditions in the special use permits for wildlife tour companies to use or mention the tour route. Charging fees would help to offset our administrative costs.

We would continue to assess the number of people that regularly watch the refuge video to decide if it should be updated. An option would be to produce a selection of shorter multimedia presentations that would be available to the public on demand rather than offering a full-length video. The multimedia presentations could also be housed on the refuge Web site or be downloaded by visitors at the visitor center. The video presentations would emphasize the role and mission of national wildlife refuges versus national parks and national forests, as well as describe the role of the refuge in the Greater Yellowstone Ecosystem.

We would stabilize and restore Miller Barn as an interpretive site where we could hold programs and events.

Jackson Hole and Greater Yellowstone Visitor Center

The designated partners in the Jackson Hole and Greater Yellowstone Visitor Center would contribute annual funding to help with operations at the visitor center and ease the growing financial burden to the refuge. We would continually document and evaluate the visitor center condition and maintenance issues, ensuring that replacement and maintenance cost estimates were current. We would rehabilitate the existing building, or we would build a new visitor center to address the ongoing repairs to the aging building, maintenance deficiencies, and lack of compliance with the Architectural Barriers Act Accessibility Standard (United States Access Board 2013). A rehabilitated, expanded, or remodeled visitor center or a new visitor center would also address the lack of space for interpretive programs and presentations to schools and other groups.

Other Uses

We would not develop hiking and biking trails, but participants in these activities might use the new self-guided, interpretive tour route described earlier. We would follow our agency policy that prohibits weddings on refuge property, including public use areas such as North Park, the Miller House, and the visitor center.

North Highway 89 Pathway

Management actions would be the same as alternative A. In addition, the refuge staff would apply criteria and determine, on a yearly basis, whether the pathway can be opened as early as April 15 in years when spring arrives unusually early. We would use the pathway during the open season as an interpretive programming venue. The refuge would explore a variety of data collection methods to assess wildlife movement across the pathway at various times of the year, especially during the times of year when the pathway is closed. Refuge staff would cooperate with Teton County to evaluate pathway impacts on wildlife and habitat and adjust use as appropriate.

North Park

When the memorandum of understanding with the town of Jackson expires in 2015, we would continue the partnership with Jackson to manage North Park through a revised memorandum that does away with the reservation and fee collection system for activities on refuge land.

Special Use Permits

Management actions would be the same as alternative A. In addition, we would charge fees for special use permits for commercial photography and filming, wildlife-viewing, and other commercial activities including those for access to refuge areas closed to the public. There would be a flat fee for all commercial special use permits and a general use fee related to the amount of time for each specific use. Many of the same permittees would also obtain special use permits in neighboring Grand Teton National Park, which has a fee system in place for similar activities.

Issuing a permit to a filmmaker would ensure that, when the film permittee was out shooting, a refuge official, contractor, volunteer, or agency partner could verify whether a particular activity had been authorized if the permittee was not accompanied by a staff member. Recognition of the National Elk Refuge and the National Wildlife Refuge System would be a requirement of the permit.

In the past, commercial horseback trail riding has been occasionally permitted along a 1-mile section of the Gros Ventre River in the northeastern corner of the refuge. We have denied requests to conduct this non-wildlife-dependent commercial use on other parts of the refuge because the benefits it provides in support of the refuge goals are minimal. Managing this use diverts limited refuge staff and management resources away from critical programs. The introduction of invasive plants through horse manure is an unnecessary risk for a non-wildlife-dependent commercial use. However, the use of horses is allowed by hunters and commercial hunting guides to support hunting, a wildlife-dependent use and a vital tool for management of elk and bison populations. The refuge would phase out this use within 5 years, and there would be no expansion of commercial horseback trail riding.

Access

Management actions would be the same as alternative A, with the following changes.

General Access

The refuge would analyze and consider more hunter access areas and designated parking lots. We would consider more bison hunter access on the northern end of the refuge though the Teton Valley Highlands subdivision—either on the western end of the subdivision to hunt retrieval road 6 or on the eastern end of the subdivision to hunt retrieval road 7. In addition, the refuge would consider archery hunter access on the western boundary of the refuge next to the Jackson National Fish Hatchery.

Elk Refuge Road

Management actions would be the same as alternative A.

Access to the National Forest

We would prohibit the overnight parking, camping, staging, and tailgating on April 30 on the refuge associated with antler collection on the adjacent Bridger-Teton National Forest. The refuge would consider an alternate gate opening time. By having a later gate-opening time than other national forest access points, refuge staff might be able to reduce or eliminate persons interested in staging on Elk Refuge Road. Users that learned other accesses onto the national forest would be opening before the refuge access might be discouraged from using Elk Refuge Road, knowing other antler collectors would be reaching the same destinations sooner.

The refuge would encourage the national forest to provide added signing for the egress route to prevent trespass on private land at the Twin Creek subdivision by people traveling to and from the Goodwin Lake Ski Cabin. We would ask the national forest to issue special use permits (rather than the refuge) for parking on refuge since the associated activity takes place on the national forest and the trespass violations occur by travelers leaving the forest and continuing through private property.

Public Outreach

Management actions would be the same as alternative A. In addition, because of the wide audience and interest in the National Elk Refuge, we would develop more media and outreach venues available to the public. The role of the refuge in the Greater Yellowstone Ecosystem would be emphasized in additional outreach. Program outreach would include the following:

- The refuge would provide more outreach for other refuge users to promote education and awareness of the refuge hunting program.
- The refuge needs more angler education about the negative effects of nonnative fish on the native Snake River cutthroat trout

fishery and to encourage angler harvest of nonnative trout.

- Outreach would be necessary to inform local justices of the peace, or anyone that has authority to perform legal wedding ceremonies, that weddings are not allowed on refuge property.

- Because we would no longer allow overnight parking the night before the winter range opening on the Bridger-Teton National Forest, the refuge would provide timely outreach to let people know about this change.

Visitor and Employee Safety and Resource Protection

Management actions would be the same as alternative A. In addition, there would be an increased law enforcement presence during the hunting season as it continued to grow and become more complex. In coordination with WGFD, the refuge would develop strategies to increase hunter safety. Expanded hunt areas have created more situations where hunters must use their discretion whether or not a safe shot can be taken. Refuge staff and WGFD staff need to check such areas and make adjustments to roads available to hunters, placement of hunt parking areas, and hunt area boundaries, as necessary. Law enforcement staff would administratively revoke more hunting permits in situations where the hunter endangers public safety or knowingly violates refuge regulations or State or Federal laws. Furthermore, violations could affect a hunter's ability to get future hunting permits or renew a special use permit.

The refuge would acquire all personal protective equipment as necessary for duties performed. Safety training would be available as needed.

Law enforcement staff and patrols would be increased:

- Increased patrols would be needed in April to deter refuge trespass and the illegal removal of shed elk antlers and other wildlife parts.

- The increased law enforcement staff would develop additional techniques (such as remote cameras, tracking devices, and motion sensors) to detect the illegal taking of wildlife and wildlife parts during known peak seasons such as the spring antler season. The staff would continue to expand the use of remote surveillance technologies and tracking devices.

- There would be 7-day-per-week coverage by law enforcement staff year-round to address increased public use.

- There would be increased enforcement of regulations related to Elk Refuge Road. Refuge law enforcement would continue to enforce the provisions of 50 CFR 27.31(h).

We would consider designating off-road parking at the entrance with a relocated entrance kiosk.

Administration

To perform our responsibility to administer all aspects of the refuge, we rely on our Government-funded budget and the associated staff and facilities it supports. In addition, our partners often provide crucial support.

Funding and Staff

Refuge base funding would increase by approximately $200,000 per year to replace private funding generously provided by refuge partners. Volunteers would remain a crucial part of the refuge workforce.

In addition to the existing refuge staff of 10.5 FTE positions, the following 15 FTE positions would be hired as permanent full-time or permanent seasonal refuge employees:

- one permanent full-time biological technician
- one permanent engineering equipment operator
- six permanent seasonal irrigators
- two permanent seasonal supplemental feed operators
- one permanent full-time environmental education specialist
- three permanent seasonal winter interpretive naturalists
- eight permanent seasonal visitor center desk staff members
- one permanent full-time law enforcement officer
- one permanent full-time maintenance program supervisor

Seasonal volunteers would still make important contributions by enhancing the mission work of the refuge.

Facilities

Management actions would be the same as alternative A. In addition, as money became available, the refuge would add up to five family houses and add housing to accommodate seasonal staff. This would help mitigate the extremely high cost of living.

Refuge facilities are located in or near Jackson, which is near Federal lands that support a variety of wildlife. Black bears live in the Bridger-Teton National Forest surrounding the town of Jackson and occasionally enter the town. Grizzly bears have been seen within 5 miles of refuge houses. Bears that become habituated to human garbage or other food rewards, would be relocated or destroyed. Local regulations have been passed to manage household garbage storage and disposal to prevent access by bears, which can quickly become habituated to this food source. The refuge would develop garbage storage and disposal rules for refuge residents that are consistent with the spirit of local regulations; these regulations would describe proper trash disposal, food storage, and use of bird feeders.

In cooperation with WGFD, the refuge would remove the existing, dysfunctional, elk trap corral at the northern end of Miller Butte and replace it with a prefabricated elk trap. The new prefabricated elk trap could be moved to various locations on the refuge to facilitate elk disease sampling, collaring, and research. The new elk trap could be disassembled and stored when not in use.

The Calkins House would be relocated or demolished and replaced in a new location when deferred maintenance money became available.

Elk Refuge Road

Management actions would be the same as alternative A. In addition, we would work with Teton County to modify dust abatement applications on the road to reduce the attraction to wildlife, especially bighorn sheep. The refuge would properly locate and increase the number of turnouts along Elk Refuge Road for winter use. Several of the existing 10 turnouts are poorly situated or are too small to accommodate the volume of use the road receives. Numbered turnouts would correspond with a winter auto tour brochure. We would add new regulatory signing to prohibit stopping or parking on or along roadway. In addition, we would consider widening the road to create more room for all road users. Public comments have suggested widening the road to three lanes, thereby making a parking lane for wildlife watching and more safely accommodating pedestrian traffic. The road widening is suggested for 1.5 miles along the base of Miller Butte. We would work with Teton County to discuss ways to make the road safer—widen, lower the speed limit, improve visibility, eliminate blind spots, realign the road at Miller House, scrape down berms, and add regulatory signage—and create more room for all road users.

In winter, the refuge would sand the road and clear the ditches of snow for safety purposes. Elk Refuge Road in the winter is heavily travelled because of the attraction of a highly visible herd of bighorn sheep. Some motorists are visitors in rental cars who are poorly skilled winter drivers; many of them end up in the roadside ditch. This section of roadway requires extra maintenance, beyond what the county provides, to accommodate visitor use.

Despite the large number of summer visitors to Jackson Hole, the refuge is largely closed to public use during summer with the only refuge access for the throngs of summer visitors being Elk Refuge Road. Contacts with summer visitors along the road usually find them lost or confused. For the extremely heavy summer visitation, the road would be maintained at a higher standard, have enhanced traffic signs, and have speed limit signs installed north of the Curtis Canyon Road.

We would increase enforcement of current regulations.

Partnerships

Management actions would be the same as alternative A. In addition, a nonprofit, National Elk Refuge Friends group would be established to help support the vision of the refuge. Refuge Friends groups have been established throughout the Refuge System to help support the mission of the Refuge System and individual national wildlife refuges. These groups are sanctioned by and receive training and support from the National Wildlife Refuge Association, an independent nonprofit organization whose mission is to conserve America's wildlife heritage through strategic programs that protect, enhance, and expand the Refuge System and the landscapes beyond its boundaries that secure its ecological integrity. The refuge would need to work closely with the Grand Teton Association to distinguish between the role of the cooperating association and the Friends group.

The refuge would increase the emphasis of wildlife projects on private lands by encouraging use of the Partners for Fish and Wildlife Program in Teton County. This is a U.S. Fish and Wildlife Service program that provides money and technical expertise to private landowners for projects that would benefit wildlife. These projects are often conducted on private lands near refuges to provide secondary benefits to refuges.

3.7 Alternative C (Emphasize Intact Ecosystems and Promote Natural Processes)

Given the National Elk Refuge is part of the Greater Yellowstone Ecosystem, one of the largest relatively intact ecosystems on the planet, refuge management would emphasize those qualities that make the ecosystem unique.

Public use emphasizes interpretation, education, and outreach over recreational opportunities that are direct experiences. Educational and interpretive programs would include more experiences off the refuge.

Climate Change

Management actions would be the same as alternative B. In addition, the refuge would focus on building resiliency in the natural systems, mainly on the northern end of the refuge, with the full complement of historical plant and animal species. Management actions would emphasize natural processes, including fire, hydrology, and ungulate grazing, that result in healthy and diverse native plant communities that support a full complement of native wildlife species:

- Work with adjacent landowners to minimize water diversions from the Gros Ventre River and maintain natural flow levels.
- Restore native plant communities in areas currently dominated by nonnative species, with an emphasis on native species that would best match predicted changes in precipitation and temperature.
- Manage fire regimes that mimic pre-European settlement fire-return intervals.

Landscape-Scale Conservation

Management actions would be the same as alternative B. In addition, conservation organizations would be involved in reducing rural development or land use that would adversely affect wildlife and other important natural resources. The refuge would engage in and support projects that would benefit natural ecosystem processes or protect and enhance wildlife corridors. These projects might occur on private or public lands.

Land use outside the refuge impacts refuge resources. The refuge would seek to expand the approved acquisition boundary to include the Twin Creek and Spring Gulch areas, which would provide another tool to resolve off-refuge land use that conflicts with refuge resource protection. We would consider land exchanges with other landowners and agencies to simplify the refuge's exterior boundary.

Habitat

The focus would be preserving intact native plant communities.

Native Grasslands and Sagebrush Shrublands

Management actions would be the same as alternative A. In addition, the refuge would emphasize a mix of age and structural classes representative of historical conditions, reached using prescribed fire and managed wildfire, but like alternative A, the emphasis would still be to protect existing, mature, dense sagebrush stands from fire and other disturbance. We would conduct habitat treatments within the greater sage-grouse core area (as defined by Wyoming Executive Order 2011–5) in consultation with WGFD.

Lori Iverson / FWS

Smooth Brome

Wetlands

In artificial ponds, the refuge would manipulate water levels to mimic natural processes. In natural wetlands, the refuge would maintain and restore natural processes: (1) assess the effect of the Gros Ventre River irrigation diversion; (2) restore woody plant communities as appropriate; (3) restore beaver populations; (4) increase monitoring and control of invasive species; and (5) use prescribed fire and managed wildfire to mimic natural fire regimes.

Riparian Woodlands and Aspen Woodlands Areas

Management actions would be the same as alternative A. In addition, the refuge would emphasize the maintenance and restoration of natural processes. This would include water management designed to mimic natural flow patterns in Flat Creek and the Gros Ventre River, temporary construction of exclosures to support restoration of woody vegetation (but removal when restoration is complete), removal of historical exclosures, and elimination of the jackstraw willow demonstration project on Flat Creek. In addition, we would use prescribed fire and managed wildfire to mimic natural fire regimes in willow, cottonwood, and aspen stands.

Flat Creek Enhancement

Management actions would be the same as alternative A.

Invasive Species

Management actions would be the same as alternative B. In addition, the refuge would monitor and control invasive plants that are not now listed as noxious weeds (such as crested wheatgrass, reed canarygrass, meadow foxtail, cheatgrass, and yellow sweetclover) and restore native plant communities as possible.

Wildland Fire Management

Actions would vary depending on type of habitat.

Native Grasslands and Sagebrush Shrublands

To more represent historical conditions of vegetative structure and age, wildfires would be managed for multiple objectives including potential benefits. However, like Alternative A, there would still be an emphasis to protect mature, dense sagebrush stands from wildfires where feasible. Prescribed fire would be used for habitat management and hazardous fuels reduction in both grasslands and sagebrush uplands. Prescribed fire treatments within the sage grouse core area (as defined by Wyoming Executive Order 2011-5) would be conducted in consultation with WGFD.

Wetlands

Wildland fire (both wildfire and prescribed fire) would be used in wetlands to mimic natural processes and reduce hazardous fuels.

Riparian Woodlands and Aspen Woodlands Areas

Prescribed fire and multiple objective wildfire will be used to mimic natural fire regimes and reduce hazardous fuels in willow, cottonwood, and aspen stands.

Wildlife

Important aspects of wildlife management would be maintaining long-distance ungulate migrations and a full suite of large native carnivores.

Elk and Bison

Management actions would be the same as alternative A.

Migratory Birds

Management actions would be the same as alternative A. In addition, the refuge would increase monitoring to establish baseline information on bird species using the refuge. We would use artificial methods, such as water structures, to mimic natural processes including natural flood regimes.

Aquatic Species

Management actions would be the same as alternative A. In addition, the refuge would work cooperatively with WGFD and water right holders to design and install screen devises that would help prevent moving nonnative fish species between distinct subdrainages, especially between the Gros Ventre River and Flat Creek at the South Park diversion. The refuge would work cooperatively with WGFD to remove more nonnative fishes. We would also work with WGFD to start abundance surveys and population trend analysis for key native fish species (not trout) to be used as aquatic habitat health indicators.

Disease Management

Management actions would be the same as alternative A. In addition, the refuge would develop a

disease contingency plan, in coordination with WGFD and Grand Teton National Park. The refuge would do more monitoring for wildlife disease.

Federally and State-Listed Species

Management actions would be the same as alternative A. In addition, the refuge would encourage maintenance and restoration of native plant communities and vegetative structure and composition that supports natural historical conditions.

Research and Monitoring

Management actions would be the same as alternative A. In addition, the refuge would emphasize research on the role of the refuge in the Greater Yellowstone Ecosystem. Research would be conducted to determine historical natural fire regimes, water regimes, and plant community composition and structure to evaluate and refine the refuge objectives.

Landscape-scale habitat protection research would be a high priority. This research would focus on the biological, social, and political responses to drivers of ecosystem change such as land use, invasive species, and climate change.

The refuge would evaluate the frequency and population status for groups of species for which little is known (invertebrates, small mammals, and bats).

We would increase all research and monitoring efforts to improve our confidence in the data.

Cultural Resources

Management actions would be the same as alternative B.

Visitor Services

Our visitor services would emphasize interpretative, educational, and outreach programs.

Hunting

Management actions would be the same as alternative A. In addition, the refuge would consider and create more hunting opportunities. As the need arises, we would analyze and consider developing hunting opportunities for species other than elk and bison. We would open the currently closed areas on the southern and western boundaries of the refuge to archery hunters to protect critical winter forage for availability to elk later in the winter.

The refuge would require the use of lead-free ammunition while hunting on the refuge. Staff would develop regulations for proper storage of bear attractants and bear-deterrent practices and would require hunters to carry bear spray while hunting on the refuge. Staff would develop management tools for assessing hunter use—such as hunter checkpoints, hunter success surveys, and improved mandatory reporting of tag use—to better manage hunt program opportunities.

We would add access for archery hunters at the Jackson National Fish Hatchery. The refuge would explore the idea of providing bison hunters access to the northern end of the refuge through the Teton Valley Highlands subdivision to either hunter retrieval road 6 or 7.

Fishing

Management actions would be the same as alternative B. In addition, our management would emphasize healthy and abundant native fish species with an active and aggressive program to remove nonnative fishes. The refuge would evaluate the effects of nonnative fish species on native fish species and consider alternatives for the removal of nonnative fish.

Wildlife Observation and Photography

Management actions would be the same as alternative A. In addition, the refuge would add webcams on the refuge to provide offsite wildlife-viewing opportunities.

The refuge would impose limits on commercial wildlife-viewing tours, including the number of tour companies and number of vehicles, to reduce road congestion and wildlife disturbance.

We would increase the photos posted to an electronic media source to provide more wildlife-viewing opportunities. This photo collection would also help the staff with the many requests the refuge gets from publications, Web sites, communication specialists, the media, our regional and national Service offices, and other groups for photos of various events and scenery. The pictures are accompanied by interpretive text, photo credits, and information about when the photo was taken.

The refuge and the sleigh ride contractor would no longer promote Elk Refuge Road for viewing bighorn sheep.

Environmental Education and Interpretation

Management actions would be the same as alternative B, except the self-guided interpretive tour route would have fewer turnouts and signs to reduce habitat disturbance; disturbance would be limited to areas that include nonnative vegetation.

The refuge would offer climate change literature through various publications offered for sale by the Grand Teton Association. These efforts would be enhanced by adding literature generated by the U.S. Department of the Interior and our agency.

Jackson Hole and Greater Yellowstone Visitor Center

Management actions would be the same as alternative B.

Other Uses

Management of other uses would focus on limiting resource effects.

North Highway 89 Pathway

Management actions would be the same as alternative B.

North Park

Management actions would be the same as alternative B. In addition, the refuge would not renew the memorandum of understanding with the town of Jackson when it expires in 2015. Refuge staff would restore North Park to native habitat. We would develop a self-guided interpretive walk through the area, explaining the types of plants and wildlife that use the area or similar habitat.

Lori Iverson / FWS

Mountain Bluebird

Special Use Permits

Management actions would be the same as alternative B. Also, staff would limit the number of special use permits for commercial wildlife-viewing tours to reduce traffic and other impacts on Elk Refuge Road

Access

Management actions would be the same as alternative B.

Public Outreach

Management actions would be the same as alternative B. In addition, outreach would emphasize the refuge's role in the Greater Yellowstone Ecosystem.

Visitor and Employee Safety and Resource Protection

Management actions would be the same as alternative B. In addition, we would consider land exchanges with adjacent Federal agencies.

Administration

To administer all aspects of the refuge, we rely on our Government-funded budget and the associated staff and facilities it supports. In addition, our partners often provide crucial support.

Funding and Staff

Management actions would be the same as alternative B. Also, we would hire three permanent seasonal interpretive naturalists to increase programs for the public, primarily at the visitor center. Programs would include (1) describing the needs and benefits of reintroducing large native predators to the Greater Yellowstone Ecosystem, (2) highlighting the nonwinter wildlife on the refuge, and (3) emphasizing the ecological functions and interrelationships found in the Greater Yellowstone Ecosystem. We would add 16.5 FTEs in new positions.

Facilities

Management actions would be the same as alternative B.

Elk Refuge Road

The refuge would work with Teton County to cease dust abatement on the road because treatment contains high salt levels that draw bighorn sheep.

The refuge would reduce the footprint of Elk Refuge Road and its turnouts to lessen ground disturbance and restore areas to native vegetation.

Partnerships

Management actions would be the same as alternative B. We would also prioritize partnerships that focus on special natural resource values of the Greater Yellowstone Ecosystem, such as long-distance migrations from there to the Yukon. Partners would help research landscape-scale activities and projects that might benefit wildlife traveling outside of this ecosystem, such as pronghorn or osprey.

3.8 Alternative D (Promote Natural Habitats and Balance Public Use)—Proposed Action

We would strike a balance between management activity and allowing natural processes and would identify priorities for research and monitoring between refuge and ecosystem because more public use would still require refuge-specific monitoring.

The proposed action represents balanced public use by providing some increase in developed areas while allowing other areas to remain undeveloped or to return to a natural state. Public use would emphasize outreach, interpretation, and education over recreation involving direct experiences.

Climate Change

Management actions would be the same as alternative C.

Landscape-Scale Conservation

Management actions would be the same as alternative C.

Habitat

Management would allow and use natural processes to promote natural habitats.

Native Grasslands and Sagebrush Shrublands

Management actions would be the same as alternative C.

Wetlands

Management actions would be the same as alternative B.

Riparian Woodlands and Aspen Woodlands Areas

Management actions would be the same as alternative B. In addition, the refuge would mimic the natural flow systems in Flat Creek and the Gros Ventre River. Artificial structures such as exclosures might be used to support efforts to restore native plant communities, but we would likely remove them on completion of restoration. Staff would remove the shelterbelt and associated exclosure in the headquarters management unit.

Flat Creek Enhancement

We would undertake a comprehensive restoration of a 3-mile reach of Flat Creek, immediately upstream of the confluence with Nowlin Creek, through the Flat Creek enhancement project. The project would be designed to improve aquatic habitat for native Snake River cutthroat trout (Biota 2013a, b). The purpose of the project is not to restore Flat Creek to presettlement form, but to enhance and stabilize the stream to meet the current demand by visitors, including anglers. We would restore channel form and function through (1) the removal of inappropriate instream structures and (2) the construction of stable channel morphology. In addition, we would remove infestations of reed canarygrass inside a 200-foot buffer on both sides of Flat Creek and revegetate with these areas with native species.

Specific goals of the Flat Creek enhancement project follow:

- Assess existing structures, tree revetments (streambank support), and other treatments for functionality and habitat values.
- Reduce hazards to anglers and wildlife.
- Remove, rehabilitate, or replace previously installed treatments with more suitable treatments.
- Improve channel dynamics and function.

- Specify appropriate stream habitat structures based on lessons learned from failed structures.
- Increase spawning, rearing, and juvenile habitat for native Snake River cutthroat trout.
- Construct appropriate stream morphology (based on hydrologic regime and sediment inputs) by improving stream processes and channel stability.
- Restore sediment transport continuity throughout the reach.
- Stabilize severe streambank erosion where it jeopardizes project success.
- Maintain conveyance for all expected discharge rates, including bankfull, 10-year, 50-year, and 100-year flows.
- Ensure appropriate floodplain connectivity at the bankfull discharge and stage.
- Provide for continued irrigation and diversion activities such that habitat enhancement and channel restoration activities are not jeopardized.
- Improve aesthetics and recreational opportunities.
- Map, treat, and control infestations of reed canarygrass.

Invasive Species

Management actions would be the same as alternative C.

Wildland Fire Management

Management actions would be the same as alternative C.

Wildlife

As in alternative C, the emphasis would be maintaining ungulate migrations and large native carnivores. An adaptive management approach would be used to evaluate hunting seasons on migratory elk.

Elk and Bison

Management actions would be the same as alternative A.

Migratory Birds

Management actions would be the same as alternative B.

Aquatic Species

Management actions would be the same as alternative A. In addition, the refuge would work cooperatively with WGFD and water right holders to design and install screen devises that would help prevent moving nonnative fish species between distinct subdrainages, especially between the Gros Ventre River and Flat Creek at the South Park diversion. The refuge would work cooperatively with WGFD to remove more nonnative fishes.

Disease Management

Management actions would be the same as alternative C.

Federally and State-Listed Species

Management actions would be the same as alternative B.

Research and Monitoring

Management actions would be the same as alternative B.

Cultural Resources

Management actions would be the same as alternative B.

Visitor Services

Balanced public use would mean some increase in developed areas while allowing other areas to return to a natural state.

Hunting

Management actions would be the same as alternative B.

Fishing

Management actions would be the same as alternative B. In addition, the refuge would provide accessible opportunities for fishing.

Wildlife Observation and Photography

Management actions would be the same as alternative B. In addition, the refuge would impose limits on commercial wildlife-viewing tours, including the number of tour companies and number of vehicles, to reduce road congestion and wildlife disturbance.

Environmental Education and Interpretation

Management actions would be the same as alternative B.

Jackson Hole and Greater Yellowstone Visitor Center

Management actions would be the same as alternative B.

Other Uses

Management of other uses would focus on limiting resource effects.

North Highway 89 Pathway

Management actions would be the same as alternative B.

North Park

Management actions would be the same as alternative C.

Special Use Permits

Management actions would be the same as alternative C.

Access

Management actions would be the same as alternative B.

Public Outreach

Management actions would be the same as alternative B.

Visitor and Employee Safety and Resource Protection

Management actions would be the same as alternative C.

Administration

To perform our responsibility to administer all aspects of the refuge, we rely on our Government-funded budget and the associated staff and facilities it supports. In addition, our partners often provide crucial support.

Funding and Staff

Management actions would be the same as alternative C.

Facilities

Management actions would be the same as alternative B.

Elk Refuge Road

Management actions would be the same as alternative B, except we would not consider widening the road.

The refuge would reduce the footprint of Elk Refuge Road and its turnouts to lessen the ground disturbance and restore disturbed areas to native vegetation.

Partnerships

Management actions would be the same as alternative B.

3.9 Comparison of Alternatives and Consequences

Table 4 summarizes all aspects of management of the refuge under alternatives A–D. The actions are summarized from the above sections 3.5–3.8, and the consequences are described in full in chapter 5.

Table 4. Summary of the alternatives and their environmental consequences for the comprehensive conservation plan for the National Elk Refuge, Wyoming.

Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
Climate change—actions			
Conduct baseline monitoring. Rely on partners for climate change information, and use it to understand local impacts. Use efficiencies of the new irrigation system. Make facilities such as insulation, windows, and water heaters energy-efficient. Engage the public at the visitor center and provide climate change brochures.	Same as alternative A, plus: Cooperate with the Great Northern Landscape Conservation Cooperative to conduct research and monitoring. Carry out management where effects are identified, focusing on bison, elk, and Federal trust species.	Same as alternative B, plus: Focus management on natural processes such as fire, hydrology, and ungulate grazing.	Same as alternative C.
Climate change—environmental consequences			
Data would be obtained from other agencies and scientific organizations that monitor and predict the effects of climate change on wildlife, habitat, and ecosystem functions. Not collecting long-term climate change data on the refuge might result in important changes not being detected until there were adverse effects on refuge wildlife or habitats. Energy efficiency actions would lower the refuge's carbon footprint, reduce costs and make more money available for other programs, and have no adverse effects on refuge work. Improved public understanding of climate change effects on natural resources would encourage support for adaptive resource management and mitigations.	Same as alternative A, plus: Involvement with the Great Northern Landscape Conservation Cooperative might provide fine-scale information that directly applies to the refuge, providing for better planning and management. More biological staff would be needed for the refuge to be involved in climate change data collection or analysis.	Same as alternative B, plus: A functioning natural ecosystem would result in resiliency, giving wildlife and plant communities the ability to respond to a disturbance or changing conditions. Limited money and staff time expended to achieve resiliency without the certainty of success. Meeting goals of the Bison and Elk Management Plan and some visitor services might be negatively affected if more money and staff were not added.	Same as alternative C.

Table 4. Summary of the alternatives and their environmental consequences for the comprehensive conservation plan for the National Elk Refuge, Wyoming.

Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
Landscape-scale conservation—actions			
Collaborate on land protection efforts with partners, and support appropriate off-refuge land protection projects. Participate in the Greater Yellowstone Coordinating Committee to coordinate management of Federal lands in the ecosystem. Coordinate with Teton County to review private land proposals that might adversely affect refuge resources.	Same as alternative A, plus: Consider partnerships to build wildlife crossings over Highway 89.	Same as alternative B, plus: Support land protection including protection of wildlife migration corridors. Expand the refuge acquisition boundary to the Twin Creek and Spring Gulch areas to maintain intact ecosystems.	Same as alternative C.
Landscape-scale conservation—environmental consequences			
Collaboration agencies and organizations would provide more resources for habitat protection that benefit refuge habitats and wildlife. Involvement with the Greater Yellowstone Coordinating Committee would provide information and assistance and resolve management controversies, helping leverage wildlife and habitat improvement on and around the refuge and promote public support of land management agencies. Partnerships would increase control of invasive plants across the landscape to keep the natural vegetation diversity, which benefits many wildlife species that rely on native plants for food and cover.	Same as alternative A, plus wildlife crossings could reduce collisions between vehicles and animals.	Same as alternative B, plus preserving wildlife migration corridors would increase genetic exchange between wildlife populations to improve the long-term survival of various wildlife in the ecosystem. Intact corridors could become avenues for the spread of invasive plants and might require increased control efforts. Strategic fee-title acquisition next to the refuge would provide opportunities to restore native plant communities and natural hydrology, increase forage, and reduce conflicts between wildlife and private landowners. This would support wildlife populations that disperse throughout the ecosystem during nonwinter months. However, the cost would be high and impractical based on current budgets.	Same as alternative C.

Table 4. Summary of the alternatives and their environmental consequences for the comprehensive conservation plan for the National Elk Refuge, Wyoming.

Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
		Restrictive easements obtained by private non-profit land trusts could complement management on the refuge. Emphasis on landscape-level projects would help ecosystem resiliency, but would divert money and staff time away from refuge-specific work.	
Habitat and Wildlife Goal—Adaptively manage bison, elk, and other wildlife populations and habitats as outlined in the Bison and Elk Management Plan. Contribute to the conservation of healthy native wildlife populations and their habitats. Restore and sustain a native fishery that provides quality fishing opportunities.			
Native grasslands and sagebrush shrublands—actions			
Control noxious weeds. Protect sagebrush shrublands and grasslands from degradation and allow areas to recover. Define desired characteristics of grasslands and sagebrush shrublands. Suppress all wildfires, do not manage for multiple objectives. Do not use prescribed fire as a management tool.	Same as alternative A, except: Carry out habitat projects with WGFD and the local greater sage-grouse working group. Introduce prescribed fire to enhance the quantity and quality of forage for elk and bison, reinvigorate native species, and to reduce hazardous fuels.	Same as alternative B, except: Emphasize vegetation age and structure representative of historical conditions. Use wildland fire to achieve desired conditions. Emphasize protecting mature, dense sagebrush stands from wildfires when feasible. Conduct habitat treatments in greater sage-grouse core areas in accordance with Wyoming Executive Order 2011–5.	Same as alternative C.
Native grasslands and sagebrush shrublands—environmental consequences			
There would be little transport of noxious weed seeds because of minimal vehicle traffic. Declines in open grassland and grassland patches in sagebrush stands would reduce habitat for birds that use these areas. Increases in older sagebrush stands would benefit birds that use these areas but have less use by elk and bison.	Same as alternative A, except: Native species composition would be maintained. More management would increase the risk of invasive plant infestation. Older sagebrush stands would be reduced compared to alternative A, so there would be less habitat for birds that depend on these areas, including less wintering habitat for greater sage-grouse.	Same as alternative A, plus: Effects from fire would be the same as alternative B except: ■ Wildfires managed for benefits would more mimic natural fire occurrence and its effects on native species.	Same as alternative A, plus: Effects from fire would be the same as alternative C.

Table 4. Summary of the alternatives and their environmental consequences for the comprehensive conservation plan for the National Elk Refuge, Wyoming.

Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
There would be increased wintering and nesting habitat for greater sage-grouse, but a decline in lek sites and brood-rearing habitat. There would be fewer changes to vegetative composition and structure for both resource management and hazard fuel reduction because wildland fire would not used to manipulate them.	Young sagebrush and grass-dominated sites would increase and benefit birds that use these areas along with elk and bison. There would be decreased wintering and nesting habitat for greater sage-grouse, but an increase in lek sites and brood-rearing habitat. Costs and staff time would be higher than alternative A. Decadent stands of vegetation would be invigorated through the release of nutrients back into soil. Hazardous fuels would be reduced, leading to possible less costly and damaging wildfires. Prescribed fire may cause a temporary reduction in air quality but duration would be short.	■ Wildland fire may cause a temporary reduction in air quality, duration is expected to be of short. ■ Wildland fire to functioning more in its natural role could lead to reduced fire suppression and treatment costs.	
Wetlands—actions			
Maintain artificial ponds and natural wetlands for trumpeter swans and other wildlife. Continue the low level of monitoring and treatment of invasive species. Conduct limited prescribed burns. Suppress all wildfires, do not manage for multiple objectives. Do not use prescribed fire as a management tool.	Same as alternative A, plus: Improve water control capability in artificial ponds to enhance swan habitat. Construct managed ponds suitable to support nesting swans. Increase monitoring and control for invasive species in natural wetlands. Introduce prescribed fire to enhance the quantity and quality of forage for elk and bison, reinvigorate native species, and to reduce hazardous fuels.	Manipulate water levels in artificial ponds to mimic natural water processes. Assess the effects of the Gros Ventre River diversion on natural wetlands. Restore woody plant communities in natural wetlands. Restore beaver to natural wetlands. Increase monitoring and control for invasive species in natural wetlands. Use wildland fire to achieve desired conditions.	Same as alternative B, plus: Fire would be used the same as under alternative C.

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Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
Wetlands—environmental consequences			
Manipulated water levels in artificial ponds would promote trumpeter swan habitat. Wetlands with more invasive species would be less valuable to native wildlife. Lack of prescribed fire would result in no change in use of these areas by elk and bison. There would be fewer changes to vegetative composition and structure for both resource management and hazard fuel reduction because wildland fire would not used to manipulate them.	Improved water control structures and more ponds would increase habitat quality and quantity for trumpeter swans (more than the other alternatives). Costs and staff time would be much higher than alternative A and moderately higher than alternative C. The rate of spread of noxious weeds would be slower and the control of new invasive species would be much higher than alternative A (with lower long-term costs than alternative A). Prescribed burning would improve forage quality for elk and bison in wet meadows. Stands of vegetation would be invigorated through the release of nutrients back into soil. Costs and staff time would be substantially higher than alternative A and moderately higher than alternative C. Hazardous fuels would be reduced, leading to possible less costly and damaging wildfires. Prescribed fire would cause a temporary reduction in air quality but duration would be short.	Resulting water regimes would create swan habitat similar to alternative A, with less habitat than alternative B. The rate of spread of noxious weeds would be slower and the control of new invasive species would be much higher than alternative A (with lower long-term costs than alternative A). Wildland fire may improve forage quality for elk and bison in wet meadows more than alternative A but less than alternative B. Costs and staff time would be higher than alternative A and less than alternative B. Wildfires managed for benefits would more mimic natural fire occurrence and its effects on native species. Wildland fire may cause a temporary reduction in air quality, duration is expected to be of short. Wildland fire to functioning more in its natural role could lead to reduced fire suppression and treatment costs. Beaver ponds (refer to riparian woodlands and aspen woodlands) would increase open water in wet meadows and more long-term diversity.	Same as alternative B plus: Fire effects would be the same as under alternative C.
Riparian woodlands and aspen woodlands—actions			
Allow natural revegetation as ungulate populations allow. Evaluate restoration techniques along Flat Creek.	Same as alternative A, plus: Use water through irrigation efficiencies to improve riparian habitat.	Same as alternative A, plus: Use temporary exclosures to support restoration work.	Same as alternatives B and C.

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Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
Cooperate with the National Park Service on Gros Ventre River hydrological assessment. Evaluate the jackstraw technique to promote willow regeneration. Suppress all wildfires, do not manage for multiple objectives. Do not use prescribed fire as a management tool.	Consider expanded willow regeneration techniques. Carry out recommendations from the Gros Ventre River hydrologic assessment. Fire actions same as under alternative A.	Eliminate the jackstraw willow regeneration project. Remove the shelterbelt and exclosure in the headquarters management unit. Explain to the public why this exclosure is not needed but in other areas they are needed. Mimic natural flow systems in Flat Creek and the Gros Ventre River.	
Riparian woodlands and aspen woodlands—environmental consequences			
With high levels of elk and bison browsing, the loss of woody plant community structure and change in some areas to grass-dominated communities would continue. Elk and bison densities would be slightly less than currently. Some cottonwood regeneration could occur in the Gros Ventre River riparian area. Costs and staff time would be slightly less than alternative B and substantially less than alternative C. Water diversion by private users would continue. Water levels and flow rates in Flat Creek and the Gros Ventre River would be similar to current conditions. Stream morphology would be similar to current conditions.	Same as alternative A, plus: Small-scale exclosures and jackstraw techniques to restore willow and cottonwood would restore only slightly more area than alternative A and much less area than alternative C. Costs and staff time would be slightly higher than alternative A and substantially less than alternative C. Fire effects same as under alternative A. If prescribed fire were allowed: Use would reduce hazardous fuels leading to reduced potential of costly and damaging wildfires. Use may assist in the restoration of riparian areas. Prescribed burning causes willows, aspen, and to a lesser extent cottonwood to re-sprout. Without exclosures, areas that have been prescribed burn are subject to heavy browsing by elk and bison.	Economic costs to private water users would be substantially higher than alternatives A and B. Allowing wildland fire to function more in its natural role could lead to reduced fire suppression and treatment costs The use of wildland fire would assist in the restoration of riparian areas. Fire causes willows, aspen, and to a lesser extent cottonwood to re-sprout. Without exclosures, areas that have been burned are subject to heavy browsing by elk and bison. Wildland fire may cause a temporary reduction in air quality. This reduction of air quality would generally be of longer duration and extent than grasslands, sagebrush, and wetland habitat types. Even though fuels within riparian habitat tend to be larger and burn for longer periods of time, smoke impacts are not anticipated to cause negative impact to the public.	Same as alternatives B and C. Fire effects would be the same as under alternative C.

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Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
There would be fewer changes to vegetative composition and structure for both resource management and hazard fuel reduction because wildland fire would not used to manipulate them. Not using prescribed fire would lead to no change in use by elk and bison.	Prescribed fire would cause a temporary reduction in air quality. This would generally be of longer duration and extent than grasslands, sagebrush, and wetland habitat types Even though fuels within riparian habitat tend to be larger and burn for longer periods of time, smoke impacts are not anticipated to cause negative impact to the public.		
Flat Creek enhancement—actions			
Monitor 1 mile of construction work on Flat Creek and removal of reed canarygrass that was completed in 2013.	Same as alternative A.	Same as alternative A.	Same as alternative A, plus: Carry out the Flat Creek enhancement project to restore channel form and function over 3 stream miles through removal of inappropriate instream structures and construction of stable channel morphology. Remove reed canarygrass infestations along the creek and revegetate with native species.
Flat Creek enhancement—environmental consequences			
Based on monitoring results, we would use adaptive management strategies as needed to increase ecological benefits and better achieve objectives.	Same as alternative A.	Same as alternative A.	Same as alternative A, plus: The Flat Creek enhancement project would reduce sediment inputs to the watershed, improve stream processes, and increase habitat for all age classes of Snake River cutthroat trout. Stable streambanks would be vegetated with native species.
Invasive species—actions			
Use integrated pest management (biological control, mechanical control, grazing, and herbicides).	Same as alternative A, plus: Increase monitoring and rapid response for new infestations.	Same as alternative B, plus: Monitor and remove invasive plants that are not listed as noxious weeds.	Same as alternative C.

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Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
Prevent transportation of invasive plant seeds onto the refuge through public education, weed-free-hay rules, and equipment cleaning. Continue limited monitoring.	Develop large-scale invasive plant eradication programs.		
Invasive species—environmental consequences			
Native plant communities would be protected and new infestations of invasive species prevented. Control work would contain an infestation, but it could not address large infestations. There would be a moderate increase in distribution and density of weed species in wetlands but less risk of new infestations because of limited vehicle traffic. Unlikely to make early detection of aquatic invasive species like zebra mussel because of limited monitoring.	Same as alternative A, plus: Locating and treating new infestations would be the best and most cost-effective way to fight the spread of invasive plants. Large-scale eradication would be more effective over the long term, but it would be more expensive and put more herbicide into the environment in the short term. Costs would increase in the short term over alternative A but be lower in the long term.	Same as alternative B, plus: Dealing with additional invasive species would be expensive and take many years of effort to carry out. Costs would be higher.	Same as alternative C.
Elk and bison—actions and environmental consequences			
We will carry out the refuge-specific management actions from the Bison and Elk Management Plan, where the effects of the actions were analyzed and described. We also developed complementary, specific actions, described in the habitats below.			
Migratory birds—actions			
Maintain areas closed to public access during the bird breeding season.	Same as alternative A, plus: Increase monitoring to establish baseline information on bird species using the refuge.	Same as alternative A, plus: Increase monitoring to establish baseline information on bird species using the refuge. Use water control structures to mimic natural processes such as typical periods of high and low water.	Same as alternative B.

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Migratory birds—environmental consequences			
Overall diversity of migratory birds would be relatively low. Birds that depend on old, dense, sagebrush stands would have more habitat. Birds that depend on open grasslands and young sagebrush would have less habitat. There would be no change in habitat for wetland-dependent birds. Birds that depend on willow, cottonwood, and aspen stands would have less habitat.	Same as alternative A, plus: Diversity of migratory birds would be slightly higher than alternative A. Birds that depend on open grasslands and young sagebrush would benefit from more use of fire to create habitat. There would be less nesting cover for migratory birds in wet meadows. Costs and staff time for monitoring would be much higher than alternative A.	Same as alternative A, plus: Improved habitat quality would result in the highest diversity of migratory birds. Birds using wet meadows would have nesting cover intermediate between alternatives A and B. Increased diversity of wetland communities on southern end of the refuge would increase habitat for shrub-nesting birds compared to alternatives A and B. Birds dependent on riparian woodlands and aspen woodlands and woodlands would have 500 –1,000 acres more of willow, 100 acres more of cottonwood, and 1,000 acres more of aspen. Costs and staff time for monitoring would be higher than alternative A and similar to alternative B.	Same as alternative B.
Aquatic species—actions			
Work with WGFD for fisheries services including abundance, spawning, and harvest surveys. Focus surveys on Snake River cutthroat trout. Target nonnative brook trout in Flat Creek for removal.	Same as alternative A.	Same as alternative A, plus: Work with WGFD and water right holders to install fish screens to keep nonnative fishes from moving between the Gros Ventre River and Flat Creek at the South Park diversion. Work with WGFD to remove more nonnative fishes. Work with WGFD to do abundance surveys and population trend analysis for key native fish species.	Same as alternative A, plus: Work with WGFD and water right holders to install fish screens to keep nonnative fishes from moving between the Gros Ventre River and Flat Creek at the South Park diversion. Work with WGFD to remove more nonnative fishes.

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Aquatic species—environmental consequences			
Basic knowledge of native trout populations would allow for effective fishery and harvest management. Working with WGFD would reduce refuge costs and ensure alignment with WGFD objectives and regulations. Native trout would have less competition from nonnative species for food and habitat resources if removal efforts could substantially reduce nonnative trout populations. Counting the nonnative trout removed would provide data for long-term population trends. Some anglers view nonnative trout removals as less fishing opportunity and a waste of money. Amphibian habitat quantity, quality, and distribution would be the same.	Same as alternative A, plus: New artificial ponds would result in a net increase in amphibian habitat compared to alternative A.	Same as alternative A, plus: Screens would decrease the introduction of nonnative trout into Flat Creek. Screens would have a high initial cost and would likely increase maintenance costs for the refuge, WGFD, and water rights holders. Increased removal of nonnative trout would benefit native fish and invertebrates. More removal would increase WGFD costs and further reduce fishing opportunities. Information about unharvested species could lead to enhanced aquatic habitat. A new program would increase WGFD staff costs, do little to improve the native trout fishery, and might be viewed as being too expensive. More beaver ponds would increase amphibian habitat more than alternative A and comparable to alternative B.	Same as alternative A, plus: Screens would decrease the introduction of nonnative trout into Flat Creek. Screens would have a high initial cost would likely increase maintenance costs for the refuge, WGFD, and water rights holders. Increased removal of nonnative trout would benefit native fish and invertebrates. More removal would increase WGFD costs and further reduce fishing opportunities.
Disease management—actions			
Carry out disease management actions in the Bison and Elk Management Plan. Monitor amphibian populations for chytrid disease. Coordinate with WGFD to detect sick bighorn sheep. Concentrate elk and bison on the refuge during February and March to reduce transmission of brucellosis.	Same as alternative A, plus: Develop a comprehensive disease contingency plan.	Same as alternative A, plus: Develop a disease contingency plan with WGFD and Grand Teton National Park. Do more monitoring for disease.	Same as alternative C.

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Complete a contingency plan for chronic wasting disease and cooperate with WGFD on monitoring for the disease.			
Disease management—environmental consequences			
There would be less risk of brucellosis transmission from elk and bison to cattle because the feeding process reduces the likelihood of mixing the wild and domestic herds. High herd densities of elk and bison on the southern end of the refuge would increase their disease risk. Monitoring of diseases would be insufficient to detect early outbreaks, including in bird populations. Monitoring would allow early detection of disease in amphibian and bighorn sheep populations.	Same as alternative A, plus: The risk of density-dependent disease in elk and bison herds would be the lowest of the alternatives. The contingency plan would result in more monitoring and the refuge having a better ability to respond to disease outbreaks. Cost and staff time would be higher than alterative A.	Same as alternative A, plus: No intervention for native disease outbreaks might result in negative effects on populations and negative public relations for letting animals die. In spite of more monitoring, the lack of response to all disease outbreaks would not reduce the effects of disease on wildlife populations. Cost and staff time would be higher than alternative A and less than alternative B.	Same as alternative C.
Federally and State-listed species—actions			
Monitor greater sage-grouse, trumpeter swan, and long-billed curlew populations. Maintain areas closed to public access to prevent disturbance of species of concern. Coordinate with WGFD and the local greater sage-grouse working group on greater sage-grouse core area strategy for refuge activities. Based on monitoring, possibly limit management activities in trumpeter swan and long-billed curlew breeding areas.	Same as alternative A, plus: With WGFD, increase monitoring of other State species of greatest conservation need. Support recovery plan goals for federally listed species where not in conflict with the Bison and Elk Management Plan. Enhance swan habitat to meet population objectives of the Trumpeter Swan Management Plan and increase nesting in areas visible to the public.	Same as alternative A, plus: Maintain and restore native plant communities with vegetative structure and composition that supports natural historical conditions.	Same as alternative C.

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Limit refuge activities as to prevent unnecessary disturbance of threatened and endangered species.			
Federally and State-listed species—environmental consequences			
Detection of population changes for only greater sage-grouse, trumpeter swan, and long-billed curlew would be likely. Greater sage-grouse wintering and nesting habitat would increase over time but lek and brood rearing habitat would decline. This alternative would have the greatest potential to support greater sage-grouse. Trumpeter swan productivity would be similar to current.	Same as alternative A, plus: Detection of status changes in more Wyoming species of conservation need would be likely. Monitoring costs and staff time would be substantially higher than alternative A. Decreased mature sagebrush stands would reduce greater sage-grouse winter habitat. This alternative would have the lowest potential to benefit greater sage-grouse. Wetland improvements and egg rescue would result in the highest productivity of trumpeter swan and likelihood of meeting nesting objectives.	Same as alternative A, plus: Detection of status changes in more Wyoming species of conservation need would be likely. Monitoring costs and staff time would be substantially higher than alternative A. Less burning would protect dense, mature sagebrush stands and result in greater sage-grouse wintering habitat comparable to alternative A. Trumpeter swan productivity would be slightly lower than alternative A and substantially lower than alternative B.	Same as alternative C.
Research and monitoring—actions			
Monitor whether we are meeting the objectives of the Bison and Elk Management Plan. Rely on other agency and nonprofit partners to conduct some monitoring. Gather population data for Federal threatened and endangered species and State species of concern. Develop modeling and decision-support tools. Determine the effects of public use and other refuge programs on habitat and wildlife.	Same as alternative A, plus: Increase monitoring of public use and other refuge programs on habitat and wildlife. Increase all research and monitoring efforts to improve confidence in data.	Same as alternative A, plus: Emphasize the role of the refuge in the Greater Yellowstone Ecosystem and determine natural processes. Focus research on landscape-scale habitat protection. Increase all research and monitoring efforts to improve confidence in data. Evaluate population status for species about which little is known, such as invertebrates and small mammals.	Same as alternative B.

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Research and monitoring—environmental consequences			
Get data about only the highest biological priorities. Marginal confidence levels in data would provide limited information. Researchers and marked animals would be a short-duration detraction from quality wildlife observation.	Same as alternative A, plus: More information would be available about the effects of public use on wildlife and habitats. Increased confidence in data might result in better management decisions. Cost and staff time would be higher than alternative A. With more activity, researchers and marked animals would have a greater effect than alternative A on visitors during wildlife observation.	Same as alternative B, plus: More data would be available about the refuge within the ecosystem. Cost and staff time would be higher than alternative A and comparable to alternative B.	Same as alternative B.
Cultural Resources Goal—Preserve and interpret cultural resources in a way that allows visitors to connect to the area's rich history and conservation heritage.			
Cultural resources—actions			
Protect cultural resources. Identify cultural resources through archaeological surveys before ground disturbance. Prohibit public access to known archaeological sites. Open the historic Miller Ranch seasonally to the public for interpretation and rely solely on volunteers to staff and run it.	Same as alternative A, plus: Develop a walking interpretive trail around Miller Ranch. Work with partners to stabilize structural problems on the Miller Barn and use it for interpretation. Restore other Miller Ranch buildings as needed. Seek money for interpreters at Miller House.	Same as alternative B.	Same as alternative B.
Cultural resources—environmental consequences			
Cultural resources would be protected from vandalism and theft. Preconstruction resource inventories and assessments would protect any archaeological resources and reduce the probability of a costly work stoppage.	Same as alternative A, plus: Visitors could learn about the historic value of the Miller Ranch when walking the interpretive trail. Construction of the trail and installation of signs would disturb some soil and vegetation.	Same as alternative B.	Same as alternative B.

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Limiting access to known archaeological sites would reduce site disturbance and loss of artifacts. The public could visit and learn about the historic Miller Ranch in summer. Reduced hours due to lack of staff would reduce visitor opportunities as well as revenue from items sold by the Grand Teton Association. The Miller Barn would continue to deteriorate without money for restoration.	Use of the trail might put visitors nearer closed areas and result in trespass that disturbs waterfowl. The historic Miller Barn would be restored in cooperation with partners and retain its historical value as well as providing another interpretive facility. Visitors to Miller Ranch would receive enhanced programs provided by permanent or seasonal interpreters.		
Visitor Services Goal—Enable a diverse audience to understand and appreciate the refuge's wildlife conservation role in Jackson Hole, while safely enjoying year-round opportunities for wildlife-dependent recreation.			
Hunting—actions			
Provide elk and bison hunting consistent with the Bison and Elk Management Plan. Adaptively revise elk and bison hunting regulations to achieve herd size objectives. Accommodate hunters with disabilities and offer a special elk hunt for young people. Promote voluntary use of lead-free ammunition. Allow game retrieval from the national forest through the refuge. Allow a ceremonial tribal hunt of bison (up to five bison per year). Prohibit hunting of any wildlife other than elk and bison.	Same as alternative A, plus: Expand hunting opportunities for young people, and develop a hunter mentoring program. Consider adding a committed refuge hunting opportunity and a bull elk hunt. Pursue access for bison hunters to the northern end of the refuge through the Teton Valley Highlands subdivision. Develop regulations for storage of bear attractants and bear-deterrent practices and encourage carry of bear spray. Conduct hunter checkpoints, surveys, and mandatory reporting of tag use to better manage hunting.	Same as alternative A, plus: Open the closed area on the southern and western end of the refuge to archery hunting. Add archery hunter access at the Jackson National Fish Hatchery. Create bison hunter access to the northern end of the refuge through the Teton Valley Highlands subdivision. Require the use of lead-free ammunition. Develop regulations for storage of bear attractants and bear-deterrent practices and require carry of bear spray. Conduct hunter checkpoints, surveys, and mandatory reporting of tag use to better manage hunting.	Same as alternative B.

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Allow guided hunting under special use permit to increase harvest success to support herd size objectives.	Consider hunting of species other than elk and bison to address management needs.	Consider hunting of species other than elk and bison to address management needs.	
Hunting—environmental consequences			
There would be insufficient harvest to meet objectives of the Bison and Elk Management Plan. Easier retrieval would encourage more hunting. Scavenging birds would be at risk of lead poisoning, because more than 60% of hunters would not use lead-free ammunition. Hunters with disabilities and young hunters would take advantage of special programs. American Indians would continue their ceremonial hunt.	Same as alternative A, plus: More opportunities could increase the number of nonlocal hunters. Opening closed areas would keep elk from building up in areas where they would be less susceptible to harvest. More access for bison hunters could increase harvest and help meet herd objectives. Subdivision residents might not support increased traffic. More elk and bison use in improved habitat would increase hunter opportunity and the likelihood of meeting elk and bison population objectives. More young people would be attracted to better hunting during mid-season of the regular hunt. Adult hunters might have less opportunity at this time. Nonhunters might be alienated because of more visible harvest in opened areas near Jackson, a bull elk harvest, and a predator harvest. Elk-viewing opportunities might decrease along Highway 89. Requiring bear spray could provide a safer environment for hunters, communities, and bears but would increase cost to hunters.	Same as alternative A, plus: More opportunities could increase the number of nonlocal hunters. Opening closed areas would keep elk from building up in areas where they would be less susceptible to harvest. More access for bison hunters could increase harvest and help meet herd objectives. Subdivision residents might not support increased traffic. Elk and bison use, intermediate between alternatives A and B, in improved habitat would increase hunter opportunity and the likelihood of meeting elk and bison population objectives. Nonhunters might be alienated because of more visible harvest in opened areas near Jackson, a bull elk harvest, and a predator harvest. Elk-viewing opportunities might decrease along Highway 89. Requiring bear spray could provide a safer environment for hunters, communities, and bears but would increase cost to hunters. Requiring lead-free ammunition would protect scavenging birds from lead poisoning but would increase cost to hunters.	Same as alternative B.

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	There would be better data for managing hunts and increasing harvest. Outreach about hunting would educate the public on the need and purpose for this recreational activity. There would be higher equipment costs and more labor needed.	There would be better data for managing hunts and increasing harvest. Outreach about hunting would educate the public on the need and purpose for this recreational activity. There would be higher equipment costs and more labor needed.	
Fishing—actions			
Provide fishing during daylight hours. Maintain fishing access along Highway 89 and parking turnouts on upper Flat Creek. According to seasons and regulations set by WGFD, open these areas to fishing: Gros Ventre River, upper Flat Creek, and Sleeping Indian Pond. Close these areas to fishing: all other refuge ponds, Flat Creek downstream from the old Crawford Bridge site, and Nowlin Creek upstream from the posted fishing boundary. Issue special use permits for guided fishing on Flat Creek only.	Same as alternative A, plus: Sponsor Kids' Fishing Day with Jackson National Fish Hatchery and WGFD. Develop a fishing program for young people including a mentoring program. Open gates to lower Flat Creek at daylight on opening day to maintain the daylight-only fishing restriction. Construct accessible fishing platform on Flat Creek. Allow guided fishing under special use permit on lower Flat Creek only. Increase habitat and waterflow management for increased fishing opportunity for native fishes. Enhance fisheries with fish screens to help native species in Gros Ventre River.	Same as alternative B, plus: Provide more support for native fish species. Do aggressive removal of nonnative fishes.	Same as alternative B, plus: Provide accessible opportunities for fishing.
Fishing—environmental consequences			
Stream morphology, fisheries habitat, access, and angler opportunity would be similar to current conditions.	Same as alternative A, plus: More young people would be exposed to fishing, and these programs would take more staff time.	Same as alternative B, plus: .	Same as alternative B, plus:

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Areas closed to fishing would protect waterfowl breeding areas, specifically trumpeter swan nest sites.	Opening the Flat Creek access gates at daylight on August 1 would be consistent with refuge regulations. More people would be able to reach Flat Creek to fish off an accessible platform. Charging a fee and restricting the number of permits for guided fishing would strengthen the enforceability of permits and reduce crowding. Fees might impact the outfitters. Fish screens on the Gros Ventre River might prevent migration of rainbow trout into the Flat Creek cutthroat population. Fisheries habitat improvement and angler opportunity in Flat Creek would be greater than alternative A and similar to alternative A in the Gros Ventre River.	Because of riparian area improvement, the fisheries habitat quantity and quality and angler opportunity would be the highest among the alternatives in the Gros Ventre River. In Flat Creek, these effects would be similar to alternative A	Because of riparian area improvement, the fisheries habitat quality and quantity and angler opportunity would be higher in Flat Creek than alternatives A and C. In the Gros Ventre River, these effects would be similar to alternative A and lower than alternative C.
Wildlife observation and photography—actions			
Maintain access to turnouts, trails, and other observation sites including these primary sites: ■ visitor center viewing platform ■ Burt Raynes Boardwalk and remote-viewing platform ■ turnout north of the visitor center ■ elk jump turnout on Highway 89 ■ North Highway 89 Pathway Open Elk Refuge Road and Flat Creek Road May 1–November 30.	Same as alternative A, plus: Develop trail pulloffs along the North Highway 89 Pathway. Develop a prominent accessible access route from the visitor center to the existing remote-viewing platform. Develop an accessible boardwalk with a photo blind through disturbed wetlands near the visitor center. Use webcams for wildlife-viewing opportunities such as watching swans nesting. Develop a wildlife checklist.	Same as alternative A, plus: Set limits for commercial wildlife-viewing companies. Use webcams for wildlife-viewing opportunities including watching swans nesting. Expand the photo gallery on the refuge Web site.	Same as alternative B, plus: Set limits for commercial wildlife-viewing companies.

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Open 3.5 miles of Elk Refuge Road for winter wildlife observation December 1–April 30. Allow wildlife-touring companies to operate through special use permit. Continue contracted sleigh rides. Use Web-based photo-sharing sites for refuge photos.			
Wildlife observation and photography—environmental consequences			
Local and nonlocal visitors would use existing facilities to observe wildlife and take photos. Effects on wildlife would be minimal because visitor use would be limited to areas that are already disturbed. User conflicts on the narrow North Highway 89 Pathway could continue. Use of the remote-viewing platform would be low, because visitors would continue to be hesitate about crossing the visitor center lawn to access the platform. People unable to visit the refuge could still enjoy views of the scenery and wildlife through a refuge photo gallery. Visitors would have opportunities for wildlife-viewing on commercial tours. Permit stipulations would ensure safe operations and reduce effects to wildlife.	Same as alternative A, plus: With new trail pulloffs along the North Highway 89 Pathway, there would be fewer conflicts among users. More visitors would use the viewing platform at the visitor center via the new path across the lawn. Construction could temporarily affect wetlands and soil. Use of the path might disturb nesting geese on the lawn: The new boardwalk would enhance the visitor experience with a longer walk for observation, and photographers could use a photo blind. Construction and maintenance would disturb wildlife for short periods. Cost would be substantial. Webcams would let people enjoy the refuge without having to be onsite. There would be minor soil effects for installation and maintenance. Technical support for webcam malfunctions may not be available.	Same as alternative A, plus: Limiting tour companies would reduce traffic congestion and wildlife disturbance. Enforcing limited tour companies would increase costs. Demand for tours would not be met. There could be reduced income for some tour companies. Web cams would let people enjoy the refuge without having to be onsite. There would be minor soil effects for installation and maintenance.	Same as alternative B, plus: Limiting tour companies would reduce traffic congestion and wildlife disturbance. Enforcing limited tour companies would increase costs. Demand for tours would not be met. There could be reduced income for some tour companies.

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Alternative A (current management)—no action	*Alternative B (enhance public use and intensive resource management)*	*Alternative C (emphasize intact ecosystems and promote natural processes)*	*Alternative D (promote natural habitats and balance public use)—proposed action*
Contracted sleigh rides would provide unique viewing opportunities while reducing stress to wintering wildlife, particularly elk: ■ Some of the money would return to the refuge and be used to hire winter naturalists who would provide school and other programs. ■ Increased visitation would contribute to the local sales tax revenue. ■ The public and media would get refuge photos from a Web site, reducing staff time on requests.			
Environmental education and interpretation—actions			
Provide education programs with nongovernment-funded winter-season naturalists to meet demand during the school year. Offer spring and summer programs with local or residential volunteers when possible. Continue contracted sleigh rides. Assess and replace as needed aging and outdated refuge signs.	Continue contracted sleigh rides. Use the North Highway 89 Pathway to interpret wetland values and other messages. Develop a self-guided, interpretive tour route on Elk Refuge Road. Assess visitor preferences and update the current refuge video or produce shorter videos. Stabilize and restore Miller Barn for use as an interpretive site. Offer improved programs at the visitor center, Miller House, and offsite areas with more permanent or seasonal interpreters.	Same as alternative B, except: Reduce turnouts and signs along the interpretive tour route. Limit disturbance to areas with nonnative vegetation.	Same as alternative B.

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	Promote understanding of invasive species control and prescribed fire as a management tool. Increase public education about refuge's migratory bird use and why areas are closed during breeding.		
Environmental education and interpretation—environmental consequences			
Nonmotorized use of North Highway 89 Pathway would increase opportunities for environmental education and interpretation. Seasonal naturalists, as many as unpredictable amounts of private money would fund, would provide programs in schools. Volunteers, as available, would provide service to visitors at the visitor center and present education and interpretation programs. Using volunteers is not a stable workforce because of the small local population to draw from, lack of housing for nonlocal volunteers, and need for continual training of new people that work limited hours. Contracted sleigh rides would provide unique learning opportunities and reduce stress to wintering wildlife, particularly elk.	Visitors could learn about the refuge resources through interpretation at pulloffs along the North Highway 89 Pathway and along the Elk Refuge Road interpretive tour route. Visitor center videos would engage visitors and explain the different roles of national wildlife refuges, national parks, and national forests and describe the Greater Yellowstone Ecosystem. People would learn more about the refuge through contacts with an increased permanent staff. Costs would be higher for more staff and interpretive materials.	Same as alternative B, except: Disturbance would be limited to areas that include nonnative vegetation.	Same as alternative B.
Visitor center—actions			
Pay most operational and maintenance costs for the multi-agency visitor center and staff with one full-time visitor center manager. Partner agencies provide minimal staff at the information desk.	Use partner contributions to help with visitor center operations. Document and evaluate the building condition and maintenance issues.	Same as alternative B.	Same as alternative B.

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	Rehabilitate, expand, remodel, or replace the existing building or build a new visitor center.		
Visitor center—environmental consequences			
The visitor center would remain open but might have reduced hours because of lack of money and staff. Reduced hours would limit public services and lower revenue at Grand Teton Association's sales outlet. Visitors would not have opportunities to learn about the refuge because the visitor center manager would not have time to develop adequate programs.	A fully operational visitor center would be adequately staffed and maintained. A new visitor center would enhance the flow of visitors in the center, provide information and interpretation, and address safety issues and accessibility deficiencies.	Same as alternative B.	Same as alternative B.
North Highway 89 Pathway—actions			
Allow nonmotorized and pedestrian use. Prohibit pets and horses. Continue to close the pathway seasonally from November 1 through April 30.	Same as alternative A, plus: Use during the open season for resource interpretation. Work with county to evaluate pathway effects on habitat and wildlife, adjust seasonal use as needed. Apply criteria and determine yearly whether to open the pathway as early as April 15 when spring arrives unusually early.	Same as alternative B.	Same as alternative B.
North Highway 89 Pathway—environmental consequences			
Public would have opportunities for wildlife observation and photography. Prohibiting pets and horses would limit disturbance to wildlife, particularly nesting waterfowl and other birds adjacent to pathway. The seasonal closure would protect elk migration corridors and prevent disturbance to wintering elk and other wildlife.	Same as alternative A, plus: People on the pathway would have access to an interpretive experience. There would be added staff time and costs for signage and facilities. Data on wildlife movement across the pathway would help the refuge adjust use as needed to protect wildlife and keep people safe.	Same as alternative B.	Same as alternative B.

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Regulations would be enforced by Teton County with a substantial public outreach effort by staff.			
North Park—actions			
Continue the partnership with Jackson to manage North Park under the current memorandum of understanding, including reservations and fee collection.	Continue the partnership with Jackson to manage North Park and revise the memorandum of understanding to do away with the reservation and fee collection system for the picnic shelter.	Same as alternative B, plus: Let the memorandum expire in 2015 and do not renew it. Restore native habitat and provide an interpretive nature walk.	Same as alternative B.
North Park—environmental consequences			
The reservation and fee collection system for the picnic shelter would not comply with agency policy. Weddings would be common and could reduce parking for refuge visitors.	There would no longer be a reservation system, which would comply with policy. Some of the public might be unhappy about not being able to reserve the picnic shelter. Jackson would lose revenue from the refuge picnic shelter but that might be offset by more reservations within the town limits.	Same as alternative B, plus: Interpretation in a more natural setting would add to visitors' experiences. More native habitat would increase the habitat value for most breeding birds, except Canada geese. There would be initial costs to restore North Park to native habitat.	Same as alternative B.
Special uses—actions			
Issue special use permits for guided hunting and fishing, hunting retrieval services, commercial wildlife-viewing tours, professional photography and videography, and research. Include special conditions in special use permits to reduce effects on the resources and other activities. Decide on an individual basis if access would be allowed in closed areas. Deny requests to hold weddings at the Miller House. Prohibit precedent-setting special access requests that would be difficult to manage.	Same as alternative A, except: Charge fees when issuing special use permits for commercial uses. Consider issuing special use permits to wildlife tour companies. Do not allow weddings on the refuge. Restrict or eliminate competitive events. Phase out commercial horseback trail riding within 5 years. Control invasives for 5 years after use has been phased out or until they are eradicated.	Same as alternative B, plus: Limit the number of special use permits for wildlife-viewing tours to reduce traffic and other impacts on Elk Refuge Road.	Same as alternative C.

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Allow commercial horseback trail rides along 1 mile segment of the Gros Ventre River as resources allow. Prohibit additional commercial horseback trail rides. Annually monitor commercial horseback riding trail and adjacent Gros Ventre River for invasive plant species. Treat new infestations before they expand and become a seed source that can be transported downstream on the refuge along the Gros Ventre River.			
Special uses—environmental consequences			
More activities that the refuge could not otherwise provide increase outreach about the refuge. Many commercial film companies would have access as staff time allowed. Research would collect and share information beneficial to the refuge. No weddings would happen at Miller House to comply with agency policy. Some public might be upset. There would be consistency in consideration of requesters of special use permits. Permit requirements would ensure uses have very little effect on other refuge resources and activities. Monitoring for and controlling new invasive plant infestations should prevent expansion on the refuge or Grand Teton National Park along Gros Ventre River.	Same as alternative A, plus: Fee collection would offset administrative costs of special use permits and be consistent with other land management agencies. Wildlife tour companies under permit to provide interpretation could increase public understanding of refuge purposes and management. No weddings would happen on the refuge to comply with agency policy. Some public might be upset. Eliminating commercial horseback riding will prevent one possible source of invasive plant introduction along the Gros Ventre River.	Same as alternative B, plus: Limiting commercial operators would help reduce traffic congestion and reduce wildlife disturbance on Elk Refuge Road. Fewer tours might not be able to meet public demand. Tour companies not selected for special use permits might have negative economic impacts.	Same as alternative C.

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Soil erosion along commercial horseback riding trail would be minimal.			
General access and Elk Refuge Road—actions			
From May 1 to November 30, keep open to the public Elk Refuge Road, Flat Creek Road, and the Curtis Canyon Road. From December 1 to April 30, keep open to the public the southern 3.5 miles of Elk Refuge Road.	Same as alternative A, plus: Consider more hunter access and designated parking lots for bison hunter access on the northern end of the refuge and archery hunter access on the western boundary of the refuge.	Same as alternative B.	Same as alternative B.
General access and Elk Refuge Road—environmental consequences			
Wildlife, especially elk and bison, would be protected from human disturbance during the critical winter season. Wildlife-viewing and photography opportunities would be available along the southern end of the refuge.	Bison harvest may increase if additional hunter access can be established on the northern end of the refuge. Elk harvest would likely increase because nonhunting sanctuaries on the western edge of the refuge would be eliminated.	Same as alternative B.	Same as alternative B.
Access to the national forest—actions			
Continue to allow overnight parking on Elk Refuge Road on April 30 for access to antler collection on the national forest. Limit access to the national forest to Crystal Butte, Dry Hollow, and Sheep Creek. Review access to the national forest from the "jump cliff" site and coordinate any actions with adjacent landowners. Allow winter users limited access on a trail to the national forest's Goodwin Lake Ski Cabin. Issue special use permits for access to reach the trail and plow a parking area.	Same as alternative A, except: Prohibit overnight parking and camping associated with antler collection on the national forest: ■ On May 1, consider opening the access gate later in the day than other national forest access gates. ■ Encourage the national forest to sign an egress route to prevent trespass in the Twin Creek subdivision for users of Goodwin Lake Ski Cabin on national forest land.	Same as alternative B.	Same as alternative B.

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	■ Ask the national forest to issue special use permits for parking on the refuge for users of the Goodwin Lake Ski Cabin on national forest land.		
Access to the national forest—environmental consequences			
Limited access would provide customer service while protecting resources, which demonstrates interagency cooperation. Minor wildlife disturbance, mainly of elk, would occur from people passing through the refuge to the national forest cabin. Staff would take time away from refuge duties to issue permits for an unrelated refuge activity. Staff duties and costs would increase in late April to manage the May 1 event. Closing "jump cliff" access to the national forest would decrease use in this area.	Same as alternative A, plus: There would be less trespass on private property by skiers using the egress route when leaving the national forest cabin. Permit administration would shift to the national forest, where the activity primarily occurs, and reduce the refuge staff workload.	Same as alternative B.	Same as alternative B.
Public outreach—actions			
Distribute news releases and articles about visitor opportunities, refuge management, and research. Maintain an email contact list of elected officials, partners, key community and business leaders, and agency contacts. Keep the refuge Web site current. Conduct media interviews. Use refuge leadership in an ambassadorial role in the community.	Same as alternative A, plus: Use more electronic media. Provide outreach on managing for migratory birds, wildlife disease, hunting, fishing, and changes that restrict or eliminate overnight parking, weddings, and competitive events.	Same as alternative B, plus: Provide outreach about the refuge's role in the Greater Yellowstone Ecosystem.	Same as alternative B.

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Provide outreach about refuge programs including management of elk and bison and refuge management practices.			
Public outreach—environmental consequences			
A wide variety of internal and external audiences would be current on visitor opportunities and management activities. The public would understand elk and bison behavior, population fluctuations, and relationships to other species. Refuge users and critics would better understand use of the hunting program for management of wildlife populations and as a Refuge System priority use. Educating anglers to harvest nonnative trout would help agency efforts to improve the native trout fisheries. A leadership role in the community and with partners would require staff time. There would be limited outreach information because of insufficient staff and reliance on seasonal staff and volunteers.	Same as alternative A, plus: More people would be reached by using social media. People would learn about migratory birds and the importance of area closures during nesting. Antler collectors on the national forest would understand the change in refuge restrictions on overnight parking. People with authority to perform weddings would be aware that the refuge is not available.	Same as alternative B, plus: The public would better understand coordination between land managers in the Greater Yellowstone Ecosystem.	Same as alternative B.
Visitor and Employee Safety and Resource Protection Goal—Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge.			
Visitor and employee safety—actions			
Emphasize employee and visitor safety.	Same as alternative A, plus: Increase law enforcement during hunting season. Develop strategies with WGFD to increase hunter safety.	Same as alternative B.	Same as alternative B.

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	Revoke hunting permits when violations occur. Provide personal protective equipment and safety training for refuge staff. Consider designating off-road parking at the entrance with a relocated entrance kiosk.		
Visitor and employee safety—environmental consequences			
Safety programs would have positive effects on visitors and employees.	Same as alternative A, plus: More enforcement of regulations and coordination with WGFD during hunting season would keep a good safety record. More enforcement staff would increase costs.	Same as alternative B.	Same as alternative B.
Resource protection—actions			
Law enforcement staff protects natural and cultural resources, refuge facilities, visitors, and employees. With few law enforcement employees at the refuge, rely on the Teton County Sheriff's Office, National Park Service, WGFD, and temporarily detailed law enforcement staff from within our agency.	Same as alternative A, plus: Increase law enforcement patrols in April. Develop methods to detect illegal taking of wildlife and wildlife parts. Increase staff and develop shift coverage for high visitor use seasons. Increase enforcement of regulations related to the Elk Refuge Road.	Same as alternative B, plus: Consider land exchanges with adjacent Federal agencies.	Same as alternative C.
Resource protection—environmental consequences			
Most major wildlife resource violations would be prevented. Backcountry violations would likely be missed and could result in loss of resources, because law enforcement staff would be insufficient to expand patrol operations into these areas.	More backcountry and boundary patrol efforts in April would deter refuge trespass and illegal removal of shed elk antlers and other wildlife parts. More staff might increase hunter and angler use data that could be used to guide future management. Increased staff, equipment, and patrol activity would have a higher cost.	Same as alternative B, plus: Land exchanges would simplify the refuge's external boundaries. Hunters would be able to better understand their location and comply with refuge-specific regulations. Exchanges would be costly and time-consuming.	Same as alternative C.

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	As visitor services expanded, the ability to protect the refuge resources would decline.		
Administration Goal—Provide facilities and effectively use and develop staff resources, funding, partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge.			
Funding and staff—actions			
Keep current funding and staff of 10.5 FTE positions. Rely on nongovernmental partnership money to hire 12 seasonal employees as irrigators, feed operators, and naturalists. Rely on 20 volunteers for visitor services and 1 volunteer for biology fieldwork. Use two National Park Service employees for hunting law enforcement patrol. Use eight law enforcement staff members of our agency on detail to the refuge to manage the opening of antler collection on the national forest. Hire more staff if money is available.	Increase refuge base funding by $200,000 to replace private contributions. Add 15 FTE positions: ■ five permanent full-time employees (biological technician, rangeland specialist, environmental education specialist, law enforcement officer, and maintenance supervisor) ■ nineteen permanent seasonal employees (irrigators, feed operators, naturalists, and visitor center staff) Continue to rely on volunteers to enhance work.	Same as alternative B, plus: Add 1.5 FTEs including: ■ three permanent seasonal interpretive naturalists	Same as alternative C.
Funding and staff—environmental consequences			
Current funding and staff would be insufficient to conduct programs and achieve refuge goals. ■ Refuge objectives could be achieved only through money from private organizations and the efforts of volunteers. Use of volunteers and seasonal employees would increase the supervisory workload for permanent staff.	Added staff would increase management capabilities: ■ More field data and staff expertise would help manage elk and bison herds. ■ Native plant plots would provide a long-term seed source for management.	Same as alternative B, plus: More environmental education and interpretation would be presented on and off the refuge, year-round, with a focus on ecosystem functions. More people would understand refuge programs and learn about refuge wildlife in the ecosystem in addition to elk and bison.	Same as alternative C.

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■ Unpredictable funding could reduce the hiring of seasonal law enforcement officers, which could result in a scaled-back hunting program. This would reduce the harvest of elk and bison making it difficult to balance habitat and herd sizes. ■ The value of long-term monitoring efforts could be severely reduced if there were not enough staff or volunteers to continue data collection. This could negatively affect our ability to make management decisions based on sound science. Working with partners providing private money would get citizens to support refuge management.	■ Efficient irrigation would increase forage production and reduce the need for supplemental feeding. ■ Public safety and wildlife protection would increase during hunting season. ■ Visitor services would have strong programs that provide education and benefits to the public year-round. Private money would enhance refuge management.		
Facilities—actions			
Maintain key operational and visitor services infrastructure and other facilities as funding allows. Provide housing for staff and volunteers as available.	Same as alternative A, plus: Add up to five family houses and more seasonal housing. Develop bear regulations (food and trash handling) for resident employees and volunteers. Demolish and replace existing elk trap with a prefabricated elk trap that can be assembled anywhere. Relocate or demolish and replace in a new location the Calkins House when money is available.	Same as alternative B.	Same as alternative B.

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Facilities—environmental consequences			
The public would get information and services at functioning, maintained refuge buildings. Maintained and restored historical buildings would retain their value and potential as interpretive sites. Employees housed on the refuge would help us retain qualified staff, increase security, provide wildlife observations, and ensure access to equipment. These employees would shop in Jackson, adding to the town's revenue. Bears might be attracted to refuge houses and become habituated. The bears could cause personal or property damage, which would require the removal or destruction of the bears.	Same as alternative A, plus: Highly qualified staff could be recruited because affordable housing would be available. Houses would reduce open space and might be perceived negatively by surrounding residents. Food handling regulations would prevent bears from becoming habituated to human food rewards. High-powered rifles would be used in the removed Calkins House area for elk and bison hunting; increased harvest could help meet herd size objectives. The incidental observation of wildlife and law enforcement violations by employees living in the house would be eliminated.	*Same as alternative B.*	Same as alternative B.
Elk Refuge Road—actions			
Provide access for staff, the public, and private landowners year-round. Provide seasonal access to the national forest. Enforce a no-stopping regulation to prevent road obstruction to other vehicular traffic. Teton County provides dust abatement during summer months. Plow snow out of turnouts to encourage vehicles to move off the road to view wildlife.	Same as alternative A, plus: Add new signing to prohibit stopping or parking on or along the road, and add interpretive signing. Develop a self-guided, interpretive tour route on Elk Refuge Road and Flat Creek Road. Maintain the road at a high standard in summer during heavy visitation. Enhance traffic signs and install speed limit signs north of the Curtis Canyon Road. Work with Teton County to modify dust abatement.	Same as alternative A, plus: Reduce the number of turnouts. Work with Teton County to stop dust abatement.	Same as alternative B.

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	Improve and increase the number of turnouts for winter use. Increase winter road maintenance. Work with Teton County on ways to create more room for all road users. Increase enforcement of current regulations.		
Elk Refuge Road—environmental consequences			
There could be more traffic incidents and spread of invasive plants from increased visitor and tour vehicles. Enforcing the no-stopping in the roadway regulation could relieve the traffic congestion. Turnouts would not have enough capacity to accommodate all visitors and might not be located in the best viewing locations. Trailhead parking would spill onto the road during hunting season, which could give the perception of favoritism to hunters and increase conflict between wildlife observers and hunters. Dust abatement treatments (salt-based) would attract bighorn sheep to the road: ■ There would be better wildlife viewing. ■ People would more likely want to stop in the road. ■ There could be more conflicts between wildlife and people and vehicles.	Same as alternative A, plus: Enforcing no roadside parking would prevent creation of unwanted parking areas and associated disturbance to vegetation. Visitors would learn about refuge wildlife and management on the interpretive tour route. Road maintenance would improve human safety. More turnouts would provide safe areas for improved wildlife viewing. Turnouts and widening the road would disturb native plant communities and create habitat loss. There would be increased risk of invasive plant infestations from the soil disturbance and importation of fill material. Increased interpretation, road maintenance, and enforcement would cost more and require staff time.	Same as alternative A, plus: Reducing the number of turnouts would decrease soil disturbance, reduce the risk of spreading invasive plants, and reduce the cost and need for snowplowing. Visitors would not have a safe alternative for parking and wildlife viewing with fewer turnouts. Ending dust abatement would keep bighorn sheep dispersed away from the road: ■ Human–wildlife conflicts would be reduced. ■ Visitors would have less opportunity for wildlife viewing overall, but viewing bighorn sheep would be in their natural dispersed population. ■ Fewer visitors might use the road, reducing congestion and the need for turnouts. ■ Less demand for tour companies might affect their revenue.	Same as alternative B.

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■ There would be more risk of disease transmission between bighorn sheep individuals and with livestock. (Also refer to the earlier "Access to the National Forest" that addresses a specific use of Elk Refuge Road.)			
Partnerships—actions			
Work with State and county governments on project such as the nonmotorized North Highway 89 Pathway, Geographic Information System (GIS) mapping, and management of greater sage-grouse core areas. Participate in the Jackson Cooperative Elk Study Group, Greater Sage-Grouse Working Group, and Jackson Interagency Habitat Initiative. Collaborate with the Jackson Hole Weed Management Association. Work with organizations on projects such as the irrigation expansion project and voluntary use of lead-free ammunition. Collaborate with the Jackson District Boy Scouts for antler collection and sale. Develop partnerships to resolve elk and bison conflicts on private and public land with help from WGFD. Continue our partnership with the Grand Teton Association.	Same as alternative A, plus: Develop a Friends group. Emphasize private land projects through the Partners for Fish and Wildlife program.	Same as alternative B, plus: Emphasize partnerships that focus on special ecosystem values and landscape-scale projects.	Same as alternative B.

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Partnerships—environmental consequences			
Effective partnerships would provide resources to address issues: ■ Ecosystem conservation could improve water quality on the refuge. ■ Coordination would benefit wildlife that cross boundaries. ■ Agencies and organizations would address specific issues like lead poisoning and needs such as invasive plant control. ■ The public would know about refuge topics and opportunities through the Greater Yellowstone Coordinating Committee, Teton County, and other organizations. ■ Jackson District Boy Scouts would help with antler pick up and manage an antler auction that would provide revenue for elk habitat projects. Partnerships would support refuge funding for services:	Same as alternative A, plus: The public would become more aware of and be able to participate in wildlife conservation through the new Friends group, which would provide volunteers or money for biological and visitor services programs. Private landowner projects could benefit refuge habitat and wildlife populations.	Same as alternative B, plus: Ecosystem-wide research would help Jackson Hole land managers better understand and manage resources. Landscape-scale activities would divert staff efforts away from refuge issues and could reduce progress on resolving refuge-specific issues.	Same as alternative B.

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■ Visitors would get information and services at the partnership-operated Jackson Hole and Greater Yellowstone Visitor Center. ■ Visitors could take part in refuge opportunities through the Grand Teton Association's sleigh ride program and operation of Miller House.			
Socioeconomic impacts			
Management and visitation activities annually generate an estimated 31 jobs, $1,356,100 in labor income, and $2,032,500 in value added in the local economy.	Annually generate 4 additional jobs, $207,200 more in labor income, and $328,200 more in value added.	Annually generate 5 additional jobs, $262,900 more in labor income, and $413,800 more in value added.	Annually generate an additional 6 jobs, $314,900 in labor income, and $490,700 in value added.
Cumulative impacts			
There would be no cumulative impacts, with the following precautions: ■ Ban activities where federally listed species occur. ■ Regulate activities to lessen impacts to species. ■ Monitor goal achievement and unforeseen conditions and apply adaptive resource management.	Same as alternative A.	Same as alternative A.	Same as alternative A.

Chapter 4—Affected Environment

Ann Hough / FWS

Bighorn Sheep

This chapter describes the characteristics and resources of the National Elk Refuge, Wyoming, under these topic headings:

4.1 Physical Environment
4.2 Biological Resources
4.3 Management Tools
4.4 Human History and Cultural Resources
4.5 Special Management Areas
4.6 Visitor Services
4.7 Socioeconomic Environment
4.8 Operations

4.1 Physical Environment

Within Teton County, Wyoming, the town of Jackson borders the refuge on the south, and the town of Kelly lies near its northern boundary. Lands to the south and west are mostly privately owned. East of the refuge are lands administered by Bridger-Teton National Forest, including the nearby Gros Ventre Wilderness.

The National Elk Refuge is 6 miles at its widest point and 10 miles from southwest to northeast, with elevation ranging from 6,200 to 7,200 feet. The northern half of the refuge consists of steep rolling hills. The southern half is glacial washout material, with one resistant formation (Miller Butte) rising approximately 500 feet above the valley floor. The refuge, along with Grand Teton National Park, John D. Rockefeller, Jr. Memorial Parkway, and Yellowstone National Park, is part of a larger area referred to as the Greater Yellowstone Ecosystem.

The following sections describe aspects of the physical environment that may be affected by implementation of the CCP:

- climate
- land features
- soils
- water resources
- air quality
- visual resources

Climate

The valley known as Jackson Hole is characterized by long, cold winters with deep snow accumulations and short, cool summers. Prevailing winds in the valley come from the southwest but strong winds are relatively rare.

Temperature

January is the coldest month with an average daily maximum temperature of 24 °F and an average daily minimum temperature of 1 °F at low elevations. Temperature extremes vary from summer highs of 92–98 °F to winter lows of –40 to –52 °F.

Precipitation

Precipitation levels are relatively steady throughout the year, with a total average annual accumulation of 15.2 inches in Jackson Hole. Average monthly precipitation levels range between 1 and 2 inches, with May and December being wettest and July and February driest. Jackson Hole averages 90 inches of snowfall per year, accounting for 60 percent of annual precipitation. Snow pack depth of 6–18 inches in southern parts of the refuge and 48 inches in the northern half are common. Maximum snow depth is reached between March 15 and April 1 (Martner 1977).

Climate Change

The U.S. Department of the Interior issued an order in January 2001 requiring Federal agencies under its direction that have land management responsibilities to consider potential climate change effects as part of long-range planning endeavors. The U.S. Department of Energy's report, Carbon Sequestration Research and Development (1999), concluded that ecosystem protection is important to carbon sequestration and might reduce or prevent loss of carbon stored in the terrestrial biosphere. The report defines carbon sequestration as "the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere" (1999).

The increase of carbon dioxide within the earth's atmosphere has been linked to the gradual rise in surface temperature, commonly referred to as global warming. Vegetated land is a tremendous factor in carbon sequestration. Large, naturally occurring communities of plants and animals that occupy major habitats—grassland, forest, wetland, tundra, and desert—are effective both in preventing carbon emission and in acting as biological scrubbers of atmospheric carbon dioxide.

Carbon sequestration constitutes the primary, climate-related effect to be considered in planning. One of our activities in particular—prescribed fire—releases carbon dioxide directly to the atmosphere from the biomass consumed during combustion. However, there is no net loss of carbon because new vegetation quickly germinates to replace the burned-up biomass. This vegetation sequesters an approximately equal amount of carbon as was lost to the air (Dai et al. 2006).

Several scientific studies report that, in the past century, the climate is becoming warmer and drier in northern Yellowstone National Park (Balling et al. 1992a, 1992b). If this warming trend continues, it could have far-reaching effects on the plants and animals of the Greater Yellowstone Ecosystem (Romme and Turner 1991).

Analysis of precipitation records from 1921 to 2002 gathered by a National Oceanic and Atmospheric Administration weather station in Jackson, Wyoming, showed no significant trends, either increasing or decreasing (Smith et al. 2004). Although temperature readings from 1931 to 2002 increased, there was a "minor decline in drought conditions," per calculations using the 1949–2001 Keetch-Byram Drought Index values that evaluate upper-level, soil moisture content (Smith et al., p. 98).

Land Features

The National Elk Refuge is centrally located in Jackson Hole in northwestern Wyoming. The refuge ranges from 6,200 to 7,400 feet above sea level and is bordered by the town of Jackson to the south, private ranchlands and subdivisions to the west, Grand Teton National Park to the north, and national forest lands of the Gros Ventre Mountains to the east. Topographic, hydrologic, and soil features interact to influence the species composition of plant communities on the refuge. The refuge comprises seven main topographic zones:

- Gros Ventre Hills
- foothills of the Gros Ventre Mountains
- Miller Butte
- Poverty Flats alluvial plain

- Flat Creek Marsh
- Flat Creek riparian zone
- Gros Ventre River riparian zone

The northern third of the refuge is dominated by the Gros Ventre Hills. These relatively steep, rolling, sedimentary formations range in elevation from 6,300 to 7,200 feet. The Gros Ventre Hills support native wheatgrass and needlegrass communities on south aspects, with mixed communities of mountain snowberry, rose, and sagebrush in sheltered draws with deeper soils. North aspects support aspen and some mixed-conifer stands of Douglas-fir lodgepole pine and limber pine. Scattered stands of Rocky Mountain juniper grow on some rocky slopes. Lower elevation draws are dominated by mountain big sagebrush, threetip sagebrush, and grassland communities. Similar vegetative features are found on foothills of the Gros Ventre mountains on the eastern border of the refuge and on Miller Butte, a 1,300-acre formation on the southern end of the refuge that rises 500 feet above the valley floor.

A gently sloping alluvial plain, called Poverty Flats by early homesteaders because if its poor agricultural potential, is the principal topographic feature in the east-central portion of the refuge. This area consists of shallow soils that overlay glacially deposited cobble. Before Euro-American settlement, the alluvial plain was likely covered by mountain big sagebrush and dry native grassland. Currently, the area is a mixture of native dry grassland, crested wheatgrass, and nonnative cultivated grassland, with only small pockets of mountain big sagebrush limited to areas of deeper soil and snow accumulation.

Approximately 2,700 wetland acres form the southwestern corner of the refuge. Flat Creek, Nowlin Creek, Twin Creek, and ground water originating from porous carbonate rocks to the east of the refuge feed the wetlands (Galbraith et al. 1998). In addition to these natural sources, the Flat Creek Marsh typically receives irrigation diversion water from the Gros Ventre River from May through July via the Boyle Ditch, which serves private water users downstream of the refuge. There is an elevation gradient to the wetlands of the Flat Creek Marsh that affects soil moisture and plant communities. The highest elevations next to the alluvial plain host wet meadow plant communities of Kentucky bluegrass, tufted hairgrass, meadow foxtail, and timothy grasses. Mid-elevation wetlands are dominated by shrubby cinquefoil, rushes, sedge species, and several species of willow. However, willows growing in these areas are mostly less than 1.5 feet in height and do not form a significant portion of the canopy cover due to browsing by elk and bison (Anderson 2002, Smith et al. 2004). The lowest elevation areas in the wetland consist of open water and cattail–bulrush marsh.

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Elk

The riparian zones of the Gros Ventre River and the portion of Flat Creek that flows over the alluvial plain are characterized by braided stream channels and cottonwood woodland plant communities. The Gros Ventre River bordering Grand Teton National Park and the easternmost portion of Flat Creek on the refuge support multi-aged communities of narroweaf cottonwood with shrub understories of chokecherry, serviceberry, rose, gooseberry, and Bebb, greenleaf and sandbar willows. Where Flat Creek flows over the western portion of the alluvial plain, only sparse, mature narrowleaf cottonwoods exist. The lack of regenerating aspen and other understory shrubs in this area has been attributed to browsing and rubbing damage from elk and bison (Smith et al. 2004).

(Note: The above description is paraphrased from Smith et al. 2004.)

Soils

More than 20 different soil types are found on the National Elk Refuge (Young 1982). Soils at lower elevations are alluvial (transported by stream or river), generally sandy loam or loam, and are shallow and permeable. Soils at higher elevations are also

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Irrigation

loamy, with considerable areas of gravelly soils and cobblestone on south-facing slopes and ridges.

Greyback gravelly loam—a deep, somewhat excessively drained soil—occurs in irrigated areas of the refuge. About 20 percent of the irrigated area has a cobbly loam surface layer but is otherwise similar to Greyback gravelly loam. Permeability is moderately rapid, and available water capacity is low. Roots penetrate to a depth of 60 inches or more. On 0- to 3-percent slopes, the surface runoff is slow, and the erosion hazard is slight. On 3- to 6-percent slopes, the surface runoff is medium, and the erosion hazard is moderate.

Water Resources

This section describes the hydrology, water quality, and water rights on the refuge.

Hydrology

Surface hydrologic features on the refuge include the Gros Ventre River, Cache Creek, Flat Creek, Nowlin Creek, and several other small creeks and springs (figure 9). The Gros Ventre River flows westerly and forms the northern boundary of the refuge. Flat Creek flows east to west and nearly bisects the refuge. Water from Cache Creek reaches the refuge by way of an underground diversion that surfaces into a cistern located near the refuge headquarters. In addition to natural watercourses, there are many miles of irrigation ditches. Three wells and an enclosed water storage reservoir are used by the town of Jackson.

Water-level contours show that ground water flows from high areas southwest through the valley toward the Snake River. Data for the alluvial valley aquifer indicate excellent water quality, supporting use for drinking water, recreation, and other commercial uses. Much of the aquifer has high permeability and substantial interconnection to the rivers and lakes, making it vulnerable to contamination from facilities, visitor use, and transportation corridors in the recharge areas (parts of the aquifer where water moves downward toward the water table).

Gros Ventre River

The Gros Ventre River, which drains approximately 600 square miles of eastern Jackson Hole and the mountains farther east, is the largest watercourse on the refuge. The relatively wide river channel is heavily braided in areas where geologic materials are of low erosional resistance, as is the case on the refuge. The many gravel bars in the river channel have little or no vegetative cover because of annual flooding and erosion.

Flat Creek

Flat Creek originates in the Gros Ventre Range east of the refuge and drains approximately 120 square miles. The Flat Creek drainage is a broad valley setting with expansive wetlands. The wide valley floor has gentle elevation relief and is made of materials deposited from river and lake processes. The natural stable stream channels are slightly entrenched, meandering, riffle-pool beds. Flows vary seasonally because of runoff, input of irrigation water diverted from the Gros Ventre River, diversions by irrigators, and losses from infiltration. The porous nature of refuge soils through which a section of Flat Creek flows causes high infiltration losses and results in a seasonally dry channel bed in this area. Nowlin Creek is a small spring-fed tributary of Flat Creek. From the southeastern part of the refuge, the creek flows westerly through four constructed impoundments to its confluence with Flat Creek.

Flat Creek has experienced direct and indirect alteration to its stream form and function from changes in hydrological and sediment inputs, installation of instream structures and treatments, and nearby land management activities. These structures from the 1980s are failing and, in some cases, are negatively affecting the stream and associated habitats. In cooperation with WGFD (project lead), the refuge is planning restoration and enhancement of the creek. After completing a categorical exclusion

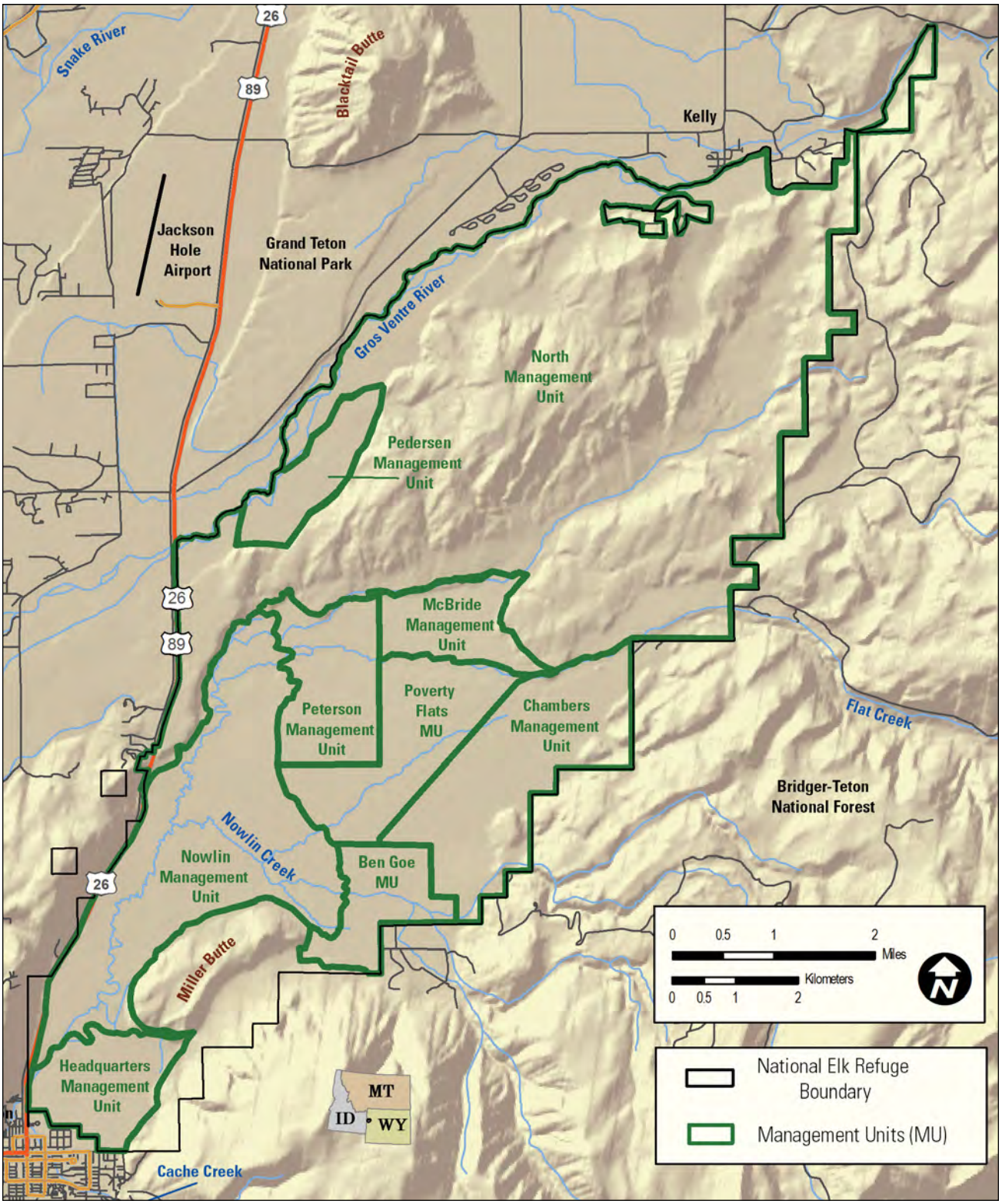

Figure 9. Map of management units and surface hydrology of the National Elk Refuge, Wyoming.

(FWS 2013) under the National Environmental Policy Act, in October 2013 the refuge restored 1 mile of Flat Creek, as follows:

- removed 39 deteriorating instream structures
- removed 347 feet of riprap
- enhanced 23 riffle and 25 pool habitat units
- removed 300 square feet of reed canarygrass
- installed 4,184 square feet of woody and sod vegetation
- created 19,000 feet of floodplain

Springs, Ponds, and Other Water Features

Smaller water features include Twin Creek and Holland Spring near the southeastern boundary, Romney and Peterson Springs in the western part, and other miscellaneous springs, like Pierre's Ponds, Sleeping Indian Pond, and Bill's Bayou, throughout the refuge.

Water Quality

Surface water quality in Teton County is believed to be high but can be adversely affected by both point source pollution (such as a gasoline station along Flat Creek) and nonpoint source pollution (such as overland runoff of fecal matter from winter concentrations of livestock). Urban development has little or no potential for influencing surface water quality on the refuge. Lower Cache Creek, however, flows through Jackson, and a diversion from this watercourse (the Cache Creek pipeline) enters the refuge where we use it for irrigation. This section could be affected by urban runoff, potentially affecting downstream water quality (Jackson and Teton County, Wyoming 1994).

There is no information about water quality in Cache Creek near the refuge. However, two ongoing studies on sections of the creek flowing through Jackson, closer to its confluence with Flat Creek, found that petroleum hydrocarbons from vehicles and sodium (probably from compounds used by local road departments for ice melting) are entering Flat Creek, along with city storm water. A similar situation may be occurring on Cache Creek. Zinc, the only heavy metal found in storm water samples, is also flowing into Flat Creek from the town, but we do not know its source (R. Norton, personal communication, as cited in FWS 1998). Hydrocarbon input might be reduced by using storm water retention cisterns.

Another possible nonpoint source of pollution affecting refuge water quality, although not documented as a problem, is the large amount of fecal material produced by wintering elk and bison. We suspect that the high concentration of waterfowl in the Nowlin Marsh area is contributing to decreased water quality in the lower section of Flat Creek on the refuge.

The Teton County Conservation District has conducted water quality sampling on several sites within the refuge (refer to table 5). Nitrates are of particular concern. Although data from 1996 to 2002 showed nitrate levels consistently below the U.S. Environmental Protection Agency's drinking water standards (10 parts per million), detected levels in 1997 and in 2002 were higher than expected for typical western Wyoming waters (R. Stottlemeyer, personal communication, 2003; Stottlemeyer et al. 2003). Irrigation, fertilization, and elk and bison fecal material could be contributing to the elevated nitrate concentrations, but we need further study.

In 2002, the Teton County Conservation District implemented source tracking of fecal coliforms. Results from DNA analysis showed that 34 percent of the coliforms come from rodents, 13 percent from bison, 13 percent from elk, 13 percent from unknown sources, 7 percent from canines, and 7 percent from birds. Farming practices such as disking, seeding, sprinkler and drip irrigation, herbicide and fertilizer application, and crop harvesting may affect water quality and quantity.

We consider ground water resources to be high quality on the refuge as a whole and not subject to septic-related pollution concerns except perhaps around the Twin Creek subdivision and other inholdings. Residential and commercial development in Jackson and elsewhere in Teton County may cause local reductions in ground water quality (Jackson and Teton County, Wyoming 1994). Although Jackson and surrounding areas use centralized wastewater treatment facilities, the perceived major threat to ground water supplies elsewhere in Teton County is pollution from individual septic systems (Jackson and Teton County, Wyoming 1994).

Water Rights

Table 6 displays the refuge's water rights.

Air Quality

In general, the air quality of Jackson Hole is high. Airborne pollutants generated by industrial activities pose no significant threats to air quality in the valley. However, Jackson Hole is a high-elevation valley surrounded by mountains and is particularly susceptible to air quality problems associated with temperature inversions. During periods of high

Table 5. Average values of selected water quality factors in or near the National Elk Refuge, Wyoming, 1996–2002.

Values	*Flat Creek control* [1] *(number of samples tested)*	*Flat Creek 1* [2] *(number of samples tested)*	*Nowlin Creek* [3] *(number of samples tested)*	*Flat Creek 2* [4] *(number of samples tested)*	*Standard*
Temperature (degrees Fahrenheit, °F)	42.2 °F (8)	45.3 °F (10)	46.5 °F (4)	46.2 °F (11)	68 °F
Dissolved oxygen (milligrams per liter, mg per L)	11.2 mg per L (7)	10.5 mg per L (9)	9.51 mg per L (4)	9.8 mg per L (10)	—
Turbidity (nephelometric turbidity unit, NTU)	0 NTU (3)	1.1 NTU (4)	1.4 NTU (4)	26.8 NTU (4)	—
Acidity or alkalinity, pH (units)	8.29 units (8)	8 units (10)	8.05 units (4)	8.14 units (11)	6.5–9 units
Nitrate as N (mg per L)	less than 0.1 mg per L (6)	0.14 mg per L (7)	less than 0.1 mg per L (5)	less than 0.1 mg per L (7)	10 mg per L
April 2000 sample					
Fecal coliform (coliform per 100 milliliters, col per 100 ml)	3 col per 100 ml	53 col per 100 ml	55 col per 100 ml	60 col per 100 ml	200 col/100 ml
Escherichia (E.) coli (col per 100 ml)	1 col per 100 ml	45 col per 100 ml	49 col per 100 ml	29 col per 100 ml	126 col/100 ml

[1] *Near the boundary of the refuge with the Bridger-Teton National Forest.*
[2] *North of the Jackson National Fish Hatchery.*
[3] *Below the third pond, next to the barn and corral.*
[4] *Outside the refuge's southwestern boundary, below the Dairy Queen, and subject to many outside influences (such as a major highway and gas station).*

atmospheric pressure, dense cold air is trapped near the valley floor by upper layers of warmer air. Air quality in the southern part of the valley next to Jackson might decline as a result of pollutants trapped in the lower atmosphere during inversions. These pollutants include carbon monoxide generated mostly by automobile emissions, dust particles, and wood smoke. This pattern may persist for several days at a time, but pollutant concentrations are dispersed when weather patterns change, especially when accompanied with winds.

Air quality on the refuge, although not measured or monitored, is considered good to excellent, with low concentrations of pollutants throughout the year. However, the lower elevations and southern part of the refuge may have periods of reduced air quality from winter temperature inversions and concentrations of airborne pollutants generated by Jackson. Current refuge management practices do not decrease air quality to any measurable degree. Vehicular use of unpaved refuge roads during dry summer and autumn periods generates dust but would likely have only a negligible lowering of overall refuge air quality.

Fire management activities which result in the discharge of pollutants (carbon monoxide (CO), Particulate Matter (PM), and other pollutants from fires are subject to and must comply with all applicable Federal, State, and local air pollution control requirements as specified in Section 118 of the Clean Air Act, as amended, 1990. Air quality is regulated by the State of Wyoming Department of Environmental Quality (DEQ). The State requires that a permit be issued by the DEQ prior to initiating a prescribed fire.

The area is currently designated as "Attainment" for the Criteria Pollutants (Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Particulate Matter 10 (PM10), Particulate Matter 2.5 (PM2.5), and Lead (Pb) by the Environmental Protection Agency (EPA) (EPA 2013). The management of smoke is incorporated into the planning of prescribed fires, and to the extent possible, in suppression of wildfires. Sensitive areas will be identified and precautions taken to safeguard visitors and local residents.

Table 6. Water rights owned by the National Elk Refuge, Wyoming.

Priority date	*Water right number*[1]	*Structure name or type*	*Source*	*Flow rate*[3]		*Use*	*Acres irrigated*
				cfs	*gpm*		
06/10/1883	TP 10329	Holland No. 1 Ditch	South Twin Creek	2.28	—	Irrigation, stock	160
06/01/1887	TP 10173	Carnes Ditch	Flat Creek	2	—	Irrigation	140
05/15/1888	TP 10306	Robert E. Miller	Cache Creek Pipeline	2.28	—	Irrigation	160
05/15/1888	TP 10307	Grace G. Miller	Cache Creek Pipeline	2.6	—	Irrigation	182
12/31/1888	TP 10317	Territorial ditch	South Twin Creek	1.07	—	Irrigation	75
12/31/1888	TP 10318	Territorial ditch	South Twin Creek	0.02	—	Irrigation	2
05/08/1899	2106	Dewey Ditch	Flat Creek	1	—	Irrigation	70
02/01/1894	642	Robert E. Miller	Flat Creek (Cache Creek Pipeline)	1.94	—	Irrigation	160
05/28/1894	732	Swamp Ditch	Swamp Creek	2.07	—	Irrigation	145
05/28/1894	732	Swamp Ditch	Swamp Creek	1	—	Irrigation	70
02/07/1896	1175	Petersen Ditch	Flat Creek	2.91	—	Irrigation	204
02/07/1896	1175	Petersen Ditch	Flat Creek	2	—	Irrigation	140
02/07/1896	1176	Longfellow Ditch	Flat Creek	3.18	—	Irrigation	223
02/07/1896	1176	Longfellow Ditch	Flat Creek	1.14	—	Irrigation	80
06/05/1896	1230	Crawford Ditch	South Twin Creek (Holland Creek)	2.28	—	Irrigation	160
08/11/1896	1301	Sheep Creek Ditch	Sheep Creek	0.24	—	Irrigation	17
05/08/1897	1478	M.C. Ditch	Flat Creek	1.9	—	Irrigation	133
06/26/1897	1517	Lanigan Ditch	Flat Creek	1.28	—	Irrigation	90
01/23/1900	2446	Adle Ditch	Flat Creek	1.42	—	Irrigation	100
04/24/1900	2587	Pettigrew Ditch	Spring Creek (Gros Ventre River)	2.84	—	Irrigation	199
06/18/1900	2667	Hanrow Ditch	Warm (Seebolm) Springs	0.86	—	Irrigation	60
06/18/1900	2668	Romeo Ditch	Gros Ventre River	0.32	—	Irrigation	22.48
02/25/1901	3036	Paulina Ditch	Valdez and Uncle Mike Springs (Swamp Creek)	0.35	—	Irrigation	25
04/22/1901	3129	Wood Ditch	Flat Creek	0.42	—	Irrigation	30
04/22/1901	3129	Wood Ditch	Flat Creek	1.38	—	Irrigation	97
10/11/1901	717E	M.C. Ditch Enlargement	Flat Creek	0.92	—	Irrigation	65
11/06/1901	3534	Elk Ditch	Swamp Creek	1	—	Irrigation	70
01/17/1902	3680	Sunnyside Ditch	White Springs (Flat Creek)	1.71	—	Irrigation	120
01/17/1902	3681	Botcher Spring Ditch	Botcher Springs (Flat Creek)	0.5	—	Irrigation	35
05/26/1902	839E	Romeo Ditch Enlargement	Gros Ventre River	1.633	—	Irrigation	114.46
07/28/1902	886E	Pettigrew Ditch Enlargement and Cherry Flats Ditch	Gros Ventre River	1.57	—	Irrigation, domestic	110
11/10/1903	5636	Maggie M. Ditch	Flat Creek	1.42	—	Irrigation	100

Table 6. Water rights owned by the National Elk Refuge, Wyoming.

Priority date	*Water right number*[1]	*Structure name or type*	*Source*	*Flow rate*[3]		*Use*	*Acres irrigated*
				cfs	*gpm*		
07/18/1904	6133	Spencer Ditch	Flat Creek	1.08	—	Irrigation	76
09/07/1905	6847	Ben Goe Ditch	Flat Creek	1.71	—	Irrigation, stock, domestic	120
04/14/1906	1519E	Crawford Ditch Enlargement	South Twin Creek	0.34	—	Irrigation	24
04/28/1906	1534E	Crawford Ditch Enlargement No. 2	South Twin Creek	0.12	—	Irrigation	9
09/07/1906	1612E	Adle Ditch Enlargement	Flat Creek	4.2	—	Irrigation	294.25
04/23/1907	1712E	Longfellow Ditch Enlargement	Flat Creek	0.86	—	Irrigation	60
07/19/1907	1743E	Glidden Ditch Enlargement No. 2	Gros Ventre River	0.62	—	Irrigation	44
07/24/1908	8619	Lost Springs Ditch	Flat Creek	4.35	—	Irrigation	305
07/24/1908	8619	Lost Springs Ditch	Flat Creek	2.21	—	Irrigation, domestic	155
10/30/1908	2146E	M.C. Ditch Enlargement	Flat Creek	0.71	—	Irrigation	50
10/30/1908	2146E	M.C. Ditch Enlargement	Flat Creek	0.47	—	Irrigation	33
05/02/1909	9892	Harry R. Robinson Ditch	Flat Creek	4.2	—	Irrigation	294
12/07/1909	2137E	Ben Goe Ditch Enlargement	Flat Creek	0.57	—	Irrigation	40
05/20/1910	9900	McInelly Ditch	Flat Creek	2.28	—	Irrigation, domestic	160
06/10/1910	2374E	Lost Springs Ditch Enlargement	Flat Creek	1.71	—	Irrigation	120
06/10/1910	2374E	Lost Springs Ditch Enlargement	Flat Creek	2.28	—	Irrigation, domestic	160
06/20/1910	9990	Sam's Ditch	Sam's Springs (Flat Creek)	0.07	—	Irrigation, domestic	5
06/02/1911	10924	Ratcliff Ditch	Flat Creek	3.43	—	Irrigation, domestic	240
06/02/1911	10924	Ratcliff Ditch	Flat Creek	3.85	—	Irrigation	270
06/02/1911	10924	Ratcliff Ditch	Flat Creek	4.43	—	Irrigation	310
01/06/1912	11137	Garton Springs Ditch	Garton Springs (Flat Creek)	0.14	—	Irrigation, domestic	10

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Romney Ponds

Table 6. Water rights owned by the National Elk Refuge, Wyoming.

Priority date	*Water right number*[1]	*Structure name or type*	*Source*	*Flow rate*[3]		*Use*	*Acres irrigated*
				cfs	*gpm*		
04/11/1912	11291	Edith A. Ferrin South Twin Creek Ditch	South Twin Creek	0.57	—	Irrigation, domestic	40
12/23/1912	11635	Scott and McBride Ditch	Flat Creek	3.71	—	Irrigation, domestic	260
12/23/1912	11635	Scott and McBride Ditch	Flat Creek	3.15	—	Irrigation, domestic	221
06/11/1913	11884	Pecos Ditch	Flat Creek	1.46	—	Irrigation, domestic	102.6
07/13/1914	12549	Pasture Ditch	Flat Creek	0.21	—	Irrigation, domestic	15
01/13/1915	3106E	Pecos Ditch Enlargement	Flat Creek	0.57	—	Irrigation, domestic	40
01/26/1915	13001	Pederson Spring Ditch	Springs (Gros Ventre River)	0.5	—	Irrigation	35
02/04/1915	3124E	McInelly Ditch Enlargement	Flat Creek	1.5	—	Irrigation	105
04/24/1917	3772E	McInelly Ditch Enlargement	Flat Creek	2.16	—	Irrigation	150
12/24/1917	3867E	Adle Ditch Enlargement	Flat Creek	0.57	—	Irrigation	40
12/24/1917	3867E	Adle Ditch Enlargement	Flat Creek	0.49	—	Irrigation	34
03/10/1927	17277	Haight Ditch	Flat Creek	1.29	—	Irrigation, domestic	90
12/06/1927	17319	Three Springs Ditch[2]	Sheep Creek	—	—	Irrigation, domestic	7
09/17/1934	18537	Shortcut Ditch[2]	Sheep Creek	—	—	Irrigation, stock	360
11/10/1937	5084E	Sheep Creek Ditch Enlargement[2]	Sheep Creek		—	Irrigation	277.7
05/13/1977	6643E	Hanrow Ditch Enlarge-ment No. 2	Warm (Seebolm) Springs	1.23	—	Irrigation	86
02/20/1990	9637R	Pierre Reservoir No. 1	Spring Creek	—	—	Wildlife	—
03/13/1990	9588R	Pierre Reservoir No. 2	Spring Creek	—	—	Wildlife	—
03/13/1990	10030R	Romney No. 1 Reservoir	Gros Ventre River	—	—	Fish, wildlife	—
03/13/1990	10031R	Romney No. 2 Reservoir	Gros Ventre River	—	—	Fish, wildlife	—
03/13/1990	10032R	Romney No. 3 Reservoir	Gros Ventre River	—	—	Fish, wildlife	—
03/30/1993	7090E	Romeo Ditch Enlargement No. 2	Gros Ventre River	24.4	—	Fish, wildlife, reservoir	—
03/30/1993	7091E	Romey Springs Ditch Enlargement	Gros Ventre River	8.56	—	Fish, wildlife, reservoir	—
01/13/1994	10054R	Elk Park Pond Reservoir	Elk Park Drain	—	—	Fish	0
11/14/2000	UW 130740	Sled No. 1 Well	Ground water	—	25	Domestic	—
02/07/2005	UW 165547	Miller/Shop Well No. 1	Ground water	—	23	Miscellaneous	—
12/11/2009	UW 191934	Shop Well	Ground water	—	30	Miscellaneous	—

[1]UW=underground well; TP=territorial proof number for rights established before statehood.

[2]Supplemental supply.

[3]cfs=cubic feet per second; gpm=gallons per minute.

Visual Resources

The quality of visual resources is an important part of the recreational experience (USDA Forest Service 1982). The visual appearance of a landscape is often the first thing to which a viewer responds.

The National Elk Refuge, the Grand Teton National Park, and the vast expanses of undeveloped national forest land surrounding the refuge offer spectacular scenic views of the Gros Ventre and Teton Ranges, Cache Peak, East Gros Ventre Butte, Jackson Peak, Sleeping Indian (Sheep Mountain), Snow King Mountain, and the Gros Ventre Hills in the northern part of the refuge. The Gros Ventre River along the northern refuge boundary supports a cottonwood-dominated riparian zone.

The most prominent view of the refuge, which is seen by several million visitors annually as they drive to and from Jackson on U.S. Highway 26/89, is the expansive Flat Creek Marsh. During winter, thousands of elk make the refuge an important visual and ecological resource for the region. Although bison are fed in areas that are not visible to the public, the public can see bison along the fence north of the Jackson National Fish Hatchery and in the McBride area before Flat Creek Road is closed in December. As the bison herd grows, bison are more frequently seen in the southern sections of the refuge.

Some refuge features that may detract from the visual quality of the refuge, include the following:

- an 8-foot fence that runs for approximately 8 miles along the southern and western boundaries of the refuge keeps elk and bison from entering the town or migrating to the cattle ranches in Spring Gulch and reduces vehicle–wildlife accidents from animals on the highway.
- a power line that parallels Highway 89 north of Jackson for about 2 miles
- feed trucks and feed sheds
- Jackson National Fish Hatchery, Elk Refuge Road, and refuge housing

4.2 Biological Resources

This section describes the biological resources that may be affected by the implementation of the CCP. Unless otherwise noted, most of the information is from our unpublished data located in files at the refuge headquarters. Descriptions of these topics follow:

- plant communities
- wildlife
- federally and State-listed species

Plant Communities

We classified 33 plant community types on the National Elk Refuge, 23 of which are dominated by native plants and 10 by nonnative grass species (see figure 10). Homesteaders or refuge staff planted nonnative grass plant communities to support hay production or pasture for livestock or elk. Smooth brome, intermediate wheatgrass, meadow brome, and Russian wildrye are common examples of these plant communities on the refuge. While some of these communities have adapted to natural conditions where adequate soil moisture exists, most are perpetuated by irrigation activities.

For this analysis, we classified vegetative communities on the refuge into one of six general categories: native grasslands, sagebrush shrublands, wetlands (marshlands, wet meadows, and open water), riparian woodlands and aspen woodlands, conifer forests, and cultivated fields (refer to table 7). Appendix E lists the plant species that occur on the refuge.

Table 7. Plant community types on the National Elk Refuge, Wyoming.

Habitat	*Acres*
Native grasslands	8,092
Sagebrush shrublands	8,010
Wetlands	
Marshlands (630 acres)	
Wet meadows (1,720 acres)	
Open water (326 acres)	2,676
Riparian woodlands and aspen woodlands	3,227
Conifer forests	160
Cultivated fields	2,400
	24,565

Native Grasslands

Native grasslands are important plant communities on the refuge because they provide winter forage for elk and bison, which are primarily grazers.

BJ Baker / FWS

A wetlant at Miller Ranch.

Native grasslands occur where there is sufficient precipitation to grow grasses but not trees or where drought, frequent fires, grazing by large mammals, or human disturbance have prevented trees or shrubs from becoming established. Native grasslands, including some bluegrass, wheatgrass, and needlegrass species, cover approximately 8,092 acres. Except for localized areas, native grasslands are in good condition, especially in the northern part of the refuge (Eric Cole, biologist, U.S. Fish and Wildlife Service, Jackson, Wyoming, personal communication, 2002).

Most native grassland habitats are dominated by native perennial bunchgrass species with native woody species such as broom snakeweed and green rabbitbrush. There is little invasion by tap-rooted forbs between grass plants. Soil between grasses is not eroding on most native grasslands on the refuge. Other plant species commonly found in native grasslands include rushes, smooth brome, brome snakeweed, yellow salsify, Junegrass, green rabbitbrush, fringed sage, and alfalfa. We consider these communities, while heavily used by elk and bison, to be largely representative of historical dry, native grassland plant communities and self-sustaining if new infestations of invasive plant species are controlled. In the southern half of the refuge, the Poverty Flats grasslands receive heavy use by elk and Miller Butte receives moderate to heavy use. On the southern end of the refuge, there is little residual growth on bunchgrasses from the previous year of ungulate grazing during the grass dormant season. This removal can increase the production of some perennial bunchgrass plants, although standing dead plant material has been shown to be beneficial to plant health by some authors (Briske 1991, Sauer 1978). The grasslands on the northern end of the refuge receive much less use by elk and bison because of deeper snow and hunting disturbance.

The largest continuous segment of native grasslands is in the center of the refuge: (1) northeast of the Nowlin Creek marshlands; and (2) northwest, west, and east of Flat Creek Road. This area is being invaded by crested wheatgrass, a nonnative grass that we once planted on the refuge.

Sagebrush Shrublands

Sagebrush shrublands encompass approximately 8,010 acres and are scattered throughout the refuge, with the largest concentrations in the east-central and northeastern parts. Sagebrush shrublands are generally tall, dense, and comprised of native species in the northern half of the refuge, with some small areas in the McBride and Peterson management units having shorter, lower density sagebrush (Eric Cole, biologist, U.S. Fish and Wildlife Service, Jackson, Wyoming, personal communication, 2002). In general, sagebrush stands closer to feedgrounds are shorter and less dense. In the southern half of the

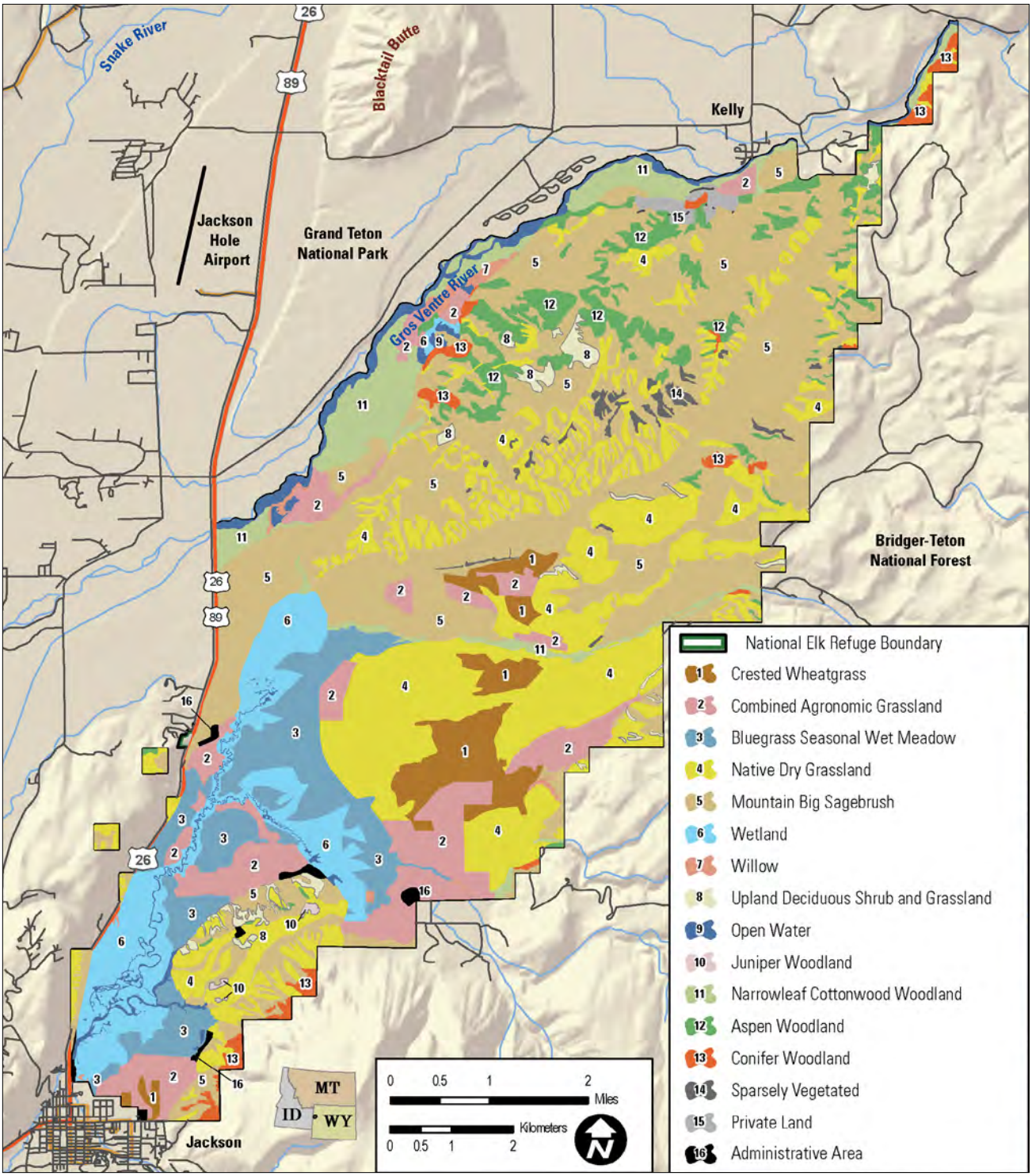

Figure 10. Map of plant communities on the National Elk Refuge, Wyoming.

refuge, sagebrush stands are in poor condition because of overbrowsing by elk and bison and mechanical damage by bison, elk, and feed equipment. Good-condition sagebrush shrubland communities in a late stage of succession have a relatively high diversity and cover of herbaceous plants. It is possible that late-seral sagebrush shrublands on the refuge are overrepresented because of a history of full fire suppression (the benefits of fire were not considered as part of the suppression strategy).

Sagebrush shrublands usually receive more precipitation (or grow on sites with more soil moisture) than grasslands, but less than forested areas. Limited areas of basin big sagebrush have extremely tall sagebrush plants (in excess of 9 feet tall), but most sagebrush communities on the refuge are dense, mature stands of mountain big sagebrush less than 3 feet tall. Communities are made up of shrubs and short trees and are fairly open, and there is a diversity of native perennial grasses and native forbs growing between sagebrush plants. Common species in this vegetative grouping are big and three-tipped sagebrush, bluegrass species, snowberry, wild rose, and smooth brome. Douglas rabbitbrush is found throughout the refuge, but occurs as a subdominant. Other plant species commonly found in sagebrush shrubland communities on the refuge are needlegrass, wheatgrass, snakeweed, and rubber rabbitbrush.

There is conflicting information on the fire-return interval and likely historical density of sagebrush stands in the western United States. Knight (1994) suggested that, on a regional scale, the overall grassland and sagebrush shrubland landscape may be remarkably similar today compared to pre-European settlement. Periodic fires produced patches of grassland and young sagebrush intermixed with dense older stands, and presettlement fire intervals were likely every 20–25 years (Tisdale and Hironaka 1981). Therefore, full fire suppression on the refuge has resulted in larger stands of dense, older sagebrush than pre-European conditions. However, more recent work by Bukowski and Baker (2013) suggests that the historical fire-return interval in mountain big sagebrush stands was 137–217 years. Therefore, fire suppression in existing old, dense, tall sagebrush stands on the refuge might be an appropriate management strategy to protect a rare plant community that is important to greater sage-grouse and other sagebrush-dependent species.

Most sagebrush plant communities on the refuge fall within the greater sage-grouse core area as defined by Wyoming Executive Order 2011–5. The core area encompasses all areas on refuge north of Flat Creek, slopes east of the Chambers management unit, and the bench above the Jackson National Fish Hatchery (WGFD 2011).

Wetlands

The National Elk Refuge contains approximately 2,676 acres of wetlands, including marshlands, wet meadows, and open water (see figure 10). Wetlands function as a natural sponge that stores and recharges ground water supplies. Wetlands moderate streamflow by releasing water to streams (especially important during drought), and they reduce flood damage by slowing and storing floodwater. Wetland plants protect streambanks against erosion because the roots hold soil in place and the plants break up the flow of stream or river currents. Wetlands improve water quality by filtering sediment, pollutants, and excess nutrients from surface runoff. As one of the most biologically productive ecosystems in the world, the nutrient-rich environment of wetlands provides food and habitat for a variety of wildlife.

Wetlands on the refuge are some of the most diverse and important in Jackson Hole because of their water-regulating functions, visual qualities, and importance to wildlife, especially resident and migratory birds. Most wetlands receive moderate to heavy winter use by elk but vegetation generally recovers its dense and tall condition and largely native species composition during the growing season. Bison rarely used wetlands in the past but recently have begun to graze wet areas next to the Poverty Flats feedground and wet meadows near the Jackson National Fish Hatchery.

Marshlands

Marshlands are low-lying and concave or occur on gentle slopes with seepage. They are inundated frequently or continually with water but are most often persistently saturated. Marshes are characterized by emergent, soft-stemmed vegetation (such as bulrush, cattail, rush, and sedge) that is adapted to living in shallow water or in moisture-saturated soils. Spring-inundated sites, which dry by fall, are also included in this category.

Marshland communities occur on approximately 630 acres of the refuge and are dominated by bulrush, cattail, and sedge species (Eric Cole, biologist, U.S. Fish and Wildlife Service, Jackson, Wyoming, personal communication, 2002). These stands develop to full stature each year dependent on water availability. In marshland habitats, considerable residual material remains under the bases of growing plants from the previous years' herbaceous growth, except in areas that have been burned. There are few invasive plant infestations in refuge marshlands.

Wet Meadows

Wet meadow habitats occur on approximately 1,720 acres on the refuge and are comprised of shrubby cinquefoil, sedges, and grasses such as fox-

tail barley, timothy, Kentucky bluegrass, tufted hairgrass, and common horsetail. Approximately 1,450 of the 1,720 acres contain willow plants less than 1.5 feet tall, indicating that mature willow stands have been converted to other plant communities because of decades of heavy elk browsing (Smith et al. 2004). Large numbers of elk on the refuge prevent these suppressed willow plants from growing out of the browse zone. However, the root systems of these willow plants remain intact and continue to produce suckers. This suggests that these areas could still support tall, dense willow communities if they were protected from ungulate browsing.

Wet meadow communities are dominated by nearly 100-percent cover of native sedge species and water-tolerant grasses. In some wet meadow habitats, shrubby cinquefoil is a major component of the cover. There is often little residual cover because of heavy grazing by elk. The amount of residual cover in wet meadow communities varies from year to year depending on the depth of snow cover and grazing pressure. There is little invasion from noxious weed species; however, invasive species, such as Kentucky bluegrass, fowl bluegrass, and clover are present in wet meadow habitats.

Open Water

Open water accounts for 326 acres on the refuge and consists of stream and river channels and sites where standing water persists through most years, including pools and ponds.

Riparian Woodlands and Aspen Woodlands

Riparian areas and aspen woodland communities occur on approximately 3,227 acres of the refuge. These habitat types have been declining in condition and acreage throughout refuge history. Riparian woodlands and aspen woodlands are particularly important as wildlife habitat and have been affected by elk and bison browsing.

Riparian wood¬land habitat consists of approximately 300 acres of willow habitat and about 1,090 acres of cottonwood communities. Riparian woodlands occur along the Gros Ventre River and Flat Creek. Decades of winter browsing by elk have reduced these willows to remnant plants less than 18 inches high. There are 1,450 acres of suppressed willow plants in what are now wet meadow communities, but were once willow habitat. Elk browsing in cottonwood communities has removed understory, and cottonwood trees are not regenerating. Cottonwood stands close to the McBride feedground experience higher snag density and higher down woody debris cover. Cole (2002a, 2002b) did not find a difference in the number of woody plant species in stands closer to feedgrounds as compared to stands farther away, but total woody cover increased with increasing distance from feedgrounds (Smith et al. 2004).

Aspen woodland habitat consists of approximately 1,850 acres of aspen-dominated communities on hillsides, usually some distance from water. Aspen-dominated woodlands are scattered on the Gros Ventre Hills throughout the northern part of the refuge and on the eastern edge of the refuge in the south, next to the Gros Ventre Wilderness. Many aspen stands are characterized by mature trees, with little if any aspen understory. Aspen stands in the northern hills of the refuge appear to be declining slowly, but some aspen communities escape browsing, and stand replacement is occurring periodically. Aspen recruitment is prevented by heavy elk browsing on aspen suckers that prevents most suckers from growing out of the browse zone.

Many aspen stems are approximately 120 years old, which is approaching the maximum lifespan of 150 years. Most of these stands will eventually convert to sagebrush shrubland habitat, primarily in the form of snowberry and rose stands. A few stands may convert to native grassland habitat, depending on their location and the understory condition. Findings by Keigley et al. (2009) suggest that limited-scale regeneration of aspen has occurred on the northernmost parts of the refuge since 2005. Possible but untested explanations of this phenomenon include changes in elk distribution because of wolf predation, changes in elk migration routes associated with changes in elk summering areas, reduction in the number of moose occupying the refuge, or some combination of these factors. Cottonwood and aspen saplings grow inside exclosures (fenced areas) on the upper section of Flat Creek, indicating that these trees can replace themselves if ungulates are totally excluded.

Riparian woodlands and aspen woodlands include stands of quaking aspen, narrowleaf cottonwood, and willows. Mountain big sagebrush, bluegrasses, brome species, Douglas-fir, pinegrass, rose species, sedges, and snowberry in some areas may be codominants (those species that influence the kinds of other species that may exist in an ecological community). Engelmann spruce trees are scattered throughout the woodland stands but are subdominant. Other plant species common in riparian woodlands and aspen woodlands are bearberry honeysuckle, bitterbrush, buffaloberry, chokecherry, horsetail, mountain timothy, muhly, needlegrass, rush species, serviceberry, wheatgrass species, and yellow salsify.

Dobkin et al. (2002) state that willow, cottonwood, and aspen stands on the refuge have been modified by overbrowsing by ungulates; this is based on historical photographs, written records, and an under-

standing of the ecology of these communities. Dieni et al. (2000) and Smith et al. (2004) also note the growing experimental evidence that ungulate browsing is the cause of declines in aspen and cottonwood communities. Dobkin et al. (2002) also found that willow sites on the refuge were "mostly poorly functioning or nonfunctioning ecologically." They concluded that although willow habitat is influenced by flooding, hydrologic conditions, ungulate use levels, fire frequencies, and precipitation patterns, the decline of willows on the refuge appears to be mostly related to heavy browsing (28- to 55-percent removal of annual growth). The decline of willows along Flat Creek in the southern part of the refuge has exceeded 95 percent (Smith et al. 2004). Shrubby cinquefoil, a less palatable woody species, is abundant in this prior range of willows and has probably increased as willows declined. In contrast, willows in the northern end of the National Elk Refuge are moderately browsed, and only some willow plants reach their full height potential. Growth of new willow stems out of the browse zone is sporadic, and there is some space between most willow clumps.

Riparian area restoration would be designed to modify bank and streambed structure and would not address ungulate browsing of willows or facilitate their recovery (Biota 2013a, b; FWS 2013).

Conifer Forests

Conifer forests on the refuge cover 160 acres and consist of Douglas-fir, juniper, lodgepole pine, wheatgrasses, and other plant species. Conifer forests occur mostly on the extreme eastern edge of the refuge in the north and in the south on hillsides next to Bridger-Teton National Forest and on the northern slopes of the Gros Ventre Hills. Elk use the refuge forests and the adjacent national forest land for cover and shelter from winter storms, and they graze on palatable understory shrubs and grasses. Bison rarely use conifer stands.

Regeneration of young conifer trees appears sufficient to replace existing stands, but subdominant species in these communities that are much more palatable to elk, such as serviceberry and chokecherry, are heavily browsed and are not regenerating. Other plant species common in conifer forests on the refuge are bluegrass species, buffaloberry, pinegrass, mountain boxwood, and snowberry.

Cultivated Fields

Cultivated fields, which we plant specifically to augment native forage that is available for elk in the winter, are used extensively by elk and bison. The refuge chooses cultivated plant species based on their palatability, persistence, ability to compete with weeds, low probability that they will invade native grasslands, and their ability to stand up after a heavy snowfall. Only part of the approximately 2,400 acres available for cultivation would likely be cultivated in any particular year. Most cultivated fields on the refuge are irrigated using the K-line irrigation system that was installed in 2010, with limited flood irrigation in the Ben Goe and Pedersen management units.

Ten plant community types are in the cultivated fields in the southern and central parts of the refuge. Dominant plant species include alfalfa, intermediate wheatgrass, Kentucky bluegrass, Russian wild rye, smooth brome, and meadow brome. Smooth brome, the most common species, provides moderate-quality standing forage but is undesirable because of its inability to remain erect in heavy snow. Smooth brome also requires irrigation in drought years and may spread to suitable sites in other cultivated fields and native grassland habitats. Experiments with other plant species are continuing in an effort to find palatable grass species that will meet refuge forage production objectives and to assess the practicality of restoring native species to some areas.

Forage Production

Forage production is an estimate of the amount of food available to elk and bison produced in a given growing season. This includes (1) annual growth of trees and shrubs that is less than 8 feet from the ground, and (2) herbaceous vegetation such as grasses, forbs (nonwoody broad-leaved plants), and weeds, which are a subcategory of forbs. Annual forage production mostly depends on the species composition of the plant community, precipitation, the amount of water available for irrigation, the number of staff members available for irrigation activities, and infestation by insect herbivores such as grasshoppers. The time of year that precipitation occurs is also important; rain in the spring and early summer increases forage production more than later in the year.

Table 8 shows estimates of forage production between 1998 and 2012. Not all annual forage production on the refuge is available to, or used by, wintering elk. Factors such as topography, location, snow accumulation and condition, species preference and palatability, growth form of vegetation, hunting pressure, and other factors work in concert to influence forage availability and elk use. Higher annual forage production often results in shorter supplemental feed seasons, but snow conditions and the number of elk and bison occupying the refuge also influence the length of the feeding season.

Table 8. Estimates of forage production on the National Elk Refuge, Wyoming.

	Type of forage and amount in tons					
Year	*Grass*	*Forb*	*Woody*	*Weed*	*Total*	*Herbaceous*
1998	17,655	1,849	1,344	170	21,018	19,647
1999	13,904	1,924	3,120	0	18,948	15,850
2000	9,879	1,304	2,189	116	13,488	11,299
2001	7,641	1,353	2,230	65	11,289	9,059
2002	7,980	1,323	4,571	228	14,102	9,531
2003	5,185	1,307	3,923	218	10,633	6,710
2004	16,324	2,927	5,153	345	24,749	19,597
2005	15,881	2,011	3,998	98	21,988	17,990
2006	12,757	2,523	3,505	187	18,972	15,468
2007	10,019	2,310	2,861	45	15,235	12,374
2008	13,087	3,272	4,009	57	20,425	16,414
2009	15,100	2,524	3,809	11	21,444	17,635
2010	11,374	2,241	2,335	37	15,987	13,653
2011	15,677	3,226	2,445	4	21,352	18,907
2012	9,873	1,800	1,844	7	13,524	11,677
Annual average	12,156	2,126	3,156	106	17,544	14,387

Source: National Elk Refuge, Wyoming, 1998–2012.

Lori Iverson / FWS

Cottonwood

Invasive Plants

Invasive plant infestations cover about 1,100 acres of the refuge. Invasive plant species (some of which are classified as noxious weeds by the State of Wyoming) are major contributors to the loss of quality wildlife habitat and rangeland, second in scope only to land development. Invasive species are nonnative plants that thrive in early succession plant community conditions where their lack of native controls (such as wildlife and insect grazers, fungal infections, and disease agents) allow them to outcompete native species in colonizing disturbed soil sites. After successful site colonization, invasive plants aggressively spread into surrounding plant communities, outcompeting native and crop plants by crowding them out, changing environmental conditions such as water availability and fire regime, and depositing chemicals into the surrounding soil that prevent other plants from successfully growing in those areas. The result is large and expanding single-species stands of vegetation that provide little or no benefit to native wildlife and insects.

Many invasive plant infestations on the refuge are a direct result of abandoned livestock feeding areas and corrals, old homesites, and roadbeds. At least 19 species of invasive plants are present (table 9).

Table 9. Noxious weed species on the National Elk Refuge, Wyoming.

Scientific name	*Common name*	*Range of infestation acreage*
Cardaria draba	Whitetop	5–30
Carduus nutans	Musk thistle	35–125
Centaurea maculosa	Spotted knapweed	25–120
Centaurea repens	Russian knapweed	<1
Centaurent diffusa	Diffuse knapweed	<1
Cirsium arvense	Canada thistle	0.1–15
Cirsium vulgare	Bull thistle	<0.5–10
Convolvulus arvensis	Bindweed	<0.1
Cynoglossum officinale	Houndstongue	0.2–2
Hyoscyanus niger	Black henbane	<0.2
Lepidium latifolium	Perennial pepperweed	0.1
Leucanthemum vulgare	Oxeye daisy	<0.1
Linaria dalmatica	Dalmatian toadflax	0.2–2
Linaria vulgaris	Yellow toadflax	<1
Matricaria perforata	Scentless chamomile	<0.2
Onopordum acanthium	Scotch thistle	0.1–1
Sonchus arvense	Marsh sowthistle	5–20
Tanacetum vulgare	Common tansy	<0.5
Verbascum thapsus	Wooly mullein	1–15

Invasive species reduce the diversity and number of native plants and change habitats, such as replacing a grass community with a forb community. Invasive plants do not provide quality winter forage for elk and other big game and often modify habitat of native wildlife and insects. Studies in Montana show that bison and deer reduced their use of a particular habitat by 70–82 percent when it was invaded by leafy spurge. Elk forage in bunchgrass sites decreased by 50–90 percent after a spotted knapweed invasion (Teton County Weed and Pest District 2002). Invasive plants also fail to protect and hold soil because they generally have a shallow root system, leading to increased erosion and sedimentation in streams. This, in turn, affects water quality and decreases fish production.

Crested wheatgrass covers approximately 650 acres. While this nonnative plant is palatable to elk and bison in the spring, it has little nutritional value to wildlife as winter forage. Its spread is a concern because the refuge is a winter range for ungulates. Although grassland condition in crested wheatgrass areas is good in terms of relative forage production, minimal erosion, and vigorous grass growth, the cover in these areas of native grass species has been reduced by 50–90 percent and replaced by crested wheatgrass (Eric Cole, biologist, U.S. Fish and Wildlife Service, Jackson, Wyoming, personal communication, 2002). Therefore, the invasion of crested wheatgrass has the potential to modify the condition of native grassland habitats on the refuge.

Cheatgrass has invaded an estimated 250 acres of native grasslands on the refuge. This annual grass is a prolific seed producer and cures out early in the summer, producing sharp, pointed seeds that can injure the eyes and mouths of grazing animals. Cheatgrass may provide forage for elk and bison in the spring during greenup, but has little nutritional value as winter forage. It is considered a serious problem because the dry grass is highly flammable, and after a fire cheatgrass spreads quickly. In the past, cheatgrass was not considered a problem in Jackson Hole because the climate was too wet; the recent drought, however, has allowed cheatgrass to expand rapidly.

The refuge and Grand Teton National Park both use biological, cultural, chemical, and mechanical means to control invasive plants. Invasive plants on the refuge have not substantially affected forage conditions, but spotted knapweed and musk thistle invasions in the park are considered serious (S. Haynes, biologist, Grand Teton National Park, Moose, Wyoming, personal communication, 2002).

Control work can be effective at containing an infestation to existing areas, but it generally is not at the level required to eradicate large infestations. Control operations are expensive, requiring designated staff, equipment, and chemicals. By its very nature, control is never complete because an infestation is never eradicated, and any lapse in vigilance allows the infestation to spread into surrounding areas. Yearly control operations are less expensive than large-scale eradication programs but, over the long term, can be much more expensive. Herbicides are the most effective means of control on invasive plants, but some people are suspicious of their use and concerned about their effects on the environment.

Wildlife

Descriptions of habitat and occurrence follow for wildlife at the refuge—mammals, birds, reptiles and amphibians, and fishes.

Mammals

Forty-eight native species of mammals inhabit the refuge:

- Elk, bison, bighorn sheep, pronghorn, and mule deer are the varied large ungulates (hoofed mammals) common on the refuge.
- Carnivores include coyote, gray wolf, mountain lion, and black bear.
- Small mammals are abundant in Jackson Hole.
- Large rodents that occur in Jackson Hole are yellow-bellied marmots, porcupines, and beavers.
- Midsize predators inhabiting the refuge include badger, bobcat, long-tailed weasel, ermine, mink, and bobcat. Raccoon, skunk, and red fox are uncommon, perhaps because of competition with the coyote.

Elk

Elk are the most abundant large mammal species occupying the National Elk Refuge, and their conservation is the reason the refuge was established. The creation of Yellowstone National Park in 1872 and the National Elk Refuge in 1912 was crucial in terms of protecting elk and their winter ranges in Jackson Hole. The creation of Grand Teton National Park in 1929, as well as its expansion in 1950, consolidated and protected elk summer ranges in Jackson Hole.

Supplemental feeding of elk wintering on the refuge was started in 1912 to mitigate the loss of natural winter range and prevent elk from eating livestock forage on private land next to the refuge. By the 1930s, the feeding program had success¬fully stabilized the elk population. Elk were fed baled hay during at least part of most winters from 1912 to 1975. In 1975, after several years of testing, a switch was made to alfalfa pellets (Smith and Robbins 1984). "No-feeding years" have occurred irregularly and infrequently. Since the refuge was established in 1912, there have been nine years when no supplemental feed was provided for elk; the last such winter was in 1980–81.

Biologists from the refuge and WGFD evaluate several factors to figure out whether feeding is needed, and if so, when it should begin and end. The feeding start date primarily depends on the amount of standing forage that is accessible to elk, which is influenced by (1) the amount of forage produced the previous growing seasons, (2) elk and bison numbers, (3) the timing of migration, (4) winter temperatures, and (5) snow conditions. Feeding typically ends within 1 week of the first day that snow has completely melted on the southern end of the refuge. These conditions correspond with new grass growth or sufficient residual forage from the previous growing seasons being exposed by melting snow. Since 1912, the period of supplemental feeding has ranged from "no feeding" to a maximum of 147 days, with an average of 70 days annually.

The 2013 winter population estimate for the Jackson elk herd was 11,051 animals (D. Brimeyer, biologist, WGFD, Jackson, Wyoming, personal communication, 2013). This is very close to the State's population objective of 11,000 for the herd size. Although the Jackson elk herd as a whole is near objective, the winter distribution of these elk is weighted heavily toward feedgrounds, and subobjectives for the population have not been met. Table 10 portrays population objectives and actual population estimates from 2011 to 2013 for the Jackson elk herd

Table 10. Winter elk population objectives and actual population estimates for the Jackson elk herd and wintering areas from 2011–2013.

Winter range area	*Number of elk*				
	Herd objective	*2011*	*2012*	*2013*	*Average*
National Elk Refuge on feed	5,000	7,746	7,360	6,285	7,130
Gros Ventre drainage	3,500	2,775	3,265	2,982	3,007
Other winter range	2,500	982	894	1,784	1,220
Total	11,000	11,503	11,519	11,051	11,357

and for segments of the population based on where elk spend the winter. The challenge to managers in meeting these objectives is to reduce the number of elk wintering on the refuge while increasing the use of native winter range.

Depending on spring conditions, elk begin leaving the refuge in late March and early April, and almost all elk have left the refuge for calving and summer ranges by mid-May. Historically, it was common for 100–200 elk to summer on the northern portion of the refuge, but currently almost no elk exhibit this behavior. The decline in summer resident elk on the refuge could be linked to hazing activities by refuge staff, the relatively recent presence of denning wolves on the refuge, changes in refuge hunting seasons, or some combination of these factors. The refuge focus for elk management is to reduce the duration of time that elk spend on the refuge to conserve winter forage, minimize the need for winter feeding, and reduce disease risk. Therefore, the decline in summering elk is viewed as a positive development by refuge managers.

Elk summer in five distinct areas: (1) southern Yellowstone National Park; (2) Teton Wilderness; (3) Bridger-Teton National Forest south of Teton Wilderness; (4) Grand Teton National Park north of Beaver Creek; and (5) Wilson to Beaver Creek, which comprises both private and Grand Teton National Park lands. Refuge staff have collared cow elk on the feedgrounds since 1978. The proportion of elk that migrate long distances from Yellowstone National Park appears to have declined over time, while the proportion of elk that migrate relatively short distances (Wilson to Beaver Creek) has increased dramatically. The shift appears to be a long-term population response, rather than individual elk switching summer ranges, but the causes of this shift remain unclear. We are examining data associated with this phenomenon and hope to publish these results by 2014. Changes in elk use of summer range are important to managers because long-distance migration by mammals is imperiled globally, plus it will be difficult to reach the refuge population objective of 5,000 elk with a growing segment of short-distance migrants. Another factor is that the Yellowstone National Park and Teton Wilderness segments are economically important to hunting guides and outfitters.

Monitoring focuses on evaluating the management strategies designed to meet the objectives of the Bison and Elk Management Plan. The primary tasks of the refuge's biological staff are to monitor the following: (1) elk and bison populations; (2) forage production relative to irrigation and other habitat enhancement projects; and (3) variables that determine start and end dates of the supplemental feeding program.

The refuge accomplishments below correspond with the elk management topics in the Bison and Elk Management Plan:

Habitat Goals

- In 2007, the refuge reseeded 100 acres of agricultural fields to increase production of nutritious, palatable natural standing winter forage.
- From 2007 through 2012, refuge staff annually treated approximately 1,000 acres of grasslands with a harrow (a farm implement used to break up and even plowed ground) to break up accumulations of elk and bison manure and to promote grass production.
- In 2010, we installed a new $5.2 million irrigation system to substantially expand and improve irrigation capacity to increase winter forage. Water use was reduced and irrigated acres increased from approximately 900 acres to 3,300 acres annually.

Population Goals

- The refuge set up a new South Unit elk hunt on the refuge.
- The staff developed the online Refuge Hunting Permit Application System to encourage broader participation in the refuge elk hunting program.
- In 2007–12, we provided recommendations and participated in the annual process for setting the elk season and harvest objectives with WGFD and Grand Teton National Park.

Information and Outreach Goals

- In 2007, refuge staff developed the Sleigh Ride Tour Interpretive Manual for the sleigh ride concessionaire to cover key messages of the Bison and Elk Management Plan and the Refuge System. Annually, 20,000 to 25,000 people take this tour.
- In 2007, we started an interpretive training program for the sleigh ride concessionaire's staff to ensure accurate delivery of key messages from the Bison and Elk Management Plan. We conduct this training annually.

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Sleigh ride tours enhance the information and outreach goals of the refuge.

- Since 2007, the refuge has presented programs to key community and conservation organizations that included explanations of management activities and strategies to achieve the goals outlined in the Bison and Elk Management Plan. Organizations and individuals include Grand Teton Association Board of Directors; Jackson Hole Historical Society; Jackson Hole Rotary; The Nature Conservancy; Teton County Commissioners; Wyoming Outfitters and Guides Association; Yellowstone Business Partnership; and local, State, and Federal elected officials.

- Since 2007, we have implemented new visitor programs to highlight refuge management activities and the above topics. Programs include roving naturalist, daily visitor center program, wildlife caravans, and teacher seminars on refuge management.

- Staff conduct school programs designed to build a foundational understanding about refuge management and basic elk and bison ecology for hundreds of school-age children.

- Refuge staff discuss refuge management goals and practices in news releases and articles that we send to an email contact list of several hundred people, including elected officials, media, and local nonprofit organizations.

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Supplemental Feeding Program

- With WGFD, the refuge developed criteria to coordinate the seasonal start of the supplemental feeding program. We have successfully used this criteria since the 2008 feeding season (refuge files). The refuge and our cooperators are collecting remote sensing and elk nutritional data to develop criteria to determine the seasonal end of the supplemental feeding program.

Disease Prevention

- Beginning in 2007, we annually coordinate with WGFD each winter to vaccinate elk for brucellosis.

- The refuge provided money from 2007 through 2013 to WGFD for hiring technicians to collect samples for chronic wasting disease on the refuge and vicinity from hunter-harvested elk during the hunting season. Most years, testing has been at the level of 95-percent confidence of detecting chronic wasting disease at 1-percent prevalence.

- Since 2008, as a standard operating procedure, permanent refuge employees carry a firearm in the tractor during supplemental feeding. They are instructed to immediately shoot any elk that exhibit suspected symptoms of chronic wasting disease. We make

sure that all elk collected are tested for the disease. Employees receive training in identifying the symptoms of chronic wasting disease and must pass a firearms proficiency test.

- In 2009, with the Wildlife Health Office in Bozeman, Montana (Tom Roffe), the refuge started a long-term project to monitor the health of elk and bison herds. The purpose of the project is to identify the presence and prevalence of all diseases in these herds. Also, part of the monitoring project is looking at whether management actions cause environmental conditions that increase the presence or prevalence of diseases. All elk collected for this project are tested for chronic wasting disease. From 2009–2013, 145 elk were collected and tested for a variety of diseases.

- In 2008, the refuge established the Chronic Wasting Disease Working Group, comprised of land and wildlife management agencies that have influence on the Jackson elk herd: Bridger-Teton National Forest, Grand Teton National Park, National Elk Refuge, WGFD, and Yellowstone National Park. The purpose of this group is to share information. When possible, we leverage efforts to detect the presence of the disease and reduce the risk of environmental contamination by chronic wasting disease.

- One of the outcomes from the Chronic Wasting Disease Working Group is a consensus about the importance of increased surveillance for the disease. The Grand Teton National Park, WGFD, and the refuge will all pursue money for more technicians to increase samples from hunter-harvested elk. The coordination of this effort and potential sharing of these technicians between agencies was the topic for the working group meeting in March 2009.

- The WGFD has provided free testing for chronic wasting disease to the refuge and Grand Teton National Park hunters. We anticipate that increased public awareness, combined with the ability for hunters to test their harvested elk, will increase the sample size for testing for chronic wasting disease on the refuge and the Grand Teton National Park.

Planning

- Since November 2012, the refuge has been developing an adaptive resource management plan for the Bison and Elk Management Plan.

Bison

The Jackson bison herd is of special importance as one of the last remnants of the extensive wild herds that once roamed much of North America. As bison continue to inhabit the landscape of what remains of the western frontier, a part of the unique American experience is preserved for future generations. This section describes (1) bison on the refuge, (2) bison in the Greater Yellowstone Ecosystem, and (3) Jackson Hole Wildlife Park.

Bison on the Refuge

The free-ranging bison established fairly well-defined movement patterns in Grand Teton National Park, spending summers in area of The Potholes, Signal Mountain, and the Snake River bottoms and wintering in the Snake River bottoms and farther south (see the "Jackson Hole Bison Herd Seasonal Ranges" map on page 150 of the environmental impact statement for the Bison and Elk Management Plan [FWS and NPS 2007b]). During the early 1970s, the bison wintered in the river bottoms north of the community of Moose and in the Kelly Hayfields vicinity, east of Blacktail Butte. Since the winter of 1975–76, however, most of the herd has wintered on the National Elk Refuge (except during the mild winter of 1976–77).

Our agency has jurisdiction over wildlife including bison on the refuge (16 U.S.C. 668dd) and the National Park Service has jurisdiction over wildlife in Grand Teton National Park (16 U.S.C. 1). In 2002, WGFD and the Wyoming Livestock Board defined two "wild bison" management areas, one for the Absaroka herd and the other for the Jackson herd. The State has jurisdiction over bison from the Jackson wild bison herd in "all lands in Lincoln, Sublette and Teton Counties west of the Continental Divide, excluding Grand Teton National Park, Yellowstone National Park and the National Elk Refuge.

Bison are counted annually on the refuge in the winter and in the park in the summer. As of February 2006, the herd numbered 948. Between 1969 and 1985, the refuge did little to manage bison. We documented the size of the herd and its sex and age composition on an opportunistic basis. A study was initiated in 1997 to find out more about bison demography, reproduction, and effects of brucellosis on the population.

Soon after the bison began wintering on the National Elk Refuge, they discovered the supplemental feed put out for the elk. Although the staff tried to haze bison away from the elk feeding areas, our efforts were largely unsuccessful. Consequently, the refuge staff resorted to liberally feeding bison to keep them away from elk feed lines and to reduce conflicts. We are concerned about bison wintering on the refuge because of (1) increased consumption of supplemental feed and the associated cost; (2) conflicts with the elk-feeding program and management guidelines for the refuge; (3) human safety concerns near the refuge visitor center, along Elk Refuge Road, and in the town of Jackson when bison approached the refuge's southern entrance; and (4) property damage such as broken fences and signs. Since discovering the elk feed lines on the refuge in 1980, the bison herd has greatly increased in size. We culled 16 bison and conducted a special permit hunt (taking 19 bison) in an effort to reduce the herd. However, litigation brought hunting to an end on the National Elk Refuge. We had not done any herd reductions on the refuge since 1990, and the bison population continued to grow at a rapid rate, increasing annually by approximately 10–14 percent.

In the 1970s and 1980s, bison on private land or animals that were a threat to human safety or property were shot. In 1989, the Wyoming Legislature authorized a reduction season for wild bison. To slow population growth, WGFD reinitiated hunting in 1998, outside the National Elk Refuge and the Grand Teton National Park, where bison could legally be hunted. Few bison have been killed, however, because the animals are mainly distributed within the refuge and park lands. The annual number of bison harvested ranged from a low of 4 in 1998 to a high of 47 in 2002.

Bison hunting was initiated under the environmental impact statement for the Bison and Elk Management Plan (FWS and NPS 2007b) in 2007. From 2007 to 2013, hunters harvested an average of 204 bison per year. This harvest level has been enough to prevent further growth of the Jackson bison herd, but sustained reduction in the population to the objective of 500 bison has not been achieved. As of winter 2013, there were approximately 850 bison in the Jackson herd.

The refuge accomplishments below correspond with the bison management topics in the Bison and Elk Management Plan:

Habitat Goals

Same as under "Elk" above.

Population Goals

- In 2007, we started an annual, public, bison hunting season to reduce the population. The season length was increased several times to maximize harvest. We offered a 145-day season in 2012–13, from August 15 through January 6. Annual harvest is strongly linked to weather conditions and has varied from a high of 266 to a low of 139.

- In 2008, we developed the first memorandum of agreement with the Shoshone-Bannock Tribes to conduct a ceremonial bison event on the refuge. The tribes have harvested an average of five bison annually through this agreement.

- The bison winter population has been reduced from approximately 1,250 in 2007 to approximately 850 in 2013.

Information and Outreach Goals

Same as under "Elk" above.

Disease Prevention

- The refuge denied WGFD's request to administer the brucellosis vaccination to 700 bison using syringe darts during the winter of 2007–8. The effective retrieval of used syringes from bison using this untested approach was in question. Large numbers of unretrieved syringes littering the refuge would pose a safety hazard to refuge employees, hunters, and other wildlife. The WGFD decided the delivery system needed further refinement and did not make a similar subsequent request.

- In 2009, with the Wildlife Health Office in Bozeman, Montana (Tom Roffe), the refuge started a long-term project to monitor the health of elk and bison herds (same as under "Elk" above).

Planning

Same as under "Elk" above.

Bison in the Greater Yellowstone Ecosystem

The American bison is native to Jackson Hole (Ferris 1940, Fryxell 1928, Hall and Kelson 1959, Long 1965, Love 1972, McDonald 1981, Skinner and Kaisen 1947, Wright et al. 1976). Prehistoric bison remains have been found throughout the valley, along the Gros Ventre River, on the western slope of the

Lori Iverson / FWS

Moose

Gros Ventre Range, on the National Elk Refuge, and along the Snake River south of Jackson (Ferris 1940, Fryxell 1928, Love 1972). Historically, bison likely lived in the northern areas of Jackson Hole as well, especially in summer. Areas where bison remains have been found represent key ungulate wintering areas, where most bison mortality would be expected to occur.

We do not know how many bison once lived in Jackson Hole. At least one reference exists, however, for an observation of "a large herd of buffalo in the valley" in June 1833 (Ferris 1940). The near extinction of the American bison occurred throughout the 19th century. By the 1820s, bison were confined almost exclusively to lands west of the Mississippi River. Many of these herds began to decline after 1830, as market hunting for hides accelerated, and prolonged drought in the 1840s further reduced bison numbers. After the Civil War, competition from domestic cattle and the greatly intensified market hunting for "buffalo" robes and tongues decimated the Great Plains herds. Tourists on railroad-shooting excursions killed thousands more. A final contributing factor was the introduction of cattle-borne contagious diseases, which reached epidemic proportions in 1881 and 1882. The combination of cattle, hunting, and epidemic disease all but eradicated the once immense western herds. By 1890, only about 300 bison remained in the United States (Malone et al. 1976).

Bison were mainly extirpated from the Greater Yellowstone Ecosystem, including Jackson Hole, by the mid-1880s (Trenholm and Carley 1964). A small herd continued to live in Yellowstone National Park (Bailey 1930, as cited in Long 1965; Wright 1984). While private herds existed throughout the United States, by 1902 no more than 23 individual bison remained of the thousands that had occupied the Yellowstone area since prehistoric times (Callenbach 1996). A small group of 8–12 free-ranging bison, whose origin is unknown, persisted in west-central Wyoming's Red Desert until the mid-1950s (Love, personal communication, as cited in NPS and FWS 1996).

Jackson Hole Wildlife Park

Except for three Yellowstone National Park bison that wandered south into Jackson Hole in 1945 (Simon, no date), bison were absent from Jackson Hole from at least 1840 until 1948. That year, 20 animals (3 bulls, 12 cows, and 5 calves) from Yellowstone National Park were reintroduced to the 1,500-acre Jackson Hole Wildlife Park near the community of Moran. This was a private, nonprofit enterprise sponsored by the New York Zoological Society, the Jackson Hole Preserve, Inc., and the Wyoming Game and Fish Commission (Simon, no date). Jackson Hole Wildlife Park served as an exhibit of important large mammals as well as a biological field station for the Rocky Mountain area. The 20 bison were considered the property of Wyoming.

In 1950, the expansion of Grand Teton National Park took in the Jackson Hole Wildlife Park, and management of the bison shifted to the National Park Service. By 1963, the National Park Service coordinated most management actions with WGFD: winter feeding, capturing bison that escaped the confines of the wildlife park (which occurred several times annually), and routine brucellosis testing and vaccination. The national park kept a population of 15–30 bison in a large enclosure until 1963 when brucellosis was discovered in the herd. Several months later, the 13 adults were destroyed to rid the herd of the disease. The national park kept four yearlings that had been vaccinated against brucellosis as calves and five new calves, which had also been vaccinated. In 1964, 12 certified brucellosis-free bison (6 adult males and 6 adult females) from Theodore Roosevelt National Park were added to the Moran bison population, bringing the total number of animals to 21. These bison represented the latest in a long line of introductions from several herds (Shelley and Anderson 1989). In 1968, the population was down to 11 adults, all of which tested negative for brucellosis, and 4 or 5 calves. Later that year, the entire herd escaped the confines of the park. In 1969, the National Park Service eventually allowed the herd to range freely, par-

tially because of recommendations contained in a report commissioned by the Secretary of the Interior on wildlife management in the national parks (Leopold et al. 1963).

Bighorn Sheep

Historically, bighorn sheep on the refuge were primarily winter residents that migrated from the Gros Ventre Range. From November to May, they occurred on the eastern slopes of Miller Butte and in the eastern parts of the refuge near Curtis Canyon. In recent years, small numbers of sheep have been observed on Miller Butte year-round, although peak numbers occur in winter, with most still migrating to the Gros Ventre Range. As many as 98 bighorn sheep were observed during on Miller Butte in 2012, and 62 sheep were observed in winter 2013.

Pronghorn

As many as 60 pronghorn have summered on the refuge in recent years. Occasionally, up to 34 pronghorn have wintered on the refuge, but survival for overwintering pronghorn is typically poor due to severe winter conditions and predation by coyotes.

In the past, as many as 450 pronghorn summered in Jackson Hole (including the Bridger-Teton National Forest, Grand Teton National Park, and National Elk Refuge). Although the population declined to approximately 175 in the early 2000s, recent surveys suggest there are approximately 400 pronghorn in Jackson Hole. Most pronghorn migrate south out of the valley, through the Gros Ventre Range, to winter range in the Green River Basin, which is about 100 miles one way.

Mule Deer

In spring through fall, a small number of mule deer can be found on the northern part of the refuge in the Gros Ventre Hills and along the Gros Ventre River. These deer may leave this area at the beginning of elk hunting season in October. Mule deer on the refuge winter primarily on Miller Butte, but their numbers have greatly declined since the refuge closed an old feed shed that allowed deer access to alfalfa pellets. No deer were seen on Miller Butte during the winters of 2001–2, 2002–3, 2003–4, or 2004–5; eight were seen in the winter of 2005–6.

Mule deer in Jackson Hole belong to the deer herd in Sublette County (southeast of Teton County), whose estimated population averaged 24,528 from 2007 through 2011, with an estimate of 21,969 for 2012 (WGFD 2013). The Sublette deer herd ranges from the Wind River Range north to the Gros Ventre Range, west to the Wyoming Range, southwest to the Green River Basin, and southeast to the Little Colorado Desert. A small proportion of these deer come into Jackson Hole, and they are not counted separately from the Sublette herd as a whole. Some mule deer winter in Jackson Hole and can often be seen in Jackson and on East Gros Ventre Butte.

Moose

The Jackson moose herd was an estimated 500 animals in 2012, with an average of 1,085 moose from 2007 through 2011 (WGFD 2013). Moose range covers the Bridger-Teton National Forest, Grand Teton National Park, and National Elk Refuge; however, only 3–14 moose winter on the refuge each year. In the past 20–30 years, moose used riparian habitat along the Gros Ventre River on the refuge during the winter. Both moose and elk browse on willow, aspen, and other woody shrubs. Bison do not typically browse on woody vegetation (except near feedgrounds), but they rub against trees and seek shelter in riparian areas. The decrease in woody vegetation because of large numbers of elk on the refuge likely has had a negative effect on moose on the refuge over the long term.

Gray Wolf

Gray wolves were deliberately exterminated from the Greater Yellowstone Ecosystem by the 1930s and were placed on the Federal endangered species list in 1973. After years of scientific research and public debate, 66 gray wolves from Canada were reintroduced into the Greater Yellowstone Ecosystem (31 wolves) and central Idaho (35 wolves) in 1995 and 1996 (FWS et al. 2003). They were classified as a nonessential, experimental population in accordance with the Endangered Species Act. This means that the species is treated either as proposed for listing in a national forest or as threatened in a national park or a national wildlife refuge (50 CFR 17). This nonessential, experimental population designation allows more flexibility to Federal, State, and tribal agencies, and private citizens in managing the wolf population. The wolf expanded rapidly under these protections, the population exceeded recovery goals, and wolves in Wyoming were removed from the Endangered Species list in 2012.

The gray wolf now falls under the management authority of WGFD, and the 2012 Wyoming Gray Wolf Population Monitoring and Management Annual Report provides recent information on wolf population trends in Wyoming (WGFD et al. 2013). In northwestern Wyoming, the wolf is considered a trophy game species with a limited-quota hunting season. No wolf hunting is allowed on the National Elk Refuge, Yellowstone National Park, or Grand Teton National Park, but wolves that den in these protected areas are subject to harvest when they venture onto surrounding national forest, State, and private lands.

Because of changes in protected status, the wide-ranging nature of the species, and potential effects of

wolves on elk numbers and distribution, the refuge cooperatively monitors wolf populations with WGFD and Grand Teton National Park. Wolves have been active on the refuge since 1999, and the first wolves denned on the refuge in 2005. The Pinnacle Peak pack has consistently denned and produced pups on the refuge from 2008 to 2012, and preliminary monitoring suggests that they denned on the refuge in 2013. Members of the pack are commonly observed by refuge visitors on the southern end of the refuge during the winter.

Studies in the Greater Yellowstone Ecosystem documented that elk compose more than 85 percent of wolf kills during the winter (FWS et al. 2003; Jaffe 2001, Mech et al. 2001.). However, preliminary evidence suggests that winter elk mortality has not increased since wolves began using the refuge in 1999. This indicates that wolf activity on the refuge has resulted in compensatory rather than additive mortality in elk—this means that wolves have mostly been killing elk on the refuge that would have died anyway.

Coyote

Coyotes are plentiful in the Greater Yellowstone Ecosystem, including the refuge. Several family groups live year-round on the refuge, but the number increases to nearly 100 as transient coyotes follow the elk herds to the refuge in the winter (F. Camenzind, biologist, Jackson Hole Alliance, Jackson, Wyoming, personal communication, 2003).

Coyotes are opportunistic predators that readily feed on carrion, but they also catch a variety of small mammals from mice, squirrels, and rabbits to fawns and calves. In addition, coyotes will feed on insects and fruit. In winter, elk and occasionally bison carrion on the refuge are an important part of the coyote diet. In spring, coyotes may take elk calves during the calves' first month of life. Coyotes rarely have the opportunity to kill bison calves because of the presence of the herd and protective mothers.

Mountain Lion

Mountain lions (also known as "cougars" or "pumas") occur throughout the Greater Yellowstone Ecosystem, including the refuge. A mountain lion and her three kittens were seen frequenting a cave on Miller Butte for 2 months during the winter of 1999. She was a skilled elk and deer hunter and provided a great wildlife-watching opportunity.

Mountain lions feed mainly on ungulates, primarily deer, throughout much of their distribution, but they can take elk, moose, and bighorn sheep. Where elk are abundant, they can become a large part of the mountain lion diet (Ruth 2004). Mountain lions have also been known to feed opportunistically on wild horses, beavers, porcupines, raccoons, and hares, indicating one of the most varied diets of any predator in the Western Hemisphere (Hansen 1992).

Mountain lions prey mostly on a combination of deer and elk in Jackson Hole, relying more on elk than in other areas of the country because of the large elk herd (Moody, personal communication, 2002; Quigley et al. 2005). The Teton Cougar Project began in January 2001 and is focusing field investigations on mountain lion predation (the Wildlife Conservation Society originally operated the project, which is now operated by Craighead Beringia South). Information collected shows that elk made up approximately 80 percent of 86 mountain lion kills from 2000 to 2004 (Quigley et al. 2005).

Black Bear

Black bears rarely occur on the refuge but are common in the Bridger-Teton National Forest and Grand Teton National Park. While black bear numbers are unknown, their population is considered stable. Inhabiting forested areas, they feed on nutritious, succulent vegetation and on grubs, fish, newborn ungulates, and carrion. Elk and bison carrion may occasionally provide valuable protein. Black bears are known to successfully prey on elk calves. Smith and Anderson (1996) reported that, from 1990 to 1992, 22 of 145 radio-collared calves died before July 15; black bears were responsible for 11 of these mortalities. During the late 1990s, black bears were responsible for 16 of 42 calf deaths (B.L. Smith, personal communication, 2003). In a north-central Idaho study, black bears killed 38 of 53 marked calves, or 72 percent (Schlegel 1976). Bison calves are not usually vulnerable to black bears because bison cows can adequately defend their young.

Small Mammals

Small mammals in Jackson Hole are abundant. Suitable habitat is the most important factor influencing the distribution and abundance of small mammal populations. Many small mammals occupy a wide variety of habitats, while others have specific needs that limit their distribution (refer to table 11). In general, most species prefer more mesic (neither wet nor dry) environments, and edge habitats generally support more species than interior habitats.

Small mammals depend on grasses for forage, as well as for cover from predators. Riparian areas and aspen typically support a greater abundance of small mammals and a greater diversity of species, although many of these species can be found in other habitats. Browsing by elk and bison has greatly altered some small mammal habitats on the refuge, which likely has changed the type of species found in affected areas. A small mammal study conducted on the refuge in the summers of 2000 and 2001 identified four species inhabiting cultivated fields—deer mice, voles,

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Pronghorn

shrews, and short-tailed weasels (L. Swanekamp, master's student, Montana State University, Bozeman, Montana, personal communication, 2002).

Overgrazing by large numbers of elk and bison can limit the numbers of rodents that can survive in grassland and sagebrush shrubland habitats. Irrigation, especially flood irrigation, designed to increase elk forage, can have a negative effect on small mammals by flooding burrows. The effects of K-line sprinkler irrigation on small mammal communities are unknown, but flooding effects of the K-line system on small mammal populations are likely to be far less than with flood irrigation. The number of flood-irrigated acres has been greatly reduced under the new system, which could benefit some small mammal species and their predators.

Table 11. Small mammals that occur in various habitats on the National Elk Refuge, Wyoming..

Habitat	*Common mammals*		
Native grasslands and cultivated fields	Deer mouse Desert cottontail Long-tailed vole	Merriam's shrew Northern pocket gopher Sagebrush vole	Uinta ground squirrel Wyoming ground squirrel Yellow pine chipmunk
Sagebrush shrublands	Deer mouse Desert cottontail Dusky shrew Heather vole Least chipmunk Long-tailed vole	Masked shrew Meadow vole Merriam's shrew Mon¬tane vole Mountain (Nuttall's) cottontail	Northern pocket gopher Sagebrush vole Uinta ground squirrel Wyoming ground squirrel Yellow pine chipmunk
Riparian woodlands and aspen woodlands	Deer mouse Desert cottontail Dusky shrew Golden-mantled ground squirrel Heather vole Long-tailed vole Masked shrew Meadow vole	Montane vole Mountain cottontail Muskrat Northern flying squirrel Northern pocket gopher Red squirrel Snowshoe hare Southern red-backed vole Uinta chipmunk	Uinta ground squirrel (aspen) Vagrant shrew Water shrew Water vole Western jumping mouse Wyoming ground squirrel Yellow pine chipmunk

Source: Based on the University of Wyoming, Geographic Information Science Center, Species Atlas, 2003.

Large Rodents

Large rodent species that occur in Jackson Hole are yellow-bellied marmot, porcupine, and beaver. Elk and bison probably do not affect marmots, but the decline of woody vegetation on the refuge because of browsing by elk and bison has likely reduced the amount of habitat available for porcupines and beavers:

- Marmots occupy rocky slopes of upper elevations, living in burrows in open areas and eating a variety of green vegetation.
- Porcupines occur in upland shrublands, riparian woodlands, and aspen woodlands. Porcupines feed on leaves, twigs, and green plants during the summer. In the winter, they subsist by chewing through the rough outer bark of trees to feed on the inner bark.
- Beavers are common in the Gros Ventre River area and in associated ponds on the northern end of the refuge. Historically, beavers occurred on the southern end of the refuge, but as willow habitat along Flat Creek declined in acreage and height, the beavers disappeared (Smith et al. 2004). Beavers inhabit rivers, streams, marshes, lakes, and ponds and use the adjacent woody, riparian areas. They feed on green plants and the bark of certain trees and shrubs, such as aspen, cottonwood, and willow.

Midsize Predators

Other predators inhabiting the refuge include badger, bobcat, long-tailed weasel, ermine, mink, raccoons, red fox, and skunk. The presence of large predators and high densities of coyotes appears to limit the abundance of midsize predators. These species prey on small mammals, and a few may opportunistically feed on elk or bison carrion, but they do not depend on it as a food source. Bobcats may take an occasional elk calf, but calf-mortality studies show that this is not a substantial cause of mortality (Smith and Anderson 1996). Mink are not known to feed on bison or elk carrion. There have only been incidental observations of raccoons and skunks, and the absence of these animals potentially reduces nest predation on breeding birds. Red fox have increased in abundance in the past decade, but still occur at relatively low densities compared to surrounding areas.

Birds

Approximately 175 species of birds have been observed on the National Elk Refuge. This section describes neotropical migratory birds, grouse, waterbirds, and predatory and scavenger birds on the refuge.

Neotropical Migratory Birds

Neotropical migratory birds, which breed in North America and spend their winters in the tropics, have been experiencing population declines throughout their range (Terborgh 1989, USGS 1999). Habitat fragmentation by development, changes in plant communities associated with invasive plant species and ungulate herbivory, and destruction of winter range are among the factors believed to be responsible for these declines (Dobkin 1994, Dobkin and Wilcox 1986, George and Dobkin 2002, Martin and Finch 1995).

Many species of neotropical migratory birds are declining in North America because of an inability to raise young successfully rather than from mortality of adult birds (Herkert et al. 1993). Loss of habitat has long been suspected as contributing to nest failure and low survival of young birds, but habitat fragmentation plays an important role (Kaufmann 1996). In fragmented landscapes, neotropical species suffer high rates of nest predation by mammals and birds and high rates of nest parasitism by brown-headed cowbirds. Researchers have shown that habitat size, shape, and the amount and type of edge can all affect breeding success. Edge habitats support a larger variety and higher density of predators (Lompart et al. 1997).

Nest Predation and Parasitism

Potential nest predators, such as crows, magpies, and ravens and foxes, raccoons, and skunks are attracted to habitat edges, often preying on eggs and young birds in narrow strips of riparian habitat and near edges of larger forests (Wilcove 1985, Yahner 1988). In some forests, this edge-enhanced nest predation has been documented to extend more than 300 feet into the interior of the forest patch (Wilcove 1985). Martin (1988, 1993) found that nest predation can account for, on average, 80 percent of nesting failures, and Donovan et al. (1997) established that where habitats are fragmented, predators gain greater access to nests at forest edges.

Brown-headed cowbirds are common in Jackson Hole, and cowbird parasitism can reduce productivity for many neotropical migratory bird species. Cowbirds lay their eggs in the nests of other birds, often removing a host egg before laying one of their own. Cowbird chicks hatch earlier and grow faster than host chicks, which results in the cowbird young

receiving most of the food and parental care from the foster parents. Female brown-headed cowbirds prefer edge habitats and can lay up to 77 eggs in a single season (Jackson and Roby 1992). Edge-tolerant songbird species can often recognize cowbird eggs and remove them from the nest, or they may abandon parasitized nests. These edge-tolerant species are often permanent residents or short-distance migrants and can nest several times in a season. This increases their chances of raising a successful brood, since cowbirds rarely parasitize late-season nests (Ehrlich et al. 1988). In contrast, interior-forest birds, which are usually long-distance migrants and only nest once or twice a year, often fail to raise any young of their own when forced to nest in edge habitats because they have not evolved behaviors to cope with nest parasitism. As a result, interior-forest species such as the veery and the American redstart disappear from small patches of forest habitat, and edge-tolerant species such as the American robin and house wren greatly increase (Herkert et al. 1993).

Habitat Size

On the refuge, small or narrow patches of riparian woodland and aspen woodland habitats often comprise sparse mature trees and lack of shrubs and small trees in the understory because of overbrowsing by ungulates. However, even if these patches are protected in some manner resulting in dense stands of small trees and shrubs, neotropical migratory birds may not benefit because of the size and shape of the individual patches for the reasons discussed above. To benefit tree- and shrub-nesting migratory birds, protection of stands from ungulate browsing should be limited to those stands that are large enough to support breeding populations of these species.

An example of a narrow habitat patch would be the cottonwood community along upper Flat Creek. This long riparian strip may always be too narrow to provide interior habitat for neotropical migratory birds that require interior-forest conditions for successful nesting. Some species of birds may avoid such areas and not attempt to nest, while others may make unsuccessful nesting attempts. For those birds that attempt nesting but fail to fledge young because of high predation and parasitism rates, this area may become (or possibly has always been) a "population sink." Nevertheless, small or narrow tracts of riparian woodland and aspen woodland habitats are still valuable to a variety of birds as stop¬over sites during migration and have other beneficial effects such as preventing streambank erosion and improving fish habitat.

Native Grasslands and Sagebrush Shrublands

Grassland and sagebrush shrubland plant communities provide important breeding habitat between May and mid-July for some neotropical migrant species, and these cover types are abundant on the refuge. Typical bird species that nest in sagebrush shrublands are Brewer's sparrows, sage sparrows, and sage thrashers. Many sagebrush bird species are declining as habitat throughout the West is converted to farmland and development. As riparian area and aspen habitats on the refuge are converted to sagebrush habitat because of heavy elk and bison browsing, more sagebrush shrubland habitat will become available to bird species that depend on that habitat.

Riparian Woodlands and Aspen Woodlands

In the arid West, riparian woodland and aspen woodland habitats with a shrub understory (1) support the most species-rich communities of breeding birds (Dobkin and Wilcox 1986; Knopf et al. 1988; Mitton and Grant 1996; Saab et al. 1995; Tewksbury et al. 2002), (2) provide important migration habitat for migratory landbirds (Dobkin 1994), and (3) are centers for biological diversity (Brussard et al. 1998). These habitats are crucial for breeding habitat and migration stopovers for 80 percent of migratory bird species (Krueper 1992), because they are used extensively for feeding, nesting, shelter, and travel corridors. The open canopies allow sunlight to reach the ground, producing a rich understory of shrub and herbaceous species offering structural diversity. The layered structure of these woodlands provides many niches for birds. Cavity nesters use snags for nest sites, while predatory birds perch on dead trees to scan for prey. Neotropical birds nest at different levels, and they feed on the diversity of insects found in woodlands.

The ecological health of a woody plant community can be directly measured by bird species composition, their relative abundance, and breeding success (Dobkin et al. 2002). Riparian woodlands and aspen woodlands shelter many bird species that have relatively narrow needs for breeding habitat. These species may occur chiefly or exclusively in willow, aspen, and cottonwood communities. In the southern part of the Greater Yellowstone Ecosystem, ecologically intact riparian woodlands or aspen woodlands can have 76 species of birds closely associated with it during the nesting season, and 23 species (neotropical migrants) will be common and relatively abundant (Dobkin et al. 2002).

Cattle and wildlife grazing and browsing, especially in arid systems, can greatly affect the quality of riparian habitat for neotropical migrants (Ammon and Stacey 1997, Roath and Krueger 1982, Saab et al.

1995, Taylor 1986). Upland aspen has been declining in Jackson Hole for the last several decades (Loope and Gruell 1973), as well as throughout the West (Kay 1998). Fire suppression is a major factor in the reduction of aspen (Kay 1998, Loope and Gruell 1973, White et al. 1998). On the refuge, ungulate browsing has greatly accelerated this decline (Anderson 2002, Dieni et al. 2000).

The mixture of riparian and upland aspen habitats found on the refuge is important to a variety of species. Anderson (2002) observed 25 bird species in riparian woodland habitats and 54 species in upland aspen habitat in Jackson Hole. Riparian woodlands and aspen woodlands that lack recruitment, such as those found on the refuge, are structurally simplified and support a less diverse community of bird species. Birds found in this simplified habitat generally have habitat needs that can be met in a wide variety of habitat types. Trabold and Smith (2001) found that European starlings on the National Elk Refuge overwhelmingly dominate the cottonwood riparian habitat along Flat Creek. This is typical of highly fragmented cottonwood habitat with low numbers of bird species (Gutzwiller and Anderson 1987). Many native cavity nesters cannot successfully compete with the highly aggressive starling. Aspen stands on the refuge also have low abundances of native bird species that are typically found in aspen, such as red-naped sapsucker and MacGillivray's warbler (Anderson and Anderson 2001). Some widespread habitat specialists are completely absent including broad-tailed hummingbird, calliope hummingbird, rufous hummingbird, veery, Swainson's thrush, orange-crowned warbler, black-headed grosbeak, fox sparrow, and song sparrow (Dieni and Anderson 1997).

The decline of woody vegetation on the refuge and the resultant decline in neotropical migrants is attributed to 100 years of heavy browsing by elk and almost 40 years of browsing by bison. Anderson (2002) conducted a study in and around Jackson Hole specifically to determine the effect, if any, that supplementally fed elk were having on landbird distribution in willow and upland aspen habitats. Anderson's (2002) results are summarized below:

- Willow habitats that are heavily browsed by elk are characterized by (1) lower willow volume, (2) lower willow shrub diameter, (3) fewer willow habitat bird specialists, (4) fewer species that nest in willow, and (5) fewer aerially foraging species.

- Riparian areas closest to feedgrounds receive the heaviest elk use and experience the greatest loss in bird species that depend on riparian habitat, such as willow flycatcher, yellow warbler, MacGillivray's warbler, fox sparrow, and song sparrow. Species of birds that are abundant near feedgrounds include those that typically nest in grasslands or sagebrush shrublands, such as Savannah sparrow, vesper sparrow, western meadowlark, and Brewer's blackbird.

- Nest predators, such as common ravens and black-billed magpies, were also more common near feedgrounds, possibly because of the greater availability of elk carcasses. These nest predators may accelerate the decline of neotropical migrants.

- Aspen woodland habitats that were browsed heavily by elk were characterized by (1) less understory volume of vegetation, (2) lower densities of nonsapling live and dead trees, (3) greater proportions of dead aspen trees (nonsapling), (4) more regeneration of suckers less than 1.6 feet, (5) less recruitment to overstory, (6) a lower density of aspen saplings, (7) a lower proportion of the stands with saplings, (8) higher rates of sucker browsing, (9) a lower proportion of suckers, (10) more damage to bark, (11) a higher density of dead trees, and (12) a higher proportion of the stands with dead aspen trees.

- Aspen woodland habitats heavily browsed by elk were also characterized by (1) fewer species of birds that nest and feed in the understory, (2) fewer species of birds that nest and feed in forest canopies, (3) fewer ground-nesting species, and (4) a greater abundance of cavity-nesting birds, probably because of the higher rates of aspen decay and mortality.

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Bohemian Waxwing

- Aspen stands on the refuge that received high elk use (stands with the longest duration of high elk densities) had a substantially lower diversity of birds, and birds were less abundant as compared to aspen stands with low elk use. When aspen stands are converted to sagebrush shrubland habitat by high elk use, there is an exchange of approximately 20–40 bird species for 3–5 bird species that are generally more common than those found in aspen stands.

- Recruitment of willow and aspen was extremely rare both on the refuge and near the WGFD Gros Ventre feedgrounds.

Smith et al (2004) corroborated Anderson's finding through an analysis of historical refuge photographs and experimental monitoring of fenced areas where elk and bison were excluded. They estimated that 95 percent of potential willow habitat had been lost on the southern end of the refuge due to browsing by elk and bison and that most willow, aspen, and cottonwood stands on the southern end of the refuge had insufficient regeneration to perpetuate themselves.

Cultivated Fields

Neotropical migrant species that can be found in the cultivated fields on the refuge include Brewer's sparrow, Savannah sparrow, vesper sparrow, and western meadowlark (Dieni 2011). These species also occur in native grasslands.

Ruffed Grouse

Ruffed grouse are generally widespread and common, occurring in deciduous and mixed woodlands. Conifer forests may be used for shelter, while deciduous habitats are primarily used for food. Because elk browse on the woody vegetation that ruffed grouse rely on for their winter diet, changes in woody vegetation can affect ruffed grouse populations on the refuge.

Sharp-tailed Grouse

Sharp-tailed grouse were eliminated from the refuge by the mid-20th century due to loss of willow and aspen habitat (Smith et al. 2004). However, as of 2001, small numbers of sharp-tailed grouse have returned to Jackson Hole, and the birds are occasionally observed in the Flat Creek area and the northern end of the refuge during the winter. Breeding has been confirmed for at least one location in Grand Teton National Park, which is the likely source of these grouse on the refuge. Given the dependence of this species on tall, dense deciduous shrub and aspen communities and the lack of this habitat on the refuge, it is unlikely that a breeding population of sharp-tailed grouse will become established on the refuge.

Waterbirds

Species of waterfowl, shorebirds, rails, and cranes that use the refuge are diverse and in most cases have habitat linked to aquatic or wetland features. They are vulnerable to predators because of their location on the ground, and they must rely on dense vegetation for camouflage or water levels high enough to impede nest raiders.

Several species of waterfowl—trumpeter swan, Canada goose, mallard, green-winged teal, gadwall, American wigeon, common goldeneye, Barrow's goldeneye, and common merganser—are year-round residents on refuge wetlands. However, most waterfowl and shorebird species in Jackson Hole are seasonal migrants. Rocky Mountain Canada geese nest on wetlands throughout Jackson Hole, and fall populations on the refuge number 300–500, with about 100 overwintering. Duck populations range from 200 to 500 annually, with gadwall, mallard, ring-necked duck, green-winged teal, cinnamon teal, and Barrow's goldeneye the largest contributors. Peak numbers of waterfowl in the fall are close to 3,000, and about 200–300 birds overwinter on the refuge.

Common shorebird and rail species that breed on the refuge include killdeer, long-billed curlew, willet, spotted sandpiper, Wilson's phalarope, and sora. These species occupy a wide range of plant communities from dry grasslands, in the case of the long-billed curlew, to dense cattail–bulrush marsh in the case of the sora rail.

The greater sandhill crane nests in small numbers in Jackson Hole, and fall concentrations of more than 150 birds have been observed on the refuge.

Predatory and Scavenger Birds

Jackson Hole has many resident species of predatory birds including the following:

- golden eagle
- bald eagle
- peregrine falcon
- prairie falcon
- northern harrier
- red-tailed hawk
- Swainson's hawk
- American kestrel
- rough-legged hawk
- great horned owl
- short-eared owl

Eagles and hawks are all predators, but their preferred prey varies widely. Small hawks typically feed on insects, while the larger hawks feed on birds and

small mammals. Eagles may take prey as large as foxes. Falcons often specialize on birds but may also take rodents and insects. Some of these raptors feed opportunistically on carrion, especially in winter.

Black-billed magpies and common ravens are omnivores that eat a wide variety of insects, rodents, lizards, and frogs, as well as eggs and hatchlings of other birds. They often feed as scavengers on carrion and human garbage. Elk carrion is an important source of food in the winter for bird scavengers on the refuge.

Reptiles and Amphibians

Only 11 reptile and amphibian species are present in Jackson Hole because of the high altitude and its associated cool climate. Most species are observed throughout the valley floor and foothill regions, especially on the floodplains of the Buffalo Fork of the Snake River, main stem of the Snake River, and Gros Ventre River. Some reptiles and amphibians inhabit the mountains up to 10,000 feet in elevation.

Several reptile species are rare, with apparently restricted distributions, including the northern sagebrush lizard, gopher snake, and valley garter snake. The northern sagebrush lizard is found at elevations up to 8,300 feet and is commonly associated with thermal areas in Yellowstone National Park (NPS 1998), but has not been found on the refuge. The rubber boa often inhabits riparian zones and could be adversely affected by soil compaction or vegetation loss.

Amphibian species that are vulnerable to population decline in Jack Hole are the boreal toad and the northern leopard frog. The boreal toad is thought to have declined in abundance in the Greater Yellowstone Ecosystem, and the northern leopard frog, documented to breed in Grand Teton National Park, is now extremely rare or absent (Koch and Peterson 1995) and has never been documented on the refuge. Both of these species inhabit a wide range of aquatic habitats including ponds, wetlands, streamsides, riparian zones, forests, and meadows. The boreal toad and northern leopard frog could be affected by water pollution, chemical herbicides, pesticides, or wetland and streambank disturbances and diseases.

Amphibian surveys conducted in 2000–2003 documented the occurrence of five species of amphibians: blotched tiger salamander, boreal chorus frog, boreal toad, Columbia spotted frog, and the nonnative bullfrog (Patla and Peterson 2004). Recent surveys conducted in the Flat Creek and Gros Ventre River drainages on the refuge have documented breeding sites for four amphibians (blotched tiger salamander, boreal chorus frog, boreal toad, and Columbia spotted frog) and the occurrence of the wandering garter snake (Patla 1998, 2000):

- Tiger salamanders are rare on the refuge, although they are quite common in Bridger-Teton National Forest.
- The most widespread amphibian on the refuge is the boreal chorus frog, which occurs in the Flat Creek and Gros Ventre River drainages at multiple sites, but their breeding populations are unexpectedly small and scattered (Patla 2000).
- Boreal toads are widespread on the refuge, with breeding populations in the Flat Creek and Gros Ventre River drainages (Patla 1998, 2000, 2004b). Although boreal toad populations remain high, recent tadpole die-offs in Grand Teton National Park suggest that continued monitoring is warranted (Patla 2012).
- There are few Columbia spotted frogs in the Flat Creek drainage, including a significant breeding site on Nowlin Creek, where they produced record high numbers of egg masses in 2012 (Patla 2012). These frogs are widespread in the Gros Ventre River drainage.

Concentrated numbers of elk and bison can affect amphibians and their habitat by decreasing water quality, increasing streambank erosion, altering marsh and riparian vegetation, and possibly transporting chytrid fungus on their hoofs. Conversion from flood irrigation to sprinkler irrigation could reduce the amount of standing water available for amphibians.

The most significant and disturbing result of the amphibian surveys was the discovery in 2000 of amphibians on the refuge killed by chytridiomycosis (chytrid disease). This was the first time this disease had been documented in northwestern Wyoming, and boreal toads are particularly susceptible. Chytrid disease is caused by an aquatic fungus that has been associated with mass die-offs and population declines in many areas and may be contributing to the continuing and potentially escalating amphibian declines throughout the United State and the world (Patla 2000). A veterinarian with the U.S. Geological Survey has stated, "The diagnosis of chytridiomycosis has potentially dire implications for all species of frogs and toads in the National Elk Refuge and, possibly, western Wyoming" (Earl Green, personal communication, as quoted in Patla 2000).

Live amphibians on the refuge were tested for the presence of chytrid fungus on their skin; in 2003, 66 percent of the sampled amphibians tested positive for the fungus and in 2004, 71 percent (Patla 2004a,

2004b). However, skin tests on live animals may not accurately determine whether the amphibian is actually infected. As of the end of summer 2004, chytrid disease had not reduced the toad populations at the two main breeding sites on the refuge, and no indicators of a population decline on the refuge (such as mass mortality events or failed reproduction) have been observed (Patla 2004b). Since the discovery of chytrid disease on the refuge, chytrid fungus has been found in several locations in the Grand Teton and Yellowstone National Parks and one location in the Bridger-Teton National Forest.

Fishes

The fish community in Jackson Hole is typical of cold waters. Eighteen species are present:

- mountain whitefish
- Snake River cutthroat trout (the only native trout in the area)
- three introduced trout species and one hybrid
- redside shiner
- several species of chub, dace, and sucker

Elk and bison can potentially affect fish habitat by reducing water quality, eroding streambanks, and suffocating spawning beds. Heavy browsing of riparian vegetation by elk and bison may raise water temperatures by removing shady vegetation. However, most fish populations in Jackson Hole are doing well, and these effects have been relatively minor or nonexistent.

Federally and State-Listed Species

There are several designated plant and animal species that we give special consideration: federally listed species, Federal candidate species, and State-listed species. Appendix D shows the federally and State-listed plant and animal species that have been documented to occur on the refuge. The following sections explain the different designations, followed by descriptions of the listed species that occur on the refuge.

Federally Listed Species

The Endangered Species Act of 1973 requires Federal agencies to carry out conservation (recovery) programs for listed species and to ensure that agency actions are not likely to jeopardize the continued existence of listed species or adversely change or destroy their critical habitat. Section 7(a) of the act requires Federal agencies to evaluate their actions with respect to any species that is listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Further, regulations implementing the interagency cooperation provision of the act are codified at 50 CFR part 402. Section 7(a)(2) requires Federal agencies to make sure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of any species listed as endangered or threatened, or to destroy or adversely change its critical habitat.

Federal Candidate Species

Candidate species are plants and animals for which we have sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act, but for which development of a proposed listing regulation is precluded by higher priority listing activities. A candidate species status is reviewed annually.

The Endangered Species Act gives no statutory protection to candidate species, and "take" as identified in the act does not apply to these species. However, we encourage the formation of partnerships to conserve these species because they are, by definition, species that may warrant future protection under the act. Furthermore, our policy requires that candidate species be treated as "proposed for listing" for purposes of intra-Service section 7 conference procedures (FWS 1998).

State-Listed Species

The WGFD has a State wildlife action plan (2010a) that identifies 180 species of greatest conservation need. These are species for which we may or may not have sufficient data to determine population trends, abundance, distribution, needs, and management actions. The designation as a species of greatest conservation need can be derived from threats to a known population or habitat or a lack of sufficient information to adequately assess a species' status. These species do not receive the same degree of protection as endangered or threatened species, although decreasing numbers or loss of habitat makes them of concern to Federal land management agencies.

Grizzly Bear

In the lower 48 States, grizzly bear was listed as threatened in 1975. In the 1980s, a recovery plan was developed, and in recent years their numbers have

increased to the point that delisting is expected in the near future.

Grizzly bears widely use the northern two-thirds of Grand Teton National Park, but can occur throughout the park and surrounding areas. Previously, grizzly bears had not been observed on the refuge since 1994, but a sow and three cubs were observed feeding on a bison gut pile in August 2013. We anticipate increased use of the refuge by grizzly bears.

Grizzly bears are omnivores that feed on nutritious succulent vegetation, grubs, insects, fish, newborn ungulates, and carrion. By mid-May grizzly bears begin preying on newborn elk calves (Gunther and Renkin 1990, Singer et al. 1997). Grizzly bears dominate other scavengers at carcasses (Servheen and Knight 1990), but many carcasses are consumed before being found by a bear (Green 1994). Individual bears are most likely to get their largest meals from adult moose and elk that are prey and from adult female bison that are scavenged (Mattson 1997).

In Yellowstone National Park from March through May, ungulate carrion (mostly elk and bison) is an important food source (Mattson 1997). This is not the case in Grand Teton National Park. Elk and bison in the Jackson herds have a low winter mortality rate because of the supplemental feeding program on the National Elk Refuge and in the Gros Ventre Range. Grizzly bears in Grand Teton National Park do not appear to depend as heavily on meat in the early spring compared to grizzlies that live to the north in Yellowstone National Park.

Bald Eagle

The bald eagle was delisted from federally threatened status in July 2007 but is protected under the Migratory Bird Treaty Act (16 U.S.C. 703) and the Bald Eagle Protection Act (16 U.S.C. 668). It is also a priority 2 species of special concern for Wyoming.

Most nesting territories in Jackson Hole are along major rivers or lakes within 3 miles of their inlets or outlets, or along thermally influenced streams or lakes. Historically, two bald eagle nesting territories have occurred on the refuge but no territories are active currently.

During the fall, as many as 100 bald eagles have been seen at one time in the cottonwood trees within the elk and bison hunting areas on the refuge (National Elk Refuge wildlife observation records). These eagles feed on the gut piles left by hunters. Typically, 5–20 bald eagles may be active on the refuge during the winter, and these birds feed primarily on the carcasses of elk that die during the winter.

Bald eagle winter habitat is generally associated with areas of open water, where fish or waterfowl congregate (Swenson et al. 1986), or ungulate winter range where eagles scavenge on carcasses of large mammals. Nearby food, suitable perches, and security from human activities are important habitat components for both nest and roost sites.

Greater Sage-Grouse

On March 5, 2010, our agency found that the greater sage-grouse warrants protection under the Endangered Species Act, but listing the species under the act was precluded by the need to address other listing actions of a higher priority. Therefore, the greater sage-grouse is a candidate species (75 Federal Register 13910). The northern portion of the refuge contains significant wintering habitat for greater sage-grouse, and much of the north end of the refuge falls within the State of Wyoming's core area policy for greater sage-grouse protection (Wyoming Executive Order 2011–5), more specifically, the Jackson core population area.

Greater sage-grouse that occupy the refuge are part of the Jackson Hole greater sage-grouse population, which is isolated from larger populations in the Green River Basin. The refuge collaborates with WGFD, Grand Teton National Park, and the Upper Snake River Basin Sage-Grouse Working Group to monitor population trends in this population by conducting lek counts each spring. The refuge hosts the North Gap lek and the Simpson lek, which are 2 of the 13 known, occupied breeding sites for the Jackson Hole greater sage-grouse population. Although grouse use of the Simpson lek has been minimal in recent years, maximum numbers of males observed on the North Gap lek were 18 in 2012 and 8 in 2013.

The northern end of the refuge contains valuable nesting and wintering habitat for the Jackson Hole greater sage-grouse population. Greater sage-grouse nest only in sagebrush shrubland habitat, using bunchgrasses and sagebrush plants as cover (Kaufman 1996). Other important habitats include meadows and grasslands close to sagebrush shrubland habitat. In Jackson Hole, Garton et al. (2011) estimated that the greater sage-grouse population is declining by 2.2 percent annually and is at risk of elimination. Factors that may be contributing to this local decline are loss of habitat to human development, prescribed burning and wildfire on winter range, birds killed by collisions with aircraft at the Jackson Hole airport, and browsing and grazing by livestock and large numbers of elk and bison. Holloran and Anderson (2004) indicated winter habitat was likely a limiting factor for this population based on the research conducted from 1999 to 2003. In general, wintering habitat consists of sagebrush plant communities that are tall enough to remain uncovered by snow.

Trumpeter Swan

The 2010 Wyoming State Action Plan classifies the trumpeter swan as a species of greatest conservation need, which is a species that warrants increased management attention and consideration in conservation planning in Wyoming. The USDA Forest Service classified the swan as a sensitive species in its Regions 2 and 4. The refuge manages swan habitat to meet objectives of the Trumpeter Swan Management Plan (Subcommittee on Rocky Mountain Trumpeter Swans 2012).

The trumpeter swan population on the refuge is part of the core tri-State area flock. The tri-State area refers to the entire State of Idaho and the portions of Montana and Wyoming within the Pacific flyway. The core tri-State area refers to the following:

- Idaho: Island Park region, Teton River drainage and Teton basin, Henrys and South Forks of the Snake River, and Camas National Wildlife Refuge
- Montana: Red Rock Lakes National Wildlife Refuge, Centennial Valley, Hebgen Lake, and Madison River and tributaries
- Wyoming: Yellowstone National Park, Grand Teton National Park, and the Snake River drainage including Jackson Hole south to Alpine

Trumpeter swans were likely eliminated from Jackson Hole during the late 1800s, but swans were reintroduced to the refuge in 1938 from Red Rock Lakes National Wildlife Refuge in Montana. Since that time, a persistent breeding population has been established, although nesting activity seems to fluctuate based on weather conditions. The refuge provides the largest wetland habitat for nesting trumpeter swans in the Snake River drainage of Wyoming. In general, dry warm spring conditions are most favorable for trumpeter swan productivity.

Most trumpeter swan nesting occurs in Flat Creek Marsh southwest of Miller Butte, with occasional nesting activity in the Pierre's Pond and Romney Pond complexes on the northern end of the refuge. In addition, there may be as many as 200 trumpeter swans on the refuge during fall migration, and 50 trumpeter swans may winter on the refuge. During the first two weeks in November, hundreds of swans congregate on Flat Creek Marsh before freeze-up when most swans disperse to other wintering sites. Fall staging behavior may play an important role in swan social structure offering an opportunity for immature swans to initiate pair bonds. Average trumpeter swan production in recent decades is 3 nesting pairs, 7.3 cygnets hatched, and 6.3 cygnets fledged per year (Cole 2011b). From 2002 to 2012, swan pairs on the refuge produced 66 mature young, which composed 43 percent of the total swan production in the Snake River core area of Wyoming (WGFD unpublished data).

Tom Koerner / FWS

Greater Sage-grouse

Long-Billed Curlew

The long-billed curlew is the largest North American shorebird and is listed as a species of concern by the State of Wyoming. The high levels of concern are due to the loss of the eastern third of the curlews historical breeding range, apparent population declines, and loss of shortgrass habitat that the birds use to nest (Fellows and Jones 2009). Because they breed in short dry grasslands common in the refuge's irrigation project area, we are concerned that irrigation activities could disturb nests of this species. As a result, the refuge staff surveys the irrigation project area to identify breeding pairs and potential nest sites each spring. Irrigation activities are delayed around potential curlew nest locations until August when the birds fledge. Typically, we identify two to five potential breeding territories for long-billed curlew in the irrigation project areas each season.

Plants

No federally listed plant species occur on the refuge. However, the State of Wyoming has given special status to 13 plant species that occur on the refuge (refer to appendix D).

No federally listed plant species occur on the refuge. However, the University of Wyoming's Wyoming

Natural Diversity Database maintains lists of Wyoming plant species of concern. Inclusion is derived from four main factors contributing to the rarity of species: (1) restricted geographic range; (2) small population size; (3) highly specific habitat requirements; and (4) significant loss of habitat or heavy exploitation. These lists, which have no status under State legislation, are sometimes cited in development of sensitive species lists by Federal land management agencies and include 12 plant species that occur on the refuge (refer to appendix D).

4.3 Management Tools

Irrigation and farming are important management tools that the refuge uses to provide forage for elk and bison.

Irrigation

Irrigation is a common habitat management tool that we use to increase both the quantity and quality of forage available to elk and bison (see figure 11). We have used irrigation to produce forage for many years on the National Elk Refuge as a technique to reduce the reliance of wintering elk on supplemental feeding. Water available for irrigation depends more on snowpack than precipitation over the growing season.

In 2010, we upgraded our irrigation capacity by installing a state-of-the-art sprinkler system that has more than 50 miles of underground water-delivery pipe and an extensive aboveground moveable pipe and sprinkler pod system called K-line. This new system can irrigate approximately 4,300 acres each year. This increased irrigation capacity will help us increase winter forage while decreasing water use. The irrigated acres have increased from approximately 900 acres that were flood-irrigated to 3,300 acres annually. The aboveground sprinkler system (170 units) is moved daily to specific locations using 4×4 utility vehicles. In most areas, the K-line irrigation replaces flood irrigation; however, some flood irrigation is still used in the Ben Goe and Pedersen management units. The refuge needs to retain the ability to irrigate with side-roll systems; when new areas are cultivated and planted, the use of K-lines is impractical because dragging hoses over disturbed soil with utility vehicles is not conducive to grass establishment.

Historically, of the water diverted annually for flood irrigation, only an estimated 5–10 percent actually reached its destination (John Kremer, personal communication, as cited in FWS 1998). This loss was due in part to the porosity of refuge soils and to the state of disrepair of ditches and headgates. This, as well as annual precipitation, staff, other refuge activities, and access to and availability of water affected how many acres we irrigated using the old system.

Farming

The refuge conducts farming practices such as disking, seeding, sprinkler and drip irrigation, herbicide and fertilizer application, and crop harvesting. The refuge annually drags about 3,000 acres using a blanket harrow to break up and help decompose deposited elk and bison fecal matter and to aerate the soil.

Fencing

An 8-foot-tall big game fence is located along the western boundary of the refuge and is designed to keep elk and bison off Highway 89. Elk "jumps" are one-way openings in the fence that allow migrating elk to enter the refuge from the west but prevent them from traveling back west onto the highway. Seven earthen elk "jump" ramps are located on the west side of the fence, with a corresponding opening in the fence. Migrating elk can walk up the ramps to a height of 5–6 feet to the fence opening and jump down onto the refuge. Since there is no ramp on the east side of the fence, the abrupt height difference prevents the elk from getting back through the fence opening, which keeps them off the highway.

Wildland Fire Management

Historically wildfires were frequent and widespread but did not burn large expanses of the landscape except under extreme drought conditions (Gruell 1980). The last stand replacement fire to burn across the National Elk Refuge occurred in 1879. Much of the surrounding forests also burned at the same time (Smith et al 2004). During most of the 20th century, the National Elk Refuge, along with other federal land management agencies in the area, suppressed wildfires with the intent to keep wildfires small. During the latter stages of 20th century and into the 21st century, federal wildland fire policy has evolved to allowing the opportunity for wildfires to

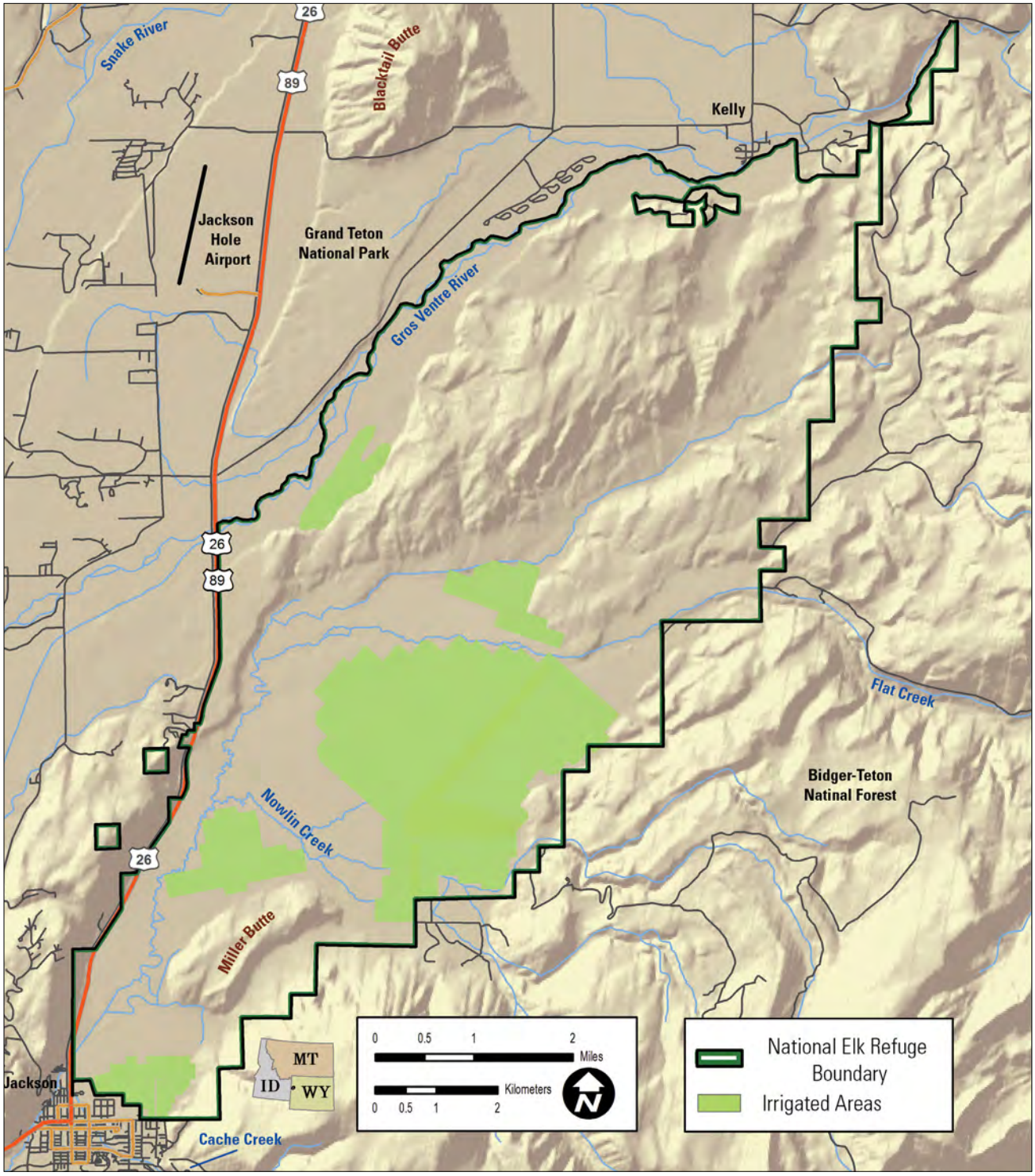

Figure 11. Map of irrigated areas on the National Elk Refuge, Wyoming.

be managed for benefits. Current wildfire management at the National Elk Refuge is to suppress all wildfires.

Prescribed fire is not currently used by the refuge. Once this CCP is completed, a revised Fire Management Plan (FMP) that is based on the goals and objectives of the CCP is required to be completed.

4.4 Human History and Cultural Resources

The human history of the National Elk Refuge starts with the indigenous, or native, people that lived in the area. The arrival of Euro-Americans had a major effect on not only the indigenous people, but also on the environment. The remains of sites, structures, or objects used by these peoples in the past are cultural resources, which reflect and preserve the area's history and increase our understanding of human interactions and development over time.

Indigenous People of Western Wyoming

The most prominent groups that occupied the eastern Idaho and western Wyoming area before settlement by Euro-Americans were the Bannock, Eastern Shoshone, and Northern Shoshone tribes. Other American Indian tribal groups have some historical or continued association with lands now within the National Elk Refuge: Assiniboine, Athabascans, Comanche, Crow, Gros Ventre, Kiowa, Kootenai, Nez Perce, Salish, Teton Sioux, and Umatilla. In addition, the Arapaho, Blackfeet, Cheyenne, and other Siouan groups and people of the Plains made excursions into the region for hunting, warfare, and trade (Walker 2005).

The Bannock are related to the Northern Paiute and are Uto Aztecan speakers who migrated from Oregon into the Snake River Plains. There they lived in peaceful cooperation among the Shoshone speakers who had arrived from the Plains. The merged Bannock and Northern Shoshone developed a single amalgamated culture that exhibited strong Plains Indian influences.

The Bannock and Shoshone–occupied areas are designated as eastern Idaho and western Wyoming. This area, the upper Snake River Plains, received higher rainfall, providing adequate grasses and forage for bison to exist. Bison were by far the greatest food resource, providing an endless supply of food, clothing and shelter materials, and weapon and tool products. Bison were also viewed as an earthly link to the spiritual world. For many tribes even today, bison represent power and strength. For example, the Shoshone believe that spiritual power is concentrated in the physical form of the bison. Many contemporary tribes maintain a spiritual connection with bison. Emigration, continuing warfare among tribes, and gradual loss of forage after the 1840s limited the amount of bison taken for food supplies. The bison herds west of the Continental Divide were greatly diminished and decimated by 1850, primarily by Euro-American immigrants.

Another principal food was fish, which were taken in the spring, when other food supplies were low, and were either eaten fresh or preserved by sun-drying or smoking. Next in importance to bison and fish were elk. As the tribes began to compete for resources when emigrations diminished the major game on the Plains, they turned to the mountains. The mountains still provided game for subsistence, whether it was elk, bighorn sheep, moose, or deer. In addition, berries were still found along the riverbanks, and roots could still be dug in the surrounding hills. Native plants were also important to the prehistoric inhabitants of the Greater Yellowstone Ecosystem. Today, modern tribes still collect and use these plants for ceremonial and traditional purposes.

The Shoshone entered into a treaty with the United States on July 2, 1863, that set apart for the Shoshone Tribe a reservation of 44,672,000 acres located in Colorado, Idaho, Utah, and Wyoming. However, the Treaty of Fort Bridger of 1868 pared this down to less than 2.8 million acres, and the treaty established both the Fort Hall Reservation (Shoshone–Bannock) in Idaho and the Wind River Reservation in (Eastern Shoshone and Northern Arapaho) Wyoming. The Bannock and Shoshone experienced extreme hardship subsequent to the treaties and later agreements that separated them from their aboriginal territories. Prohibitions on off-reservation hunting, meager rationing, and diseases adversely affected the tribal populations and social health.

By the end of the 1800s, tribal land bases were greatly diminished, and tribal rights to hunt were curtailed. In Ward v. Race Horse (1896), tribal hunting beyond the boundaries of the reservations was curtailed because the U.S. Supreme Court reasoned that this provision was temporary, and when Wyoming was admitted into the Union, it did so on an equal footing with all other States without lands within the State being encumbered.

After additional treaties, congressional acts, Executive orders, and agreements, the Bannock and Shoshone now occupy the Fort Hall Reservation in

eastern Idaho and the Duck Valley Reservation in southwestern Idaho. The Eastern Shoshone are on the Wind River Reservation in west-central Wyoming. At least 15 other American Indian tribal groups have some historical or continued association with lands now within the National Elk Refuge (Walker 2005).

Historical Euro-Americans

John Colter, a member of the Lewis and Clark expedition and later an explorer and trader for the Manuel Fur Company, might have visited Jackson Hole in 1807. Other trappers and traders from the Missouri Fur Company trapped the rivers and streams of Jackson Hole in 1810–11 (Daugherty 1999). During the 1820s and 1830s, Jackson Hole served as a crossroads of the fur trade in the northern Rocky Mountains.

Except for a few prospectors searching for gold, Jackson Hole was virtually deserted by Euro-Americans from the 1840s to the 1880s. However, three military surveys passed through the valley in the 1860s and early 1870s. These military surveys were followed by the Hayden surveys (1872, 1877, and 1878), sponsored by the U.S. Geological Survey, and explored the Jackson Hole and Yellowstone country. It was during the 1872 Hayden survey that William H. Jackson took the first photographs of the Teton Range.

In 1884, the first permanent settlers arrived and built cabins along Flat Creek inside the boundaries of the present-day National Elk Refuge. By 1900, 638 people resided in Jackson Hole (Daugherty 1999). The first homesteaders planted crops and raised cattle on small family ranches throughout the valley. Long cold winters with deep snows, poor soils, and dry conditions that required digging irrigation ditches to water crops made homesteading in Jackson Hole a difficult endeavor. By 1900, many of the original settlers had already left the valley (Daugherty 1999). In 1912, when the U.S. Government allocated money to buy up homesteads to set aside land for the National Elk Refuge, many homesteaders willingly sold their property and moved into town. In other parts of the valley, cattle ranching continued and expanded through the 1930s (Daugherty 1999) and remained the mainstay of the economy into the 1960s (Charture Institute 2003a).

Before Euro-American settlement, some researchers believe that most elk migrated out of Jackson Hole in the winter. However, homesteaders gradually forced elk off traditional winter ranges both inside and outside the valley (Anderson 1958, Craighead 1952, Cromley 2000), and then these settlers cut and stacked elk winter forage in Jackson Hole to feed domestic livestock. Even before the Jackson Hole environment was changed by the arrival of homesteaders, early hunters and settlers noted that winters of unusually heavy snow caused thousands of elk to starve to death. This situation ultimately led to the establishment of the National Elk Refuge in 1912.

Bison played no role in early settlers' lives because bison had been eliminated from Jackson Hole by the 1840s. By 1900, less than 1,000 bison existed in the entire United States. Bison were reintroduced into Jackson Hole in 1948.

Ethnographic Resources

An ethnographic resource study (a scientific description of specific human cultures) is being conducted that pertains to past treaties and traditional cultural activities that occurred within the Grand Teton National Park, Yellowstone National Park, and National Elk Refuge (Walker 2005). The final report could influence future cultural resource surveys and management on the refuge, and it could yield more information on how tribes used the refuge and parks.

Archaeological Resources in Jackson Hole

Limited but documented archaeological evidence indicates that American Indians have used Jackson Hole for at least 11,000 years. Shifting climate patterns and the resulting change in plant and animal communities, along with drought and fire, determined how and when the valley was used. From 11,000 before present (B.P.) to around 5,800 B.P., American Indians occupied Jackson Hole sporadically to hunt and to obtain obsidian and other lithic (stone) material for tools. These people lived a hunter-gatherer lifestyle and traveled in small groups. Primarily gathering plants for food, medicine, and manufacturing materials, these prehistoric peoples also hunted mule deer, bison, elk, and bighorn sheep. Although bone does not preserve well, particularly in shallow soils, bison remains are present in 13 archaeological sites in Jackson Hole and elk remains in 8 locations (Cannon et al. 2001).

Evidence of permanent settlements by American Indians has not been found in Jackson Hole. In the northern part of Jackson Hole, most evidence indicates that large base camps were established along the shores of Jackson Lake, where a band of individu-

Lori Iverson / FWS

Interior of the historic Miller House.

als lived during the spring and early summer (Wright 1984). As the weather improved, the band would disperse into family groups and move into the canyons and higher alpine meadows, following the emergence of edible plant species. After using the resources of the higher mountains, the entire band would move into areas such as Idaho to spend the winter. Many tools, fire hearths, and roasting pits dating after 5,800 B.P. have been found, particularly around Jackson Lake.

The peoples of southern Jackson Hole entered the valley from the Gros Ventre River drainage after wintering in the Green River, Wind River, or Big Horn basins of northwestern Wyoming. They followed the ripening plants south into the Gros Ventre Range and by the following winter had moved into the more mild intermountain basins east of Jackson Hole (Daugherty 1999).

Cultural Resources on the Refuge

About 20 percent of the refuge has been inventoried for cultural resources. There are 28 known cultural resources on the National Elk Refuge: 8 prehistoric sites and 20 historic sites. Six sites are eligible or potentially eligible for the National Register of Historic Places. Based on cultural resource inventories on surrounding lands, we expect that more historic and prehistoric resources are on the refuge. Although a comprehensive survey of the refuge would be the best method to identify and evaluate any unrecorded resources, additional survey is generally done on a project-by-project basis under section 106 of the National Historic Preservation Act. This act, in concert with other historic preservation laws and regulations, requires that we consider the effects our undertakings have on historic properties (cultural resources that are eligible for the National Register of Historic Places) and that we conduct consultation to identify, evaluate, and manage the significant resources.

The refuge has not been evaluated for the potential for the following:

- Cultural landscapes—geographical areas that are significant because of their distinctive combination of cultural and natural features
- Traditional cultural properties—places associated with historical beliefs, customs, or practices of a living community

The diverse topography, wildlife, and habitats on the refuge along with the rich cultural history of the region provide an excellent combination for the existence of both cultural landscapes and traditional cultural properties.

Prehistoric Sites

Eight prehistoric archaeological sites have been recorded, which include roasting pits, stone circles, and a bison kill site. Tipi rings begin to appear in the archaeological record after 5,000 B.P., and a few tipi rings can be found on the refuge. Among the artifacts that have been discovered are bones from elk and bison, numerous flakes, choppers, scrappers, and projectile point pieces.

Historic Sites

The historic sites are primarily ditches and associated water control structures, artifacts and foundations associated with homesteads, and the remains of a local schoolhouse.

The historic Miller Ranch was one of the early homesteads in Jackson Hole and has three main structures: the Miller House, the Miller Barn, and a cabin. Miller House is a log home built in 1898, and was one of the first houses in Jackson Hole. Miller House and the surrounding land was the first property that the Federal Government bought to become part of the National Elk Refuge, and Miller House served as the original office and home for the first refuge manager.

In 1969, Miller House and the cabin were placed on the National Register of Historic Places. The National Register nomination was amended in 2001 to include the Miller Barn. These buildings are the only historic structural resources recorded on the refuge and listed on the National Register of Historic Places (48 TE903).

Although the exterior of Miller House looks much as it did during its period of historical significance, the interior has undergone at least three major construction events:

- In 1969, modifications made the house more comfortable and energy efficient for its use as a Government employee home.

- Miller House eventually fell into disrepair and, in the 1970s, the decision was made to destroy the house by having the local fire department burn it. Fortunately, the attempt to burn the structure was unsuccessful. Although the house was damaged from the attempted razing, it was later decided to restore and preserve the house. With help from the Grand Teton Association and other partners, the refuge restored the house to period standards and aesthetics, by removing or replacing contemporary fixtures and decorating the building with early 1900s décor and antique furniture. In the 1980s and 1990s, refuge staff occupied Miller House.

- Through a grant with the Community Foundation of Jackson Hole and the use of a specialized volunteer crew, a 2-week rehabilitation project in summer 2007 brought portions of the original house interior closer in feel to the historic period it represents.

When refuge employees vacated Miller House in April 2005, refuge managers decided that converting parts of the house to an interpretive site would be an adaptive use related to the goals of the refuge and would offer unique education opportunities. We opened Miller House to the public 2 months later, and the house is open for tour by the public during the summer. Eighteen other historic sites on the refuge include ditches and associated water-control structures, artifacts and foundations associated with homesteads, and the remains of a local schoolhouse. The volunteers who staff the house provide information and interpretive programming. In addition, the Grand Teton Association runs a seasonal sales outlet and bookstore in Miller House that provides merchandise with a historical theme. In 2013, the Miller House had 3,762 visitors, which is a 19-percent increase from 2012 and a 245-percent increase from 2007. The refuge contracted with the University of Wyoming's American Studies program to develop an initial interpretive and restoration plan for Miller House and the related buildings on the refuge.

Miller Barn is not open to the public. The barn is in fair overall condition, but it requires attention to

Chuck Mulcahy / FWS

History demonstrations are given at the chuckwagon located at the Miller House.

ensure its preservation including foundation stabilization, improved drainage, repair of split or loose battens in the walls, and possible roof repairs. Subsequent to the needed rehabilitation, Miller Barn would expand the interpretive opportunities by having another restored building on site that the public could view and that could be an alternate site for holding programs indoors when needed. The upper floor of the barn has outstanding potential for use as an interpretive site and a location for programs and events.

A USDA Forest Service cabin is the third building on the Miller Ranch property listed on the National Register of Historic Places. The cabin, not open to the public now, would need substantial rehabilitation before it could be opened to the public including cleaning the interior, replacing plaster and floor boards, repairing windows and doors, and installing lights.

We manage areas with official designations to retain the special features that led to their designation. There is no existing or potential wilderness on the refuge, as described under "Wilderness Review" below.

Wilderness Review

A wilderness review is the process we use to decide whether to recommend lands or waters to the U.S. Congress for designation as wilderness; the CCP process requires us to conduct this review. Lands or waters that meet the minimum criteria for wilderness would be identified in a CCP and further evaluated to figure out whether they merit recommendation for inclusion in the Wilderness System. To be designated as wilderness, land must meet certain criteria as outlined in the Wilderness Act of 1964:

- generally appears to have been affected primarily by the forces of nature, with the imprint of human work substantially unnoticeable
- has outstanding opportunities for solitude or a primitive and unconfined type of recreation
- has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition
- may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value

The refuge is next to the town of Jackson and is bordered by a major highway (89). In addition, private land next to the refuge has been developed for housing and other recreational purposes. The refuge has been altered by roads, ditches, and structures. Other development activity includes the refuge irrigating grasslands to provide more forage for wintering elk.

Although the National Elk Refuge does provide visitors with some opportunities for solitude and has educational and scenic value, overall the refuge does not meet the criteria for wilderness designation and we are not recommending any areas for inclusion in the Wilderness System.

Important Bird Area

The Flat Creek Marsh and Wetland Complex on the National Elk Refuge is recognized as an important bird area by the Audubon Society. Flat Creek Marsh is the largest wetland in northwestern Wyoming and the largest calcareous fen in the State. The area provides important breeding habitat for Wyoming species of greatest conservation need such as trumpeter swan, redhead, lesser scaup, sandhill crane, and bobolink and is a critical migratory stopover for dozens of other bird species.

4.6 Visitor Services

We manage areas with official designations to retain the special features that led to their designation. There is no existing or potential wilderness on the refuge, as described under "Wilderness Review" below.

- oversees a large elk and bison hunting program and fishing program
- maintains and operates an interagency visitor center and exhibits that had more than 320,000 visitors in 2010

- maintains and operates a historic home and site that receives seasonal visitation of more than 3,000 people per year
- coordinates a contracted sleigh ride program in the winter that averages 22,000 riders per year
- organizes annual antler collection and sale that generates money for refuge habitat projects
- issues approximately 40 special use permits annually for a variety of activities
- serves an ambassador and leader in the community, including extensive involvement in a variety of partnerships
- hosts dignitaries traveling as guests with the U.S. State Department
- organizes special events
- maintains and updates the refuge Web site and social media sites
- maintains and expands the refuge's online photo gallery
- responds to extensive media and environmental education requests
- writes about 10 articles per year about refuge management and public use operations for internal and external audiences
- prepares and sends out approximately 25 news releases per year
- manages and operates nine budget accounts including both Government and nongovernmental money
- recruits, trains, equips, and manages a volunteer program that logged more than 19,000 hours by individuals and volunteer groups in 2013
- provides training to seasonal and volunteer staffs
- collects fees
- develops and manages publications

Hunting

Hunting is both a wildlife management tool and a wildlife-dependent recreational opportunity at the refuge. The refuge's Web site contains a link that educates the public on the Service's position of allowing hunting as a recreational activity. A seasonal display in the visitor center also offers information on the need and purpose for hunting on refuges.

Two large and significant hunting programs are conducted annually for elk and bison, each with their own seasons, regulations, and licensing system. The goal of these hunts is twofold: (1) to reduce elk and bison populations and achieve herd size objectives as specified in the Bison and Elk Management Plan; and (2) provide for wildlife-dependent priority public uses as legislated in the Improvement Act.

Jackson Hole is a popular destination for both resident and nonresident hunters. The refuge manages the hunts in cooperation with WGFD, and special permits are required. The refuge allows permitted elk and bison hunters to access areas of the refuge not open to the general public. In addition, the refuge has accommodations for hunters with disabilities. Depending on the hunt area, we allow hunters to use a variety of weapons: (1) rifles; (2) archery equipment; and (3) designated limited-range weapons such muzzle-loading rifles, shotguns with slugs, and handguns.

The best available data suggest that between 20 and 40 percent of refuge hunters use lead-free ammunition. Research confirms the negative effect that lead ammunition has on scavenging bird populations such as bald eagles and ravens. The large harvest of elk and bison on the refuge and the resultant boon of gut piles has altered the migration patterns in bald eagles and potentially other raptors, placing a large number of these scavengers at risk of ingesting lead from bullets in gut piles.

Elk

Hunting is the primary management tool used to control the size of the Jackson elk herd. Hunting is the herd's main cause of mortality. The first hunting season on the National Elk Refuge was in 1943, but hunting did not become an annual event until 1955. Refuge hunters apply for and receive refuge-specific permits online through a WGFD Web site. We have historically designated the first weekend of the season, usually in October, for young hunters (ages of 14 to 17). Bulls may be taken during the first week; the rest of the season is restricted to cow and calf hunting. From 1997 to 2001, WGFD issued an average of 2,116 hunting permits, with an average of 312 elk

killed each season. In 2004, WGFD issued 1,806 permits, and 179 elk were killed.

Hunting on the refuge and the elk reduction program in Grand Teton National Park, along with harvest in Bridger-Teton National Forest and on non-Federal lands, take place from mid-October to mid-December. These methods are used to bring total elk numbers as close as possible to the WGFD herd objective of 11,000. From 1998 to 2002 about 2,300 to 3,300 elk were harvested annually from the Jackson elk herd, resulting in removal of approximately 16 percent of the prehunt Jackson elk herd population each year. Hunter harvest accounted for nearly 90 percent of adult mortality in the Jackson elk herd during the 1990s (Smith 2000). The 2005 harvest of 1,776 elk removed about 14 percent of the estimated 13,000 elk in the herd. Over the last 20 years, harvest in the park has contributed about 25 percent to the total harvest, and harvest on the refuge has contributed about 10 percent. The remaining 65 percent of the harvest takes place mainly in the national forest (Teton Wilderness and the Gros Ventre River drainage).

Some wildlife managers believe that, in the past, the eastern migratory segment of the herd (those elk that migrate east of Grand Teton National Park during the fall) were overharvested, largely because of increased road and other access on national forest lands. At the same time, western migratory segments were believed to have grown, decreasing hunting opportunities as more elk migrated through protected park areas. Concerted attempts to increase numbers in the eastern segments and to reduce numbers in the western segments by regulating hunting seasons and harvest strategies since the late 1980s have met with some success. Nevertheless, the elk reduction program in the park and hunting on the refuge can affect hunting opportunities and numbers of elk outside these areas. Consequently, refuge and park staffs work closely with WGFD in developing annual hunting quotas and regulations, so management of the entire herd is based on a holistic framework that includes all land and wildlife management responsibilities.

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Fishing is popular on the refuge.

Bison

Bison hunting first occurred on the refuge in 1989 and ended in 1990, with 39 bison taken during these two seasons. Hunting resumed in 2007 and continues to be popular on the refuge, attracting nonlocal, including out-of-state, hunters. The refuge provides one of the few opportunities in the Nation where hunters can pursue wild, unconfined bison in a fair chase hunt that could be eligible for a Boone and Crocket record. Since 2007, the total annual bison harvest in Jackson Hole has ranged from a high of 266 to a low of 139. Most bison cows are harvested on the refuge, usually after deep snows move them from the protection of the Grand Teton National Park onto the refuge. Hunting at current levels on the refuge and the national forest has been sufficient to halt the exponential growth of the Jackson bison herd. However, Grand Teton National Park is closed to bison hunting, and this has become a safe zone that bison use to avoid harvest. As a result, the bison herd is still about 70 percent above the 500 population objective.

Presently, the Shoshone-Bannock Tribes enjoy a ceremonial bison hunt on the refuge.

Fishing

The refuge provides fishing opportunities during daylight hours as a compatible wildlife-dependent recreational opportunity from April 1 through October 31, with fly-fishing being the preferred technique. We allow carefully regulated fishing on the refuge to the extent that it does not conflict with objectives of the refuge and the State of Wyoming. The Gros Ventre River, Flat Creek, lower Nowlin Creek and Sleeping Indian Pond are open to fishing according to season dates and regulations set by WGFD. All other refuge ponds—Flat Creek downstream from the old Crawford Bridge site, and Nowlin Creek upstream from the posted fishing boundary—are closed to fishing. The fishing program is popular with local and visiting anglers, attracting about 4,500 anglers each season. Traffic to refuge waters supports local fishing tackle shops and fishing outfitters.

Refuge waters support a wild population of Snake River cutthroat trout, a unique variety of cutthroat species and the only trout native to the area. The refuge promotes quality fishing for wild native fish. The Flat Creek fishery is managed for a native, wild, and trophy-sized Snake River cutthroat trout population. Long-time devotees of Flat Creek report a decline in the opportunity to fish for large cutthroats. Furthermore, recent fish surveys show that nonnative trout (brook, brown, and rainbow) account for almost half of the trout population of the stream.

Lower Flat Creek opens to fishing on August 1 and is the most popular fishing water on the refuge. The section from the Jackson National Fish Hatchery to the old Crawford Bridge boundary is the most heavily fished area. This piece of stream is renowned for holding trophy-sized Snake River cutthroat trout. Locally, cutthroats over 20 inches in length are recognized as trophy-sized, and this part of stream annually produces fish in the 22- to 24-inch range. The stream is crowded with anglers from opening day through August, and then use tapers off until the October 31 closing.

In 2011, the refuge received two verbal comments from anglers about guided fishing trips on lower Flat Creek. Both parties believed that guided trips were unnecessary and undesirable and contributed to streamside crowding. The refuge issued nine permits for guided fishing in 2011, which accounted for an estimated 135 people (guides and clients) using the streamside on lower Flat Creek. Refuge law enforcement contacted three additional guided trips, without refuge permits, that included groups of seven, five, and three individuals. Given that less than 10 percent of the lower Flat Creek anglers are checked by refuge law enforcement staff, we do not know the extent of the illegal, unpermitted, guided fishing activity. Generally, it seems as if the refuge permit requirement is disrespected.

Wildlife Observation and Photography

In 2001, the refuge had 780,299 visitors participate in onsite interpretation and nature observation. Visitation included 24,664 sleigh riders, 304,987 stops at the visitor center, and 439,148 visitors using observational facilities such as auto turnouts. In 2013, 14 wildlife-viewing companies under special use permit made 604 trips with 2,540 clients, as documented in the special use reports required of the permittees at the end of the season.

Sleigh rides are a well-established activity and have been part of the refuge wildlife observation and outreach program for close to 50 years. During the 2011–12 winter season, ridership reached 20,705. The unique wildlife-viewing opportunity raises awareness of the refuge, receives national as well as international attention, and is frequently listed in travel-related articles, Web sites, and publications as a top attraction in Jackson Hole during the winter. Sleigh drivers are knowledgeable of wildlife viewing etiquette and are experienced in recognizing actions that cause stress to animals. The sleigh ride contract stipulates that the refuge receives a percentage of revenue generated by the sleigh ride operation; we use this money to hire a seasonal winter naturalist.

A 2002 survey of refuge sleigh ride visitors found that elk viewing was the most frequent local and nonlocal visitor activity, followed by sightseeing, snow skiing, and pleasure driving (Loomis and Caughlan 2004). The survey also asked about the overall importance of activities in terms of deciding to take recreation trips to Jackson Hole. The numbers reflect the average importance of an activity and its relative importance in terms of attracting people to Jackson Hole. Viewing the mountains was rated as the most important activity by local and nonlocal refuge visitors, followed by viewing elk, other wildlife, and bison (Loomis and Caughlan 2004).

Environmental Education and Interpretation

Public programming, such as daily talks at the visitor center and special events for families, is offered year-round. The North Highway 89 Pathway gives the refuge staff an area for guided walks to interpret wetland values. Refuge staff does extensive training and communication with the sleigh ride contractor and staff to make sure the operation offers a quality interpretive experience, expresses the mission of the refuge, and does not create conflicts with wintering wildlife.

However, the refuge does not have staff to meet the high public demand for environmental education and interpretation programs. The refuge uses nongovernmental money to hire winter naturalists or uses volunteers to meet the demand for environmental education and interpretive programs during the school year. During the summer months when visitor center visitation peaks, the refuge relies on a large residential volunteer workforce as the primary means to offer formal and informal interpretation.

Room for program attendees at the visitor center is extremely limited during winter or times of inclement weather. Further, it lacks sufficient accommodations for persons with physical disabilities and

does not meet the requirements of the Architectural Barriers Act Accessibility Standard (United States Access Board 2013).

Jackson Hole and Greater Yellowstone Visitor Center

The Jackson Hole and Greater Yellowstone Visitor Center, on the southern end of the refuge, plays a critical role in Jackson's tourism-based economy, serving approximately 300,000 people each year and providing a wide range of visitor services. The visitor center is often the first place that people stop at for information during their visit to the Jackson area, and many hotels and businesses, including the chamber of commerce, encourage people to go the visitor center to get information. Displays in the visitor center give an overview of the role of Federal lands and State wildlife agency partners. The information is shared in presentations, talks to key groups, and in news releases when possible.

The visitor center building is more than 40 years old and has several maintenance deficiencies, including some that affect visitor safety, and the building does not meet requirements of the Architectural Barriers Act Accessibility Standard (United States Access Board 2013). The visitor center does not have space to hold programs for the large number of visitors that we see during peak visitation or for visiting youth and school groups.

The visitor center is an interagency facility, staffed and supported by area agencies and organizations—Bridger-Teton National Forest, Grand Teton Association, Grand Teton National Park, Jackson Hole Chamber of Commerce, and National Elk Refuge. Operation of the visitor center helps the partner agencies distribute information and permits vital to their organizations.

While directly quantifying the economic impacts of the visitor center is difficult because of a number of factors, the importance of the Center itself, as well as the value of the service and information provided to visitors by Refuge staff, should not be overlooked or discounted.

Other Uses

Areas such as North Highway 89 Pathway and North Park have special considerations and management. Also, we manage several commercial and noncommercial activities on the refuge under special use permit.

North Highway 89 Pathway

We constructed a multi-use pathway on the eastern side of the refuge that opened to the public on May 1, 2011. The North Highway 89 Pathway runs adjacent to the refuge fence from Jackson to the Gros Ventre Junction and passes through several types of habitat. We do not allow pets on the pathway. Further, the refuge closes the pathway seasonally (between November 1 and April 30) to reduce the effects on migrating and wintering wildlife.

North Park

The town of Jackson manages North Park (located on the refuge) as a public park under a memorandum of understanding with the refuge. North Park is mowed, weeded, and otherwise maintained, similar to the way Jackson maintains its public parks. Currently, the Teton County Parks and Recreation Department uses an online system and collects fees for reserving North Park for activities such as weddings; however, reservations and fee collection are not in compliance with our agency policy.

Special Uses

The refuge issues about 40 special use permits per year, which the visitor services staff administers. The refuge allows several restricted public use activities under special use permit, providing services we could not otherwise offer to the public because of limited funding and staff. Refuge staff assesses each activity for which a special use permit is required and develops specific special conditions for that particular activity. Common special uses follow:

- guided wildlife-viewing tours
- guided hunting trips
- guided fishing trips
- elk and bison retrieval services
- commercial photography and filming
- Shoshone–Bannock Tribes ceremonial hunt
- antler collection (refer to "Partnerships" in section 4.8 below)
- grazing
- research

Wildlife Viewing

In 2011, 11 wildlife-viewing companies applied for special use permits to conduct tours on Elk Refuge Road. In addition, the refuge coordinates the winter sleigh ride contract. The refuge receives a percentage of the revenue generated by the sleigh ride operation. This money is collected and deposited into an account administered through the Grand Teton Association and is a source of nongovernmental money that we use to hire a seasonal winter naturalist.

Guided Hunting, Guided Fishing, and Retrieval Services

Game retrieval businesses have operated on the refuge for decades and provide a convenient service to hunters. Starting in 2008, two companies operating under special use permit provided guided hunts for elk and bison. In 2010, the refuge issued two permits to operators who each provided guided hunting and game retrieval services to hunters.

Commercial Photography and Filming

We require all photographers, videographers, and media to obtain a special use permit. Some requesters want access to areas of the refuge not open to the public. Permits specify what areas are allowed for access including stipulations for use of the areas.

The National Elk Refuge accommodates a large number of commercial photographers and film companies each year, especially during the winter. In addition, the refuge receives an extensive amount of local, regional, national, and international media attention. Media coverage includes print, electronic, and video and film venues. Responding to media requests has become an increasing part of the visitor service program's winter duties.

Because the refuge is a focus of media attention and millions of people visit this area each year, we have the opportunity to be an ambassador for the Refuge System and the mission of the U.S. Fish and Wildlife Service.

Weddings

A substantial number of people request to hold a wedding ceremony at the visitor center, at North Park, at Miller House, or on a sleigh ride. Many of the couples do not request permission to marry on the refuge, but rather show up with a justice of the peace or other official to conduct the ceremony.

Weddings in the visitor center can detract from other visitors' experience because the long, linear design of the building makes it difficult for groups to stand out of the way of people walking through the building, looking at the exhibits, or enjoying the views or wildlife-viewing opportunities. Depending on the size of the wedding party, a wedding at the visitor center can result in a loss of available parking spaces for visitors using the center to learn about the area and get visitor service information.

Occasionally, people hold weddings on the visitor center lawn or under a shelter area on the North Park lawn without prior consent from the refuge or visitor center staff. The visiting public does not recognize the park as refuge property, and there is no notice that prohibits weddings on the park's lawn. Consequently, weddings frequently take place on the site. Again, this limits other visitors' opportunities to use these areas for other purposes.

Some of our seasonal employees live in Miller House during both the winter and summer seasons. Weddings at this location would have a significant adverse effect on these employees. In addition, no public rest rooms are available at Miller House.

Private sleigh rental to hold a wedding ceremony provides an economic benefit for the contractor and reduces effects on other refuge activities and users.

Access

Many visitors are interested in accessing the refuge to enjoy what it offers. Other people want to travel through the refuge to access private land or other Federal land.

General Access and Elk Refuge Road

Elk Refuge Road, which stems north of the east–west Broadway Street in Jackson, is the primary access to the refuge and the only legal entrance to the refuge for the public. Teton County has a perpetual easement for the operation, maintenance, and improvement of Elk Refuge Road from Broadway Avenue to the north side of the Twin Creek subdivision. The purpose of the easement is to provide the public and private landowners of property east of the refuge with ingress and egress across part of the southeast corner of the refuge. Because of the ease of access to the refuge and its proximity to town, local residents use Elk Refuge Road extensively for walking, jogging, and bicycling.

Access for Boating

The northern boundary of the refuge is the north shore of the Gros Ventre River, which places the Gros Ventre River on the refuge. Boaters floating down the Gros Ventre from Slide Lake are required to exit the river at the "jump cliff" site immediately on entering the refuge. This long-standing closure of the Gros Ventre River on the refuge has been in place

because of the potential disturbance to wildlife and because this is not a wildlife-dependent activity.

The refuge segment of the Gros Ventre River upstream from the town of Kelly was recently designated as scenic under the Craig Thomas Snake River Headwaters Legacy Act of 2008. This act requires the refuge and the Grand Teton National Park to create a comprehensive river management plan to guide the management of each segment designated as wild, scenic, or recreational for a 15-year period. This public process has been completed and the plan has been completed and signed by these agencies.

Access to the National Forest

Winter users of the Goodwin Lake Ski Cabin on the Bridger-Teton National Forest have limited access across the refuge to reach the national forest boundary. The refuge plows a parking area for three cars and allows people to cross refuge lands to get to national forest lands. Our visitor services staff issues special use permits for this access.

4.7 Socioeconomic Environment

Jackson is the primary destination for visitor activities in Jackson Hole, and Jackson serves as the gateway community to the National Elk Refuge, Grand Teton National Park, Bridger-Teton National Forest, and Yellowstone National Park. Natural and scenic resource issues have a direct and profound effect on the economic well-being of Jackson Hole.

Most of the economic activity related to the Refuge is located within the two-county area of Teton County, Idaho, and Teton County, Wyoming; therefore, these counties comprise the local economic region for this analysis. The Refuge is also a partner in the establishment and daily operations of the Jackson Hole and Greater Yellowstone Visitor Center (Visitor Center) located just minutes from the Refuge entrance.

Population, Ethnicity and Education

Table 12 compares population estimates and trends for Teton County, Idaho, and Teton County, Wyoming. In 2012, Teton County, Idaho, and Teton County, Wyoming, accounted for 0.6 percent and 3.8 percent of the Idaho and Wyoming populations, respectively. From 2000 to 2012, the population growth rate for Teton County, Idaho, was 67.6 percent, far outpacing that of the state as a whole (23.3 percent). The growth rate in Teton County, Wyoming, population was slightly higher than that of Wyoming (18.8 percent to 16.7 percent).

The percentage of the Teton County, Idaho, population aged 25 or older with at least a Bachelor's degree is higher than both the state and national averages (33.2 percent compared to 24.6 percent and 28.2 percent). Over half of the population of Teton County, Wyoming, (52.7 percent) aged 25 or older holds at least a Bachelor's degree, while only 24.2 percent of the population of the state of Wyoming holds at least a Bachelor's degree (United States Census Bureau, 2012a).

In 2011, 81 percent of the population of Teton County, Idaho, self-identified as white, not of Hispanic or Latino origin, compared to 81.6 percent of the Teton County, Wyoming, population. Both of these figures were lower than the respective state averages (83.6 percent for Idaho and 85.5 percent for Wyoming). Meanwhile, 17.2 percent of Teton County, Idaho, residents (compared to 11.5 for the state of Idaho) and 15.4 percent of Teton County, Wyoming, residents (compared to 9.4 percent for the state of Wyoming) self-identified as of Hispanic or Latino origin (United States Census Bureau, 2012a).

Regional Employment and Income

Table 13 shows the median household income, poverty, and unemployment rates for the two-county study area and corresponding states. As of 2011,

Table 12. State and county population estimates.

	Residents (2012)[2]	*Persons per square mile (2012)*[2]	*Percent population change (2000-2012)*[2]	*Percent bachelor's degree or higher*[1]
Idaho	1,595,728	19.1	23.3	24.6
Teton County	10,052	22.3	67.6	33.2
Wyoming	576,412	5.9	16.7	24.2
Teton County	21,675	5.1	18.8	52.7

Source: [1](United States Census Bureau, 2012a) [2](United States Census Bureau, 2012b).

median household income for Teton County, Idaho, was higher than that for Idaho ($52,444 compared to $46,890). The household median income of residents of Teton County, Wyoming, far exceeded that of the state as a whole ($73,627 compared to $56,380) (United States Census Bureau, 2012a). In 2011, non-labor income constituted 53.1 percent of total personal income for Teton County, Wyoming, compared to 35.7 percent for Teton County, Idaho, and the national average of 34.1 percent (Bureau of Economic Analysis, 2012a).

In 2011, the percent of the population in Teton County, Idaho, living below the poverty line was lower than both the state and national figures (7.2 percent compared to 14.3 percent and 15.9 percent, respectively). Similarly, the percent of the population of Teton County, Wyoming, living below the poverty line was below that of Wyoming (7.6 percent compared to 10.1 percent, respectively). From 2000 to 2011, Teton County, Idaho, experienced a 4.4 percent increase in its unemployment rate, compared to a 1.3 percent increase for the state as a whole. The unemployment rate of Teton County, Wyoming, increased slightly by 0.6 percent over the same time period, though the unemployment rate of the state of Wyoming declined by 0.2 percent (United States Census Bureau, 2012a). This is likely due to the high concentration of service-related employment within these two counties.

Table 14 shows percent employment by sector for the two-county area. The combined two-county area had a total employment of more than 31,400 individuals in 2011. Farm employment accounted for nearly 2 percent of the workforce. The highest percentage of total employment was found in the accommodation and food service sectors (21.1 percent of non-farm employment). The real estate rental and leasing and government and government enterprises sectors had

Table 13. State and county income, unemployment, and poverty statistics.

	Median household income (2011)	Percentage of individuals below poverty (2011)	Percentage unemployed (2011)	Change in percent unemployed (2000-2011)
Idaho	$46,890	14.3	5.1	1.3
Teton County	$52,444	7.2	6.8	4.4
Wyoming	$56,380	10.1	3.3	-0.2
Teton County	$73,627	7.6	2.9	0.6

Source: (United States Census Bureau 2010a)

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Local Boy Scouts collect antlers on the refuge every year for an auction that also benefits elk refuge management.

the second and third largest percentage of total non-farm employment (11.5 percent and 9.6 percent, respectively). Forestry, fishing and related activities accounted for less and 1 percent of non-farm employment (Bureau of Economic Analysis, 2012b).

Table 14. Employment by sector, 2011, in Teton County, Idaho, and Teton County, Wyoming.

Industry	*2011*	*Percent of Total*
Total employment	31,459	
Wage and salary employment	20,600	65.5
Proprietors employment	10,859	34.5
Farm proprietors employment	370	1.2
Nonfarm proprietors employment	10,489	33.3
Farm employment	612	1.9
Private nonfarm employment	27,826	88.5
Forestry, fishing, and related activities	32	0.1
Mining	63	0.2
Utilities	*	0
Construction	2,706	8.6
Manufacturing	435	1.4
Wholesale trade	79	0.3
Retail trade	2,401	7.6
Transportation and warehousing	461	1.5
Information	431	1.4
Finance and insurance	1,963	6.2
Real estate and rental and leasing	3,608	11.5
Professional, scientific, and technical services	1,902	6
Management of companies and enterprises	56	0.2
Administrative and waste management services	1,465	4.7
Educational services	415	1.3
Health care and social assistance	1,155	3.7
Arts, entertainment, and recreation	1,456	4.6
Accommodation and food services	6,640	21.1
Other services, except public administration	1,423	4.5
Government and government enterprises	3,021	9.6
Federal, civilian	462	1.5
Military	160	0.5
State and local	2,399	7.6

Source: (Bureau of Economic Analysis, 2012b)

* Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Agriculture

In 2007, there were 299 farms in Teton County, Idaho, which reflects a decrease of 3 farms since 2002. Acreage of cropland also fell over this time period from 91,979 acres to 85,149 acres (U.S. Department of Agriculture, 2007). Agricultural sales for Teton County, Idaho, in 2007 totaled $33 million which represents an increase in sales from the 2002 figure of $24.1 million. Ranking 26th statewide in total agricultural sales in 2007, the top selling products of Teton County, Idaho, were vegetables, melons, potatoes, and sweet potatoes ($16.2 million), cattle and calves ($3.4 million), and nursery, greenhouse, floriculture, and sod ($2.8 million) (U.S. Department of Agriculture, 2007).

From 2002 to 2007, the total number of farms in Teton County, Wyoming, increased from 110 to 180, but the county experienced an overall decrease in total farmland, from 57,089 acres to 52,930 acres (U.S. Department of Agriculture, 2007). During the same time period, the market value of agricultural products sold increased by 24 percent, from $7.4 million to $9.2 million. Cattle and calf sales totaled $5.3 million in 2007, accounting for more than half of total agricultural sales. Other top selling agricultural products within the county were, grains, oilseeds, dry beans, and dry peas sales worth $747,000 (U.S. Department of Agriculture, 2007).

Recreation and Tourism

Angling, hunting and wildlife viewing are popular recreational activities across Wyoming and Idaho and within the two-county area. According to our 2011 report, Nation Survey of Fishing, Hunting, and Wildlife-Associated Recreation, approximately 838,000 and 775,000 residents and nonresidents participated in wildlife-associated activities in Idaho and Wyoming, respectively (FWS 2012). All visitors to the Refuge that engage in wildlife watching are considered away-from-home participants. In Idaho, residents and nonresidents spent over 3.2 million days hunting and over 5.5 million days fishing, with residents of the state accounting for 61 percent of hunting days and 86 percent of angling days. In Wyoming, residents and nonresidents spent over 1.7 million days hunting and over 5.3 million days fishing. Residents of the state accounted for 64 percent of hunting days and 38 percent of angling days.

For the purpose of the National Survey, wildlife watching is categorized into (1) away-from-home (activities taking place at least 1 mile from home) and (2) around-the-home (activities taking place within 1 mile from home. In 2011, residents and nonresidents in Idaho spent a total of 3.8 million days watching wildlife away from home, with residents accounting

for 86 percent of wildlife watching days. In Wyoming, residents and nonresidents spent 3.1 million days watching wildlife away from home and residents accounted for 36 percent of wildlife watching days.

Across both states, in-state spending associated with these activities totaled $5.5 million (2011 dollars), with $3 million spent on trip-related expenditures, $2 million spent on equipment and $526 thousand spent on other items (FWS 2012).

Important to the economies of both counties, travel- and tourism-related employment accounted for 46.8 percent of total private employment in Teton County, Wyoming, in 2011, and 15.6 percent of total private employment in Teton County, Idaho. The economic sectors comprising this category include retail trade, passenger transportation, arts, entertainment and recreation, and accommodations and food. Of these sectors, accommodations and food services jobs accounted for 35.4 percent of total private employment in Teton County, Wyoming, and 11.2 percent of private employment in Teton County, Idaho. Although a large portion of the employment in these counties is in these travel and tourism sectors, average annual wages in travel and tourism sectors were substantially lower than mean wages across all private sectors (United States Census Bureau, 2013).

Among the major tourist attractions for Teton County, Idaho, are downhill and Nordic skiing, snowboarding, and snowmobiling, as well as the Teton Valley Great Snow Fest, which takes place in the city of Driggs. Teton County, Idaho, also hosts a summer festival, which includes a hot air balloon rally, craft fair, antique show, rodeo, and parade. Additional attractions include fly fishing, golfing, horseback riding, mountain biking, and river sports (Teton Valley Chamber of Commerce, 2013).

The tourism industry in Teton County, Wyoming, benefits from the county's natural amenities, which offer year-round activities for visitors. In addition to two local ski areas, winter activities include snowmobiling, Nordic skiing, snowshoeing, dog sledding, wildlife tours, and scenic flights. Popular summer opportunities include hiking, camping, whitewater rafting, golfing, horseback riding, mountain biking, scenic tours, and wildlife tours. Noteworthy summer festivals include the Jackson Hole Art Fair, Grand Teton Music Festival, and the Teton County Fair (Jackson Hole Chamber of Commerce, 2013).

Economic Contributions of the Refuge

The refuge contributes to the local economy in several ways:

- Refuge employees rely and spend money on local services in their personal lives.
- We locally buy many supplies and services to manage the refuge.
- The visitors that the refuge brings to Jackson Hole spend money in the area.

U.S. Fish and Wildlife Service Employment

Refuge employees reside and spend their salaries on daily living expenses in the local area, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals or households to industries for goods and services used for personal consumption.

Current annual salaries total approximately $1,021,000. It is estimated that salary spending by refuge personnel generate the annual secondary effects of 3 jobs, $120,300 in labor income, and $225,200 in value added in the local economy.

Antler Sales

Since the late 1950s, the Jackson District Boy Scouts have picked up elk antlers on the refuge each spring under a special use permit, and then the Scouts sell the antlers. Approximately 75 percent of the proceeds from the auction go to the refuge for elk management. The amount received in 2012 was $90,469 for 7,398 pounds of antlers. The 10-year average is 8,369 pounds of antlers yielding $76,941.

Visitor Spending

Spending associated with recreational visits to national wildlife refuges generates substantial economic activity. The Service report, Banking on Nature: The Economic Benefits of National Wildlife Refuge Visitation to Local Communities, estimated the impact of national wildlife refuges on their local economies (Carver and Caudill, 2013). More than 46.5 million people visited the national wildlife refuges in fiscal year 2011, which generated $2.4 billion of sales in regional economies. Accounting for both the direct and secondary effects, spending by national wildlife refuge visitors generated over 35,000 jobs and $792.7 million in employment income (Carver and Caudill, 2013). Additionally, spending on refuge recreation generated approximately $342.9 million in tax revenue at the local, county, State and Federal levels (Carver and Caudill, 2013).

4.8 Operations

Operations involve the administrative, or logistical, aspects of managing the refuge: money, staff, facilities, and partners.

Funding and Staff

In 2008, the Service conducted a nationwide staff analysis for all national wildlife refuges. At that time, the refuge had 10 permanent FTE positions, but the analysis found that a minimum of 18 permanent FTE positions was necessary to conduct the programs—a 45-percent staff deficit. The current staff level of 10.5 FTE positions is insufficient to achieve the refuge goals. To address this need for staff, we rely on 12.5 FTEs of volunteers and seasonal staff, counting on uncertain nongovernmental money, to conduct refuge programs. A list of the additional, nonpermanent assistance follows:

- one volunteer for biological program fieldwork
- eight seasonal irrigators
- one seasonal operator for supplemental feeding
- eight detailed (from other refuges) law enforcement officers to patrol during the May 1 national forest opening for antler collection
- two seasonal National Park Service law enforcement officers for hunting season enforcement
- twenty volunteers to staff the visitor center and Miller House
- three winter naturalists

Facilities

We rely on facilities such as the visitor center, maintenance buildings, and refuge housing to give the public and our staff a safe, inviting place to visit and to work, respectively. Other infrastructure, such as pathways and roads, let visitors have on-the-

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Jackson, Wyoming

ground experiences in the refuge and help our staff efficiently carry out management activities.

Visitor Buildings

Several refuge buildings are more than 50 years old and qualify for protection under the National Historic Preservation Act. The continued maintenance, use, and staffing of these buildings preserves their historic value while providing the public with a connection to refuge history.

The refuge has two primary visitor services facilities: Jackson Hole and Greater Yellowstone Visitor Center and Miller House. The maintenance and use of these facilities are vital in achieving refuge goals for environmental education and interpretation.

At the Jackson Hole and Greater Yellowstone Visitor Center, each partner agency is required to provide only minimal staff at the information desk. The refuge staff manages and maintains the facility; only one partner in the visitor center helps with the operations or maintenance costs with short-term funding. However, in accordance with the Grand Teton Association's establishing mission and guidelines, the nonprofit organization returns a portion of sales projects to the refuge for educational and interpretive programs. Routine operational costs, including heating and cooling, cleaning, electricity, gas, phone and Internet service, snow removal, and supplies were about $80,000 in 2011. The collaborative partnership approach to funding the operation of the visitor center enables the refuge to provide important visitor services to more people than it could under current budget levels. The visitor center manager is a refuge employee, benefitting the other partner agencies at no cost to their organizations. The manager has the following duties:

- compiling and disseminating a weekly schedule for approximately 30 people that work at the center
- training employees and volunteers on all aspects of information desk services
- presenting education and interpretation programs
- managing the center budget and ordering supplies (such as trash bags, light bulbs, office supplies for the information desk, rest room supplies, paper products, and maps)
- taking care of routine maintenance and other center issues
- serving as the refuge volunteer coordinator for the region's largest volunteer program

Refuge Housing

Government housing is available for rent on the refuge for approximately six families and up to eight seasonal employees. Sharing a seasonal housing unit may limit or deter some employees or volunteers. All refuge housing suitable for permanent staff is occupied. Seasonal irrigators are housed in refuge travel trailers as part of their compensation package.

Parking sites for recreational vehicles and trailers with water, sewer, and electrical hookups are available to accommodate about 25 volunteers that can provide their own recreational travel trailers. We provide these sites free to volunteers that work a minimum of 20 hours per week per person.

Elk Refuge Road

Elk Refuge Road, Flat Creek Road, and the Curtis Canyon Road are open to the public for wildlife observation and access to the national forest from May 1 through November 30. During winter, 3.5 miles of Elk Refuge Road are open to provide access to private property (and minor access to the national forest), as well as to provide wildlife-viewing opportunities such as for bighorn sheep.

Elk Refuge Road provides safe, reasonable, uninterrupted access (ingress and egress) for the refuge staff, the public, and private owners year-round. The road has 10 turnouts that are plowed by refuge staff during winter to encourage vehicles to move off the road to view wildlife. There is a no-stopping regulation for people driving on Elk Refuge Road.

Teton County has an easement on Elk Refuge Road, retaining the responsibility for general maintenance and improvements to the road. Traffic on the road has no limits for the number of vehicles allowed, including people conducting commercial operations on the roadway. Magnesium chloride (salt)-treated water, applied by Teton County for dust abatement during the summer, remains on the road surface throughout the year.

The refuge has authority to control parking along a 30-foot right-of-way on either side of Elk Refuge Road. We maintain parking space for several vehicles at a marked trailhead at our boundary with the Bridger-Teton National Forest.

Partnerships

The National Elk Refuge has a history of fostering partnerships that help accomplish the refuge programs. We have entered into various projects and activities with many partners including conservation organizations, private companies and businesses, other Federal agencies, State agencies, universities, local schools, and county and city governments. The refuge also has an active volunteer program, primarily for visitor services. The refuge could not begin to meet the needs of the thousands of refuge visitors without these volunteers.

Partnerships are essential for operating the Jackson Hole and Greater Yellowstone Visitor Center. Information about wildlife and the different missions and uses of the various Federal lands in Jackson Hole enhances the public's understanding about the purpose of the refuge. In addition, the visitor center provides an important service to the public by providing information about area accommodations, services, and available recreational activities.

Partners have assisted in wildlife and habitat management, visitor services, land protection, law enforcement, and community outreach. Several of these relationships have developed into formalized partnerships with written agreements or memoranda of understanding, while others remain more informal. The following describes some of our ongoing partnerships:

- Bridger-Teton National Forest and Grand Teton National Park
- Craighead-Beringia South
- Grand Teton Association
- Greater Yellowstone Coordinating Committee
- Jackson District Boy Scouts
- Jackson Hole Weed Management Association
- Teton County
- Wyoming Game and Fish Department

Bridger-Teton National Forest and Grand Teton National Park

Cooperative agreements between the refuge, the Bridger-Teton National Forest, and the Grand Teton National Park provide important wildfire suppression capability that the refuge does not have. Fire is a natural ecosystem process, but wildfires (unplanned) can be destructive to agency facilities and sometimes obstruct wildlife management efforts. For example, a wildfire in September that would remove most of the refuge forage intended for use by wintering elk and bison would be counterproductive to the refuge's management strategy. This partnership helps prevent damage to wildlife habitat, refuge structures, and adjacent private lands.

Craighead-Beringia South

The discovery of elevated blood-lead levels in scavenging birds on the refuge and Grand Teton National Park is a good example of positive involvement by a nongovernmental organization. Craighead-Beringia South—a private, nonprofit, wildlife research organization—not only conducted the research that identified the blood-lead level problem, but they also obtained private money to help correct the problem. As a result of their involvement, a program for voluntary use of lead-free ammunition was established for Federal lands in Jackson Hole and is showing positive results in reducing lead exposure to specific wildlife populations.

Grand Teton Association

The Grand Teton Association has shown exceptional leadership and remarkable assistance in supporting the Jackson Hole and Greater Yellowstone Visitor Center. In 2011, the association completed the purchase of the visitor center building, which they promptly donated to the refuge, a gift valued at $1 million. This facility serves more than 300,000 visitors annually and is a tremendous asset to Jackson's tourist-based economy. Financial support from the association has been invaluable in providing temporary staff to run the visitor center when key positions are vacant. We use proceeds from the visitor center sales outlet that is run by the Grand Teton Association to support environmental education, interpretation, and wildlife research programs.

The Grand Teton Association coordinates with a private concessionaire to conduct winter sleigh ride tours that serve 20,000 to 25,000 refuge visitors each year. The refuge does not have the resources to provide this program to the public, and the sleigh rides are only made possible through our partnership with the Grand Teton Association and the private sleigh ride contractor.

The visitor center and sleigh rides are integral to wildlife observation, photography, and interpretation on the refuge and generate revenue used to provide these programs.

Greater Yellowstone Coordinating Committee

The Greater Yellowstone Coordinating Committee is a coalition of all Federal land management agencies within the Greater Yellowstone Ecosystem. The refuge has been a member of the committee since 2002. Members include national wildlife refuge managers, national park superintendents, and national forest supervisors for their units within the ecosystem. A memorandum of understanding provides a vehicle for mutual cooperation and coordination in the management of these Federal lands. The committee periodically identifies resource management issues where coordination across the Greater Yellowstone Ecosystem is desirable. By leveraging financial and management efforts, these Federal land managers can best address ecosystem-wide threats and opportunities.

Jackson District Boy Scouts

The refuge has enjoyed a 55-year partnership with the Jackson District Boy Scouts. Hundreds of Scouts have earned badges of achievement while conducting outdoor activities on the refuge.

The most popular activity for the Scouts is helping the refuge with the collection of shed elk antlers each spring, which they do under special use permit. This program reduces damage to feeding equipment, prevents trespassing and antler poaching, and stops unnecessary disturbance to the elk herds. These antlers pose a hazard to refuge equipment because they can puncture vehicle tires and damage track assemblies, especially during the supplemental winter feeding operations and spring programs like harrowing and irrigating. The antlers can become obscured by snow and dried grasses, making them impossible to see and avoid by vehicle and equipment operators.

The antlers are sorted, bundled, weighed, tagged, and sold at the Boy Scouts of America Elk Antler Auction in the Jackson town square on the Saturday before Memorial Day weekend each year. About 120 bidders from 28 States, representing local buyers, western export houses, and regional crafts people, usually attend. The 10-year average is 8,369 pounds of antlers yielding $76,941. The Scouts donate 75 percent of the proceeds from the auction to the refuge. We use this money primarily for habitat projects like the operation of the irrigation system to provide more forage for wintering elk. In the past, we have used the proceeds to acquire equipment to improve habitat and pay for seasonal irrigators.

Jackson Hole Weed Management Association

Invasive plants like spotted knapweed and cheatgrass reduce natural vegetation diversity and are a problem throughout Jackson Hole. Our participation and cooperation with the Jackson Hole Weed Management Association has resulted in a partnership to address this landscape problem on and off the refuge. These partners have given us technical and plant control assistance for eradication efforts on the refuge. In addition, control efforts for invasive plants in Jackson Hole, especially next to the refuge, help prevent new infestations on the refuge.

Teton County

Our coordination of the North Highway 89 Pathway with Teton County has expanded public opportunities for wildlife observation, photography, and interpretation on the refuge. The refuge works with Teton County and other private, nonprofit organizations to inform the public of use restrictions on the pathway that are necessary for compatibility. This has helped reduce conflicts with wildlife and has reduced violations. Public compliance with these restrictions helps ensure that use of the pathway remains a compatible use and that the pathway is open to the public in the future.

Wyoming Game and Fish Department

Cost sharing with partner organizations for projects of mutual interest and benefit is a common approach to leveraging limited refuge money. An example of cost sharing is our cooperation with WGFD to monitor chronic wasting disease on the refuge and in Jackson Hole. The refuge has contributed money to help defray the cost of seasonal technicians who collect samples from hunter-harvested deer and elk. The WGFD supervises these technicians, coordinates the sampling schedule, analyzes the samples, and writes the annual report. This cost-sharing partnership enables a disease detection program on the refuge that is vital to both agencies and likely could not be conducted at a high level of confidence without this collaboration.

Chapter 5—Environmental Consequences

Lori Iverson / FWS

Visitors learn about wildlife through environmental education programs on the refuge.

This chapter provides an analysis of the potential effects on the environment associated with the implementation of management alternatives for the refuge. We assessed the expected, potential environmental consequences of carrying out each of the alternatives on the physical, biological, cultural resource, and socioeconomic environment of the refuge.

Management actions are prescribed in the alternatives as the means for achieving the vision and goals for the refuge, while responding to issues raised by our managers, the public, and governmental partners. Because management would differ for each alternative, the environmental and social effects would likely differ as well. This chapter has the following sections:

5.1 Analysis Methods
5.2 Effects Common to All Alternatives
5.3 Climate Change Effects
5.4 Air Quality Effects
5.5 Landscape-Scale Conservation Effects
5.6 Habitat Effects
5.7 Wildlife Effects
5.8 Federally and State-Listed Species Effects
5.9 Research and Monitoring Effects
5.10 Cultural Resources Effects
5.11 Visitor Services Effects
5.12 Safety Effects
5.13 Resource Protection Effects
5.14 Administration Effects
5.15 Socioeconomic Impacts

Table 4 at the end of "Chapter 3—Alternatives" summarizes the alternatives' actions and the associated consequences described below.

5.1 Analysis Methods

The determination of effects is evaluated at several levels including whether the effects are adverse or beneficial and whether the effects are direct, indirect, or cumulative with other independent actions. In addition, we used the duration of effects in the evaluation of environmental consequences.

- Direct effects are those where the effect on the resource is immediate and the direct result of a specific action or activity. Examples of a direct effect are the effect of trail construction on vegetation along the trail and the effect of hunting on wildlife.

- Indirect, or secondary, effects are those induced by implementation actions but that occur later in time or farther removed from the place of action through a series of interconnected effects. Examples include the effects on downstream water quality from an upstream surface disturbance and the effect that recreational use along a trail may have on nearby plant communities.

- A cumulative effect is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7).

Impacts are often described in terms of their context, intensity, and duration. The duration of effects is either short term or long term. Short-term effects would persist for a period of 3–5 years and would consist primarily of temporary disturbance from habitat restoration or facility construction and subsequent revegetation efforts. Long-term effects would last more than 5 years after project initiation and may outlast the 15-year lifespan of the CCP. Many long-term effects consist of long-term benefit to wildlife habitat resulting from management actions.

5.2 Effects Common to All Alternatives

The following potential effects would be similar for each of the four alternatives:

- Carrying out the management direction (goals, objectives, and strategies) would follow the refuge's best management practices.

- Management activities and programs would avoid and reduce adverse effects on federally threatened and endangered species.

- The refuge staff, contractors, researchers, and other consultants would acquire all applicable permits, such as those for future construction activities.

The sections below describe in more detail other effects, including cumulative impacts, expected to be similar for each alternative.

Regulatory Effects

As described in chapter 1, we must follow Federal laws, administrative orders, and policies in the development and implementation of our management actions and programs. Among such mandates are the Improvement Act, the Endangered Species Act, the Clean Water Act of 1977, and compliance with Executive Order 11990—Protection of Wetlands and Executive Order 11988—Floodplain Management. The implementation of any of the alternatives described in this draft CCP and EA would not lead to a violation of these or other mandates (refer to appendix A).

Environmental Justice

Within the spirit and intent of Executive Order 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, no actions being considered in this draft CCP and EA would disproportionately place any adverse environmental, economic, social, or health effects on minority or low-income populations when compared with the public.

We are committed to ensuring that all members of the public have equal access to the Nation's fish and wildlife resources, as well as equal access to information that would enable them to take part meaningfully in activities and policy shaping.

Geology and Soils

All alternatives would positively affect soil formation processes on the refuge. Some disturbance to

surface soils and topography would occur at locations selected for (1) administrative, maintenance, and visitor facilities, (2) removal and eradication of invasive plant species, and (3) restoration of native habitat.

Bison and Elk Plan

The Bison and Elk Management Plan was approved in April 2007 and would continue to serve as the guiding document for the management of elk and bison on the refuge. The implementation of any of the alternatives described in this draft CCP and EA would not supersede the goals and objectives in the Bison and Elk Management Plan.

Elk and bison management on the refuge has the potential to directly and indirectly affect threatened and endangered species and other species of concern. Indirect effects include (1) disturbance caused by shooting and hazing elk and bison, (2) the alteration of habitat used or potentially used by threatened or endangered plants or wildlife, (3) the introduction of disease agents into the environment through vaccination of elk and bison, and (4) changes in numbers and distribution of elk and bison, which serve as live prey or carrion for threatened or endangered animals.

By supporting the Bison and Elk Management Plan's population level objectives for elk and bison, the refuge produces greenhouse gases in excess of the benefits of the actions described above. Diesel equipment contributes to greenhouse gasses. More animals congregate on the refuge's enhanced habitat (because of deliberate management) than would naturally occur.

Migratory Birds

Operation of the K-line irrigation system entails dragging irrigation hoses using off-road vehicles. These activities have the potential to destroy ground-nesting bird nests and would likely decrease nest success for various species; the species most likely to be negatively affected are Savannah sparrow, vesper sparrow, horned lark, western meadowlark, and long-billed curlew (Dieni 2011). The refuge did surveys in 2011 to find long-billed curlew nest sites and to delay irrigation in these areas until the end of nesting. These techniques would be used to mitigate the negative effects of irrigation activities on ground-nesting birds, but there would be financial costs associated with the monitoring.

Irrigation activities would likely change the composition and structure of refuge grasslands over time (FWS and NPS 2007a). Nesting activity by species associated with shortgrasses would potentially decline, while nesting activity by species associated with taller, denser grasses might increase within the irrigation project area.

Seasonal closures would limit human disturbance of breeding birds under all alternatives, improving habitat and nesting success for migratory birds (Blumstein et al. 2005, Henson and Grant 1991, Tremblay and Ellison 1979).

Wildland Fire Management

The use of wildland fire as a tool for hazard fuel reduction and ecosystem management has been well documented by various land management organizations. Wildland fire provides many benefits that cannot be duplicated by other management techniques. Fire causes an immediate release of nutrients and warming of the soil that stimulates grass and forb growth. Fire also stimulates re-sprouting and suckering in many deciduous woody species (such as willow, aspens, and cottonwoods). Some plant species, such as lodgepole pine, are also depended on fire for seedling establishment. Fire can also be used to create a barrier to protect highly valued areas such as private property or administrative sites.

As previously mentioned, fire can stimulate suckering and re-sprouting in deciduous plant species. However, this new growth of woody vegetation is highly sought after for browsing by large ungulates. This is a concern at National Elk Refuge. Unless large ungulates can be excluded from an area after a fire, this browsing can further degrade the habitat.

Air quality is sometimes affected by wildland fire. Smoke from wildland fire contains many chemicals including particulate matter, water vapor, and carbon dioxide just to name a few. Smoke is known to cause adverse health effects in humans especially those susceptible to asthma and other respiratory illnesses. Wildland fire managers have many techniques that can be used to help minimize the impacts from smoke. Fire managers work closely with the National Weather Service and Wyoming Department of Environmental Quality to determine the best conditions for prescribed fire implementation and, to the extent possible, management of wildfires to minimize the impact of smoke emissions on the public.

As with other refuge lands, the potential invasion of a recently burned areas to be invaded by non-endemic vegetation is a concern. The best practice is to continue to work with neighboring landowners to prevent invasions in the area. An aggressive monitoring program of recently burned areas will also allow refuge staff to identify any new infestations while they are small and much easier to control.

Finally, keeping equipment clean and cleaning equipment before moving to new areas, especially if having just been in an area known to contain non-endemic vegetation, will help prevent the spread of non-native vegetation

Antler Collecting

Prohibiting the collection of antlers adheres to our agency policy of not collecting or removing items, including wildlife part, from national wildlife refuges. If antler collecting was allowed, the refuge would likely see increases in trespass into areas closed for the protection of wintering wildlife, resulting in substantial impacts to elk at critical times of the year. Prohibiting antler collection also protects wildlife habitat. However, the refuge, in a long-standing partnership with the Jackson District Boy Scouts, allows the Scouts to help us by picking up shed elk antlers that pose a hazard to refuge equipment. Most of the proceeds from an auction of antlers held by the Scouts are returned to the refuge and used primarily for habitat projects benefitting elk.

Access for Boating

Boating on the Gros Ventre River segment bounding the refuge was evaluated during development of the Snake River Headwaters Comprehensive River Management Plan. The potential wildlife and habitat effects of hand-propelled boating along this scenic river segment were reviewed and determined to be unacceptable. Disturbance from boating would affect the following:

- grizzly bears, which are known to use riparian habitat along the Gros Ventre River
- elk, moose, and bison that use riparian habitat and adjacent uplands in the summer for calving
- moose, mule deer, and small numbers of elk and bison that winter within the river corridor
- bison and elk movement between the Grand Teton National Park and the refuge during spring and fall migrations
- bald eagles and osprey that nest or hunt along the river

The Snake River Headwaters Comprehensive River Management Plan did not recommend changing the existing prohibition against nonmotorized boating because of the effects listed above, which would also occur along the segment of the Gros Ventre River located downstream from the town of Kelly.

The refuge staff evaluated nonmotorized boating for Flat Creek and ponds (impoundments). The wildlife disturbance to waterbodies and adjacent areas would be significant. There would likely be adverse effects on the following:

- trumpeter swans that nest in the lower reach of Flat Creek
- up to 200 trumpeter swans that stage on and use the refuge as a resting site during fall migration
- elk and bison during early spring when disturbance would burn their diminished energy reserves
- nesting, migrating, and wintering waterfowl

Nonmotorized boating on Flat Creek would also result in significant conflicts with the existing wildlife-dependent fishing program. Motorized boating was considered impractical due to the small size and shallow nature of refuge waterbodies. Furthermore, no boats reduces the potential introduction of aquatic invasive species.

Cumulative Impacts

Cumulative impacts are the incremental effects of the actions for an alternative when added to past, present, and reasonably foreseeable future actions. Cumulative impacts can be the result of individually minor effects, which can become significant when accumulated over time. The Council on Environmental Quality regulations that carry out the National Environmental Policy Act requires mitigation measures when the environmental analysis process detects possible significant impacts on habitat, wildlife, or the human environment.

We do not expect or intend any of the activities proposed for the CCP to produce significant levels of cumulative environmental impacts that would require mitigation. Nevertheless, the final CCP would contain the following measures to preclude significant environmental impacts from occurring:

- We would protect federally listed species from intentional or unintended impacts by banning activities where these species occur.
- We would regulate all proposed activities to lessen potential impacts to wildlife, fish, and plant species, especially during sensitive reproductive cycles.
- We would establish monitoring protocols to determine goal achievement levels and possible unforeseen impacts to resources and for application of adaptive resource management to make sure wildlife and habitat resources as well as the human environment are preserved.
- We could revise and amend the CCP after 5 years of implementation to apply adaptive resource management for correcting unforeseen impacts that occurred during the first years of the plan.

Mike Nordell / FWS

Willows

5.3 Climate Change Effects

Climate change is the preeminent issue for conservation in future decades. Over the next two decades, a warming of about 0.36 °F per decade is projected globally. Warming is expected to continue for centuries, even if greenhouse gas emissions were stabilized, because of substantial time lags in the feedback loop of climatic processes (Christensen et al. 2007).

Consequent with the projected warming, the atmospheric moisture transport and convergence is projected to increase, resulting in a widespread increase in annual precipitation over most of the continent except the southern and southwestern parts of the United States (Christensen et al. 2007). This increased precipitation is more likely to occur in winter and spring months, rather than summer (Christensen et al. 2007). It is also considered likely that extreme weather (heat waves and flooding) would become more frequent. Increases in annual precipitation might be partially offset by increases in evaporation. Moisture availability, rather than just precipitation, is a critical resource for plants and animals.

Current trends in climate change are expected to affect high-mountain ecotypes and lower elevation, snowmelt-dependent watersheds, such as those found near the refuge, more acutely than some other landscape ecotypes. The effects of climate change would extend beyond the boundaries of any single refuge and would, therefore, need large-scale, landscape-level solutions that extend beyond the refuge boundary. Such solutions include supporting intact, interconnected landscapes, restoring fragmented or degraded habitats, and preserving and restoring ecological processes. The collective goal is to protect and improve resilience in ecological systems and communities, so that, even as climate conditions change, the natural landscape would continue to support its full range of native biodiversity and ecological processes.

Resiliency in ecological system is dependent on several factors. Diversity is important for maximizing the options by which a system can respond to disturbance. Embracing ecological variability, such as droughts and floods, is also key. For example, eliminating periodic fire from forests can actually reduce resiliency and make them more vulnerable to catastrophic wildfires. Expecting the unexpected and recognizing that the understanding of systems, thresholds, and driving variables is often imperfect are also important to managing resiliency in systems and creating long-term sustainability (Gunderson 2000, Holling 1973, Walker and Salt 2006).

Alternative A

The refuge does not have the capacity or expertise to conduct climate change research, monitoring, or modeling. Fortunately, the refuge is located in the Greater Yellowstone Ecosystem where other land management agencies and scientific research organizations have a great deal of interest in monitoring and predicting the impacts of climate change on wildlife, habitat, and ecosystem functions. As ecosystem-specific climate change information becomes available, it would provide a scientific foundation for making management changes to benefit fish and wildlife and their habitats. Obtaining valuable climate change information would continue to be a tremendous help to a refuge with limited money and staff. This approach would save staff time and money and continue to allow staff to focus on refuge-specific activities.

The collection of ecosystem-wide climate change data may not show the more subtle, refuge-specific changes. By not collecting long-term climate change data on the refuge, we may not detect important changes until serious adverse impacts have occurred to wildlife or their habitats. Furthermore, we may lose the window of opportunity to address or prepare for unforeseen changes without advance notice.

As climate change information for the Greater Yellowstone Ecosystem became available, it would provide an opportunity for the refuge to respond to the our agency's strategic plan for responding to accelerating climate change. This plan, "Rising to the Urgent Challenge—Strategic Plan for Responding to Accelerating Climate Change" (FWS 2010) outlines three categories of response: adaptation, mitigation, and engagement. Climate change science would continue to advance and, in the future, provide fine-scale information that would enable the refuge to make science-based adjustments to management to help reduce the impacts of climate change on fish and wildlife and their habitats. Adaptation would be our primary focus in responding to climate change.

The refuge is implementing 14 climate change mitigations that have been identified in the "Sustainability Across Boundaries: the Greater Yellowstone Area Climate Action Plan" (Fiebig 2011), which the Greater Yellowstone Coordinating Committee sponsored. These efforts would help reduce our carbon footprint and move the refuge toward our agency goal of becoming carbon neutral by 2020. These mitigation actions fall into three categories: (1) vehicle efficiency; (2) building efficiency; and (3) reduced energy consumption.

- The refuge would accomplish vehicle efficiency through the gradual replacement of low mile-per-gallon vehicles with more efficient vehicles and the use of re-refined oil. Changing driver habits such as not letting vehicles idle and choosing to use energy-efficient vehicles when available would continue to be part of staff training. These changes would have positive effects on lowering our carbon footprint and reducing costs and have no adverse effects on completing refuge work.

- We would improve energy efficiency for refuge buildings through the gradual addition of insulation and the replacement of inefficient windows, water heaters, and furnaces. Construction of new buildings would meet high standards for energy efficiency. Over time, these building improvements would reduce maintenance and operation costs, thus making more money available for refuge activities.

- The recent irrigation system expansion quadruples the refuge irrigation capacity while reducing water consumption and fuel consumption. Previously, approximately 500 acres were sprinkler-irrigated using pressure generated by fuel-powered pumps. The new irrigation system is pressured by gravity, which eliminates pumping fuel that some years had cost up to $5,000 per week, or $20,000 per year. This system would continue to substantially increase irrigation capacity, reduce our carbon footprint through reduced fuel consumption, and eliminate maintenance time and costs.

As refuge staff continued to engage the public at the visitor center, there would be improved public understanding of climate change effects on natural resources that would encourage support for the refuge in changing management to mitigate the effects of climate change on refuge natural resources.

Alternative B

Same effects as alternative A. In addition, our involvement and cooperation with the Great Northern Landscape Conservation Cooperative might provide opportunities for the refuge to be part of ongoing climate change research. By including the refuge as a study site for data collection, the research might provide fine-scale information that directly applies to the refuge. This information would likely apply more to refuge management and planning than regional climate change information, thus providing specific information that can improve planning and management of the refuge.

Refuge staff would be involved to some degree with research conducted on the refuge if only to evaluate techniques and potential conflicts with refuge programs and policies. This would redirect limited staff time away from meeting other objectives; this would have an adverse effect on operations and existing programs. We would need more biological staff to collect or analyze data for climate change.

Alternatives C and D

Same effects as alternative B. In addition, we would use specific management practices such as replacing cheatgrass monocultures with native plant communities to reestablish healthy, natural ecosystem functions and natural wildlife and plant communities on the refuge and surrounding lands. The resulting ecosystem resiliency would benefit wildlife and plant communities by enabling them to better respond to disturbances or changing conditions by resisting damage and recovering quickly.

Creating and maintaining resilient ecosystems would divert focus away from meeting the refuge goals—limited staff and finances would be used to achieve long-term ecosystem resiliency without the certainty of success. Our ability to meet the objectives of the Bison and Elk Management Plan and some visitor services programs would suffer if adequate money and staff were not added.

5.4 Air Quality Effects

Effects on air quality would not significantly affect the refuge or the Jackson Hole environment.

Alternative A

Effects on air quality would be negligible.

Alternatives B, C, and D

Same as alternative A. In addition, effects from prescribed burning would temporarily reduce air quality by diminishing visibility and by releasing natural compounds through combustion.

3.5 Landscape-Scale Conservation Effects

One of the greatest threats to wildlife today is residential development and human population growth. Much of this growth is happening in rural areas. Land development has three main effects on wildlife: (1) direct habitat loss; (2) increased risk of mortality by increasing the frequency and lethality of human–wildlife conflicts; and (3) displacement and avoidance of developed areas by wildlife, which decreases available habitat and serves to isolate populations. Isolated populations are less resilient to changes in environment because of genetic inbreeding that decreases genetic diversity and produces genetic abnormalities that are often detrimental to individuals and populations. Isolated populations are also less resilient to disease, overhunting, or catastrophic events like floods and fire.

As habitat fragmentation continues to create barriers to animal movement, habitat connectivity grows increasingly vital in promoting the long-term survival of species. Continued connectivity between large areas of habitat is critical to the survival of many species of concern, especially those species that travel great distances and have large home ranges such as grizzly bear, gray wolf, wolverine, and Canada lynx.

Alternatives A and B

Collaboration with land management agencies and nonprofit organizations can provide more resources and tools for habitat protection projects, which benefit refuge habitats and wildlife populations. This collaboration combines resources to complete projects that are beyond the capacity of just the refuge. For example, Flat Creek, which flows through the refuge, is a nationally known cutthroat trout fishery that attracts anglers from around the country. WGFD is interested in maintaining and improving the Flat Creek fishery. Our cooperation with WGFD to update the bank protection and stabilization on the refuge would contribute to a healthy cutthroat trout fishery throughout the Flat Creek system. A healthy cutthroat trout fishery would be a benefit to the refuge and would enable the continuation of a quality catch-and-release fishing program on the refuge.

Our involvement with the Greater Yellowstone Coordinating Committee would continue to provide resource management information and technical and management assistance, which would leverage actions for wildlife and habitat improvement on and around the refuge. It would also continue our collegial relationships that enable the effective resolution of controversial challenges that cross the administrative land management boundaries. Sharing resources and reducing land management controversies would help promote public support of land management agencies including the refuge.

Invasive plants such as spotted knapweed and cheatgrass reduce natural vegetation diversity and

are considered problems throughout Jackson Hole. Our participation and cooperation with the Jackson Hole Weed Management Association has resulted in a partnership to address this landscape problem on and off the refuge. This landscape effort would continue to help protect and enhance native plant communities and preserve plant diversity on the refuge for the benefit many wildlife species. It would also contribute to landscape resiliency, which would enable plants and wildlife to better withstand and adapt to climate change.

Alternatives C and D

Same effects as alternative A. In addition, emphasizing area-wide, off-refuge, land protection efforts that develop or preserve wildlife migration corridors would enhance genetic exchange between discrete wildlife populations, improving the long-term survival of various wildlife populations in the ecosystem. Landscape protection efforts such as "Path of the Pronghorn" (FWS, NPS, and USDA Forest Service 2008) provide positive benefits to wildlife populations across the landscape.

Migration corridors can provide a route for invasive plants and animals to enter and infest the refuge, decreasing species diversity and landscape resilience. Increased refuge monitoring would be necessary for early detection of invasive species. Once detected, a rapid response would be necessary to control and eradicate infestations to prevent establishment of problem plants and the loss of species diversity. Migration corridors might increase the long-term genetic health for wildlife but also increase the likelihood of new diseases reaching the refuge. Increased disease monitoring to account for increased risk of disease transmission would be necessary.

Land use protection through a willing-seller Federal acquisition program would contribute to landscape-scale conservation. Easements or fee acquisition in strategically selected areas could mitigate the surrounding land uses that negatively affect the refuge and wildlife populations. However, we are limited in acquiring land interest (fee or easement) to within the refuge acquisition boundary, and nearly all lands within this boundary have been protected. The expansion of the refuge acquisition boundary is a public process that requires public input.

Fee-title acquisition to protect land next to the refuge would provide more forage and reduce conflicts between wildlife and existing homes and ranch operations. However, the cost to buy land and remove existing homes and structures would be exorbitant and impractical.

Land protection using land-use easements on undeveloped acreage would be expensive but is a more realistic approach than fee purchase. These easements could be as selective as identifying the timing of cattle presence to avoid brucellosis transmission or broader to restrict future development. Easements obtained and held by private nonprofit land trusts could also be effective in complementing management efforts on the refuge.

FWS

A view of the refuge from Snow King Resort in Jackson, Wyoming.

Emphasis on landscape-level projects would help keep the ecosystem resilient to climate change, but would divert limited refuge money and staff time away from projects that directly benefit the refuge.

5.6 Habitat Effects

This section describes the effects of alternatives pertaining to the following:

- native grasslands and sagebrush shrublands
- wetlands
- riparian woodlands and aspen woodlands
- invasive species

Native Grasslands and Sagebrush Shrublands

The effects of each alternative on grasslands and sagebrush shrublands are described below.

Alternative A

The most extensive native grassland and sagebrush shrubland plant communities exist in the Gros Ventre Hills on the northern end of the refuge, and therefore the impacts of the alternatives primarily affect this area. Lack of any management other than full fire suppression and invasive plant control would reduce motorized vehicles in native plant communities and minimize the transport of noxious weed seeds from other locations (Von Der Lippe and Kowarik 2007).

Habitat for bird species dependent on open grassland or grassland patches within sagebrush stands would decline, and habitat for bird species dependent on older, dense sagebrush stands would increase (Knick et al. 2005). Wintering and nesting habitat for greater sage-grouse would increase over time, but potential lek sites and brood-rearing habitat would decline.

Continued full fire suppression and lack of prescribed fire would result in an increase in the age and density of sagebrush stands, which would decrease elk and bison use of these areas over time (Cook 2002, Grover and Thompson 1986, Smith et al. 2004).

Alternative B

Same effects as alternative A. However, while native species composition would be maintained, the extent of older, dense sagebrush stands would be reduced compared to alternative A, and the extent of young sagebrush stands and grass-dominated sites would increase. More management could increase the transport of noxious weed seeds. The costs and staff time associated with prescribed burning and controlling invasive plants would be substantially higher than alternative A.

There would be a reduction in the extent and distribution of tall, mature sagebrush stands, which would reduce the amount of wintering habitat for greater sage-grouse.

We would still protect native grassland and sagebrush shrubland communities from degradation, but we would place greater emphasis on managing these plant communities to improve habitat quality for elk and bison. An increase in the size and distribution of grass- and young sagebrush-dominated areas would increase elk and bison use of the northern end of the refuge.

Alternatives C and D

Same effects as alternative A. In addition, increased use of prescribed fire and managed use of wildfire would be necessary to achieve desired conditions, although the frequency and extent of burning would likely be less than under alternative B. There would be an intermediate risk of invasive plant invasion. The costs and staff time for fire management, monitoring, and weed control would be substantially higher than alternative A but slightly less than alternative B.

The effects on greater sage-grouse habitat and elk and bison distribution could be greater than alternative B. However, the core area policy for greater sage-grouse is to mitigate activities in the core area; therefore, adverse effects on greater sage-grouse should be avoided.

Wetlands

The effects of each alternative on wetlands are described below.

Alternative A

The infrequent manipulation of water levels in artificial ponds would continue to promote foraging and nesting habitat for trumpeter swans.

With our current level of noxious weed control, there would be a moderate increase in the distribution and density of some weed species, particularly Canada thistle, in wet meadow habitat. Invasive plant species that are not State-listed as noxious weeds would continue to increase in distribution and density in wet meadows. Lack of prescribed fire in wetland plant communities would result in similar use by elk and bison of wet meadow habitat to that of recent years. This use would continue to be high (Cole and Ketchum 2010), but would be lower than alternative B. Costs and staff time associated with planning, carrying out, and monitoring prescribed burns would be substantially lower than alternatives B–D.

Alternatives B and D

Same effects as alternative A. In addition, there would be increased capability to improve swan habitat and potentially increase habitat quantity with new ponds (more than the other alternatives). The costs of improving water control structures and building new ponds would be much higher compared to alternatives A and C.

The costs of monitoring invasive plant and aquatic animal species would increase compared to alternative A in the short term, but the likelihood of identifying and controlling infestations before they became a major ecological problem would be much greater than under alternative A. Therefore, the long-term costs of invasive species control would likely be substantially lower than alternative A.

Prescribed burning would improve forage quality in wet meadow plant communities to a much greater extent than alternative A and modestly more than alternative C, resulting in higher elk and bison use of wet meadows on the southern end of the refuge. Costs and staff time associated with planning, implementing, and monitoring the effects of prescribed burns would be substantially greater than alternative A and modestly greater than alternative C.

Alternative C

Water regimes that mimic natural flow conditions would likely result in swan habitat similar to alternative A, with more limited swan habitat than alternative B. Costs and staff time associated with improving water control structures on existing artificial ponds would be greater than alternative A but, because no new ponds would be created, costs would be lower than alternative B.

The costs of monitoring invasive plant and aquatic animal species would increase compared to alternative A in the short term, but the likelihood of identifying and controlling infestations before they become a major ecological problem is much greater than under alternative A. Therefore, the long-term costs of invasive species control would likely be substantially lower than alternative A.

The scale and extent of prescribed burns would be lower than alternative B, resulting in a modest improvement in forage quality for elk and bison in wet meadow habitats compared to alternative A but to a lesser extent than for alternative B. Costs of planning, implementing, and monitoring the effects of prescribed burns would be greater than alternative A but less than alternative B.

As willow communities were restored (refer to "Riparian Woodlands and Aspen Woodlands—Alternative C" below), beaver presence could be reestablished and beaver ponds would increase the amount and distribution of small open water areas in wet meadow plant communities on the southern end of the refuge compared to alternative A and B. Succession at the beaver ponds would produce mudflat conditions that would support regeneration of willows from seed (Cooper et al. 2006), which over the long term would generate new willow stands intermixed with wet meadow habitat and would contribute to the increased diversity of wetland plant communities.

Riparian Woodlands and Aspen Woodlands

The effects of each alternative on riparian woodlands and aspen woodlands are described below.

Alternative A

Browsing intensity by bison, elk, and moose, the location of woody plant communities, and the relative palatability of the plant species, dictates the potential structure of woody plant communities on the refuge (Smith et al. 2004). Loss of woody plant community structure and, in some cases, a complete change from shrub and woodland communities to grass-dominated communities would continue. Without restoration of willow and cottonwood along Flat Creek, riparian communities would continue to deteriorate. Regeneration of cottonwoods would be possible in parts of the Gros Ventre River riparian area, but more palatable species such as willow, chokecherry, serviceberry, and silverberry would be heavily browsed and potentially disappear from Gros Ventre River riparian areas over time. (Keigley et al. 2009). There would be continued loss of the extent, density, and height of willow and cottonwood communities. Elk and bison density would be slightly less than current conditions, and distribution would be similar to current conditions (Cole and Ketchum 2010). Costs and staff time to carry out woody vegetation recovery strategies would be slightly lower than alternative B and much lower than alternative C.

Retention of irrigation water in the Flat Creek system through efficiency of the refuge irrigation system was discussed in "Bison and Elk Grazing Impacts" in the Bison and Elk Management Plan (FWS and NPS 2007a). These conditions would be true for each alternative.

Riparian flow regimes would be similar to current conditions. Diversion of water by private users from the Gros Ventre River to the lower Flat Creek at a level of up to 140 cubic feet per second would continue to occur from May to August in most years (Shields 1983). Stream morphology would be similar to current conditions.

Alternative B

Same effects as alternative A. In addition, because the refuge would likely use only small-scale experimental exclosures and jackstraw techniques, the structure and composition of riparian woody plant communities would be similar to alternative A. Costs and staff time for small-scale restoration of woody riparian communities would be slightly higher

than alternative A and much lower than alternative C.

The refuge would implement recommendations from the Gros Ventre River Hydrologic Assessment as appropriate, but these recommendations and their effects on riparian habitat are unknown at this time. Economic impacts to private irrigators might be possible, but given the uncertainty about the Gros Ventre River Hydrologic Assessment, those impacts are uncertain.

Comprehensive fisheries habitat improvement projects on lower Flat Creek would entail substantially higher costs and staff resources than alternatives A and C.

Alternative C

Same effects as alternative A. In addition, given the current condition of willow and cottonwood communities on the southern end of the refuge, fenced exclosures would be necessary to restore riparian willow and cottonwood communities. The Bison and Elk Management Plan prescribed the use of 500- to 1,000-acre willow exclosures and a 100-acre cottonwood exclosure to restore riparian plant communities along Flat Creek. Data from current small-scale experimental exclosures on the refuge suggest that fenced areas would have to be in place at least 10 years for willow and cottonwood to regain sufficient structure to resist browsing pressure from elk and bison. If exclosures are subsequently removed at the 500 bison and 5,000 elk population levels, these communities would only temporarily be able to withstand browsing pressure. Perpetual rotation of exclosures on a 15-year cycle would make sure that some riparian habitat would be available as elk and bison habitat, while also ensuring that willow and cottonwood plant communities would be restored on the southern end of the refuge. However, exclosure construction would be costly, requiring considerable staff resources to check fence integrity and to rotate fenced areas compared to alternatives A and B.

Nonessential exclosures and woody vegetation restoration techniques that do not support restoration to pre-European settlement conditions would be removed. For example, jackstraw structures along lower Flat Creek would be removed because there is no historical evidence that large woody debris existed in this part of the creek (Galbraith et al. 1998, Smith et al. 2004), and the shelterbelt exclosure in the Headquarters management unit would be removed, because it supports trees and shrubs that would not have existed at that site. Staff time associated with removal of these structures would be substantial, and public education efforts would be required to inform the public about the apparent contradiction in management activity (constructing exclosures in some areas and removing woody vegetation in others).

In general, mimicking natural flow regimes in the Gros Ventre River and Flat Creek drainages would result in high water levels during spring runoff (May–July) and low water levels from late fall to early spring. The existing flow regime in Flat Creek and the Gros Ventre River conforms to this pattern, but irrigation diversion by the refuge and private water users reduces flows below natural levels in upper Flat Creek and in the Gros Ventre River and increases water levels in the lower part of Flat Creek. In extreme cases, this results in the complete dewatering of parts of the Gros Ventre River during late summer and early fall. If more water stayed in the stream channels, stream morphology would more closely resemble pre-European conditions, and opportunities for cottonwood and willow regeneration would be enhanced. Implementation would be contingent on the cooperation of private water users to mimic natural flow regimes, which would entail substantially higher economic costs for these users compared to alternatives A and B.

Alternative D

Same effects as alternatives B and C.

Flat Creek

The effects of the alternative actions on Flat Creek are described below.

Alternatives A, B, and C

Based on the results of monitoring, we would use adaptive management strategies to adjust project components as needed to increase ecological benefits and better achieve objectives.

Alternative D

The Flat Creek enhancement project would reduce sediment inputs to the watershed, improve stream processes, and increase habitat for all age classes of Snake River cutthroat trout. Stable streambanks would be vegetated with native species.

Invasive Species

The effects of each alternative on invasive species are described below.

Alternative A

The refuge staff's use of integrated pest management strategies would continue to protect native plant communities and prevent new infestations. Preventing new infestations is the best and most cost effective way to fight the spread of invasive weeds, but prevention strategies can be inconvenient and incur cost to refuge users, and the demands of increased vigilance and public education require increased staff time. Operations that control invasive plants protect native plant communities by preventing the spread of existing infestations.

With our current level of noxious weed control in wetlands, there would be a moderate increase in the distribution and density of some weed species, particularly Canada thistle, in wet meadow habitat. Invasive plant species that are not State-listed as noxious weeds (such as meadow foxtail, timothy, and reed canarygrass) would continue to increase in distribution and density in wet meadows. Because there would be little management and vehicle traffic in these areas, the risk of invasive plant infestation would be minimal under alternative A compared to the other alternatives. Monitoring and control costs would also be minimal under alternative A compared to the other alternatives.

With limited monitoring for aquatic invasive species, we would be unlikely to make early detection for control of zebra mussel, quagga mussel, Asian carp, hydrilla, Asian clam, and Eurasian watermilfoil (WGFD 2010b).

Alternative B

Same effects as alternative A. In addition, more monitoring and rapid response for new infestations, including aquatic plant and animal species, would increase the likelihood of identifying and controlling infestations before they became a major ecological problem.

The large-scale eradication programs would be potentially much less expensive in the long term with less risk of an expanding infestation than if doing more limited control work. Large-scale eradication operations potentially put a greater quantity of herbicide into the environment during the short-term effort but likely put much less herbicide into the environment than long-term, never-ending control work. The goal of eradication operations is to eliminate the infestation, resulting in reduced effort in the future, which would be focused on monitoring and spot treatment as necessary.

The costs of monitoring invasive plant and aquatic animal species would increase compared to alternative A in the short term, but the long-term costs of invasive species control would likely be substantially lower than alternative A.

Alternatives C and D

Same effects as alternative B. In addition, the monitoring and control of invasive plants that are not listed as noxious weeds would help restore native plant communities, but complete success in control of "naturalized" invasive species would be difficult to achieve. There would be higher costs in labor, equipment, chemicals, and seed to carry out what would be a long-term effect.

5.7 Wildlife Effects

This section describes the effects of alternatives pertaining to the following:

- migratory birds
- aquatic species
- disease management

Migratory Birds

The effects of each alternative on migratory birds are described below.

Alternative A

The overall diversity of migratory bird species would be relatively low.

The current management in grassland and sagebrush shrubland communities would increase the size and distribution of older, dense, tall sagebrush patches. This would increase the available habitat for migratory birds that depend on these conditions and, at the same time, decrease the habitat quantity and quality for migratory birds that depend on younger sagebrush stands and open grasslands (Knick et al. 2005). Habitat quality for ground-nesting bird species that depend on shortgrasses would decline.

Wetland habitat for migratory birds would not change.

With the continued loss of willow, cottonwood, and aspen stands, the habitat quantity and quality for migratory birds that depend on understory shrubs and midcanopy woodland habitats would continue to decline (Smith et al. 2004).

Steve Koob / FWS

Yellow-headed Blackbirds

Alternatives B and D

Same effects as alternative A. In addition, the resulting diversity of migratory bird species would be slightly higher than alternative A.

Migratory birds that depend on open grasslands and young sagebrush would benefit from management that used more fire to create these conditions.

There would be less herbaceous nesting cover for migratory birds that use wet meadows. In addition, migratory birds that use riparian areas would have little change in habitat, because the willow and cottonwood restoration would occur on a very small scale.

Costs and staff time for monitoring bird populations would be substantially higher than alternative A.

Alternative C

Same effects as alternative B. In addition, habitat quality for migratory bird species would be improved, and alternative C would likely result in the highest diversity of migratory bird species.

For migratory birds that use grasslands and sagebrush shrublands, the habitat age distribution and density would be intermediate between alternatives A and B.

For migratory birds that use wet meadows, there would be an intermediate amount of herbaceous nesting cover in wet meadow areas between alternatives A and B. An increased diversity of wetland plant communities on the southern end of the refuge would increase habitat for shrub-nesting birds compared to alternatives A and B (Medin and Clary 1990).

For migratory birds that depend on riparian areas and woodlands, there would be 500–1,000 acres more of tall willow-dominated areas, 100 acres more of restored cottonwood woodlands, and 1,000 acres more of restored aspen.

Cost and staff time for bird monitoring would be higher than alternative A and comparable to alternative B.

Aquatic Species

The effects of each alternative on aquatic species are described below.

Alternative A

Current monitoring and management strategies would continue to yield a basic knowledge of native trout populations and their long-term trend in refuge waters. These strategies would allow for effective fishery and harvest management.

Working cooperatively with WGFD would continue to greatly reduce refuge costs for fisheries management and ensures good alignment with WGFD management objectives and fishing regulations. It also takes advantage of the superior fisheries management knowledge and experience of WGFD in managing resident fish populations.

Nonnative trout removal would continue to benefit native trout through the reduction of competition for food and habitat resources and release some of the predation pressure. Counting the nonnative trout removed would provide data for long-term population trends. Although removal of nonnative trout species would create positive effects for native trout, other native fish, and invertebrates, some anglers view these removals as a loss of fishing opportunity and a waste of limited resource management money. The current level of nonnative trout removal might not be enough to substantially reduce populations and might

not even be able to stop the increased brook trout population that Flat Creek has experienced in recent years. However, these activities certainly have negative effects and slow that population growth.

Given the lack of willow growth in riparian areas, beaver would continue to be absent. As a result, there would be no new beaver ponds in wetland habitats.

Alternative B

Same effects as alternative A. In addition, the construction of new artificial ponds to create wetland habitat and the rehabilitation of water control structures would increase the amount and quality of amphibian habitat compared to alternative A and would be comparable to alternative C. Increased habitat quality and quantity would increase the likelihood of stable to increasing amphibian populations (Ficetola and Bernardi 2004, Marsh and Trenham 2001).

Alternative C

Same effects as alternative A. In addition, the screens at irrigation diversions would substantially decrease the introduction of nonnative trout into Flat Creek's trophy cutthroat trout fishery. Increased removal of nonnative trout would benefit native trout, other native fish, and invertebrates by substantially reducing the abundance of nonnative trout, especially brook trout. Screen installation would have a substantial initial cost, and the screens would likely increase maintenance costs for the refuge, WGFD, and water rights holders to clear debris jams.

Information on the population trend and age structure of an unharvested species or suite of species could lead to enhanced aquatic habitat over the long term. However, a new program would increase WGFD staff costs, would do little to improve the native trout fishery, and might be viewed by anglers as being an expensive and trivial monitoring program.

Reestablishing beaver populations on the southern end of the refuge would be contingent on restoration of surrounding willow communities as a beaver food source (refer to riparian woodlands and aspen woodlands effects above). More beaver ponds would increase the amount and distribution of small open-water areas in wet meadow plant communities on the southern end of the refuge compared to alternatives A and B, and the net effect would be more amphibian habitat than alternative A (Cunningham et al. 2007) and comparable amphibian habitat to alternative B.

Alternative D

Same effects as alternative A. In addition, the screens at irrigation diversions would substantially decrease the introduction of nonnative trout into Flat Creek's trophy cutthroat trout fishery. Increased removal of nonnative trout would benefit native trout, other native fish, and invertebrates by substantially reducing the abundance of nonnative trout, especially brook trout. Screen installation would have a substantial initial cost, and the screens would likely increase maintenance costs for the refuge, WGFD, and water rights holders to clear debris jams.

Increased removal of nonnative trout would benefit native trout, other native fish, and invertebrates by substantially reducing the abundance of nonnative trout, especially brook trout. More removal activities would increase WGFD staff costs and further reduce opportunities for anglers to fish for nonnative trout.

Reestablishing beaver populations on the southern end of the refuge would be contingent on restoration of surrounding willow communities as a beaver food source (refer to riparian woodlands and aspen woodlands effects above). More beaver ponds would increase the amount and distribution of small open-water areas in wet meadow plant communities on the southern end of the refuge compared to alternatives A and B, and the net effect would be more amphibian habitat than alternative A (Cunningham et al. 2007) and comparable amphibian habitat to alternative B.

Disease Management

The effects of each alternative on wildlife disease and its management are described below.

Alternative A

By concentrating elk and bison herds in February and March, there would be less risk of brucellosis transmission from elk and bison to cattle because the current feeding regime limits commingling of elk and bison with domestic livestock. However, this alternative would have the highest densities of elk and bison on the southern end of the refuge, which would increase the herds' risk of density-dependent diseases.

Because the refuge would do only minimal disease monitoring, we would likely be unable to detect diseases in the early stages of an outbreak, particularly in populations of birds, which would reduce our ability to carry out an effective management response (Mörner et al. 2002, Stallknecht 2007).

WGFD monitoring of bighorn sheep and refuge monitoring of amphibians would help us in early

detection of diseases and to respond before there were subsequent negative population effects.

A contingency plan for chronic wasting disease would identify strategies to minimize the effects of the disease should it become established in the Jackson elk herd. These strategies potentially could reduce the prevalence of chronic wasting disease and its effects on the elk population over the long term. Monitoring would be sufficient to detect 1-percent disease prevalence with 95-percent confidence annually. The long-term incubation period of this disease suggests that chronic wasting disease has not been present in the Jackson elk herd historically. Early identification of the disease in the population might trigger a more aggressive management response, which also could reduce disease prevalence and population effects over the long term.

Alternative B

Same effects as alternative A. In addition, habitat management would result in the lowest elk and bison densities on the southern end of the refuge and the lowest risk of density-dependent disease.

Implementation of the comprehensive disease contingency plan would likely intensify disease monitoring efforts and result in management responses to disease outbreaks. There would be more early detection of diseases compared to alternative A. Management in response to disease outbreaks would have a greater potential to reduce the effects of diseases on wildlife populations compared to alternative A (Fenichel and Horan 2007, Lloyd-Smith et al. 2005). However, increased monitoring and management would require substantially more money and staff time than alternative A.

Alternatives C and D

Same effects as alternative A. In addition, the interagency disease contingency plan allowing native diseases to run their course with minimal intervention might result in population reductions in some instances, which could result in negative reactions from the public (Decker et al. 2006).

Disease monitoring efforts would be more intense than alternative A, but lack of disease management for native diseases would result in moderately higher cost and staff time than alternative A and moderately lower staff time and costs than alternative B. Therefore, our response to disease outbreaks would have less chance of reducing the effects of diseases on wildlife populations compared to alternative B.

5.8 Federally and State-Listed Species Effects

The refuge would maintain the current distribution and timing of areas closed to the public to reduce disturbance to species of concern and maximize habitat effectiveness (Frame et al. 2007, Henson and Grant 1991, Mallord et al. 2007, Redmond and Jenni 1986). In addition, staff would conduct refuge management activities in a manner to reduce disturbance to species of concern (Major 1990).

Alternative A

Monitoring would be sufficient to detect major population changes for refuge populations of grizzly bear, bald eagle, greater sage-grouse, trumpeter swan, and long-billed curlew. The ability to detect status and trends for the other Wyoming species of greatest conservation need (Keinath et al. 2010, WGFD 2010a) and for sensitive plants would be minimal.

We do not predict any significant changes in refuge populations of bald eagle, greater sage-grouse, trumpeter swan, and long-billed curlew, but we do anticipate that grizzly bear use of the refuge will increase based on the trends in current range expansion of this species. Current baseline information is insufficient to predict future population trends for all other Wyoming species of greatest conservation need that occupy the refuge.

Alternative B

Same effects as alternative A. However, alternative B would have the highest probability of meeting the nesting pair objectives of the Trumpeter Swan Management Plan (Subcommittee on Rocky Mountain Trumpeter Swans 2012). Wetland improvements would enhance trumpeter swan habitat. Rescuing eggs and installing floating nest platforms would increase nest success. These strategies would help meet the population objectives for the Snake River core area (the Snake River basin in Wyoming but outside of Yellowstone National Park) of 18 nesting pairs and 60 total adults and subadults.

This alternative is more likely than alternatives A,C, and D to result in a decline in greater sage-grouse populations. Because of the emphasis on using habitat treatments on the northern end of the refuge to promote elk and bison use of these areas, there would be a net loss of mature sagebrush habitat and a possible decline in greater sage-grouse populations.

Staff coordination with WGFD to do more monitoring would provide information about the status and trends of the Wyoming species of greatest conservation need on the refuge. Costs and staff time would be substantially higher than alternative A and comparable to alternative C.

Alternatives C and D

Same effects as alternative A. However, water management of wetlands that mimics natural flow regimes would result in slightly lower habitat quality for trumpeter swans and the potential for slightly lower swan productivity than alternative A and moderately lower swan productivity than alternative B. The likelihood of meeting swan breeding pair objectives in the Trumpeter Swan Management Plan (Subcommittee on Rocky Mountain Trumpeter Swans 2012) would be lowest under alternatives C and D.

Recent research suggests that the fire-return interval in mountain big sagebrush stands is substantially less frequent than previously indicated (Bukowski and Baker 2013) and that high-density, tall sagebrush stands may be a rare ecological type on the landscape compared to the time of pre-European settlement. Therefore, protection of dense, tall sagebrush stands from wildfire and lack of prescribed fire in these areas is an appropriate management strategy to mimic historical conditions and to preserve key wintering habitat for the greater sage-grouse (Holloran and Anderson 2004). Subsequently, effects on greater sage-grouse habitat and populations would be comparable to alternative A.

Increased monitoring would provide information about the status and trends of the Wyoming species of greatest conservation need on the refuge. Consequently, costs and staff time would be substantially higher than alternative A and comparable to alternative B.

5.9 Research and Monitoring Effects

The effects of each alternative for research and monitoring are described below.

Alternative A

The refuge would get data on only the highest biological priorities because of limited money and staff and heavy reliance on volunteers and cooperators.

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Tagging wolves is part of the research and monitoring program.

Data collection to support model development and decision support tools is sufficient only to address the highest priority decisions such as feeding-initiation protocols and elk harvest strategies. Funding and staff to support these activities assures only moderate confidence in the models and decision-support tools.

Data collection to determine the effects of public use on habitat and wildlife is sufficient only to measure effects on the highest priority activities such as the effects of human disturbance on elk habitat use. Funding and staff levels assures only moderate confidence in measuring these effects.

Some monitoring projects—such as global positioning system (GPS) collar studies for elk (Cole and Ketchum 2010), forage production monitoring (Cole 2011a), irrigation effects on plant communities and birds (Dieni 2011, Dieni and Cole 2011), and disease monitoring in elk (Henningsen 2011)—provide quality data that effectively guides management decisions. However, most monitoring projects result in only marginal levels of data confidence because of insufficient money and staff. Therefore, the ability of managers to predict the outcome of management actions and emerging threats—such as public use effects, invasive species effects, disease in wildlife other than elk and bison, and fisheries effects—would be compromised.

Activities by researchers and animals marked with collars might have short-duration negative effects on visitors that observe and photograph wildlife (Bergman 2005, Mech and Barber 2002).

Alternatives B and D

Same effects as alternative A. In addition, we would find out more about the effects of public use on wildlife and habitats.

Prioritizing key information needs, developing study designs to answer questions of interest, and ensuring adequate resources to conduct research and monitoring would ensure data quality necessary to adequately inform management decisions (Legg and Nagy 2006, Lenth 2001, Osenberg et al. 1994, Stockwell 2002). This would improve local decisionmaking compared to alternative A.

Cost and staff time for biological monitoring and research would be substantially higher than alternative A.

Activities by researchers and animals marked with collars might have short-duration negative effects on visitors that observe and photograph wildlife (Bergman 2005, Mech and Barber 2002). This would increase substantially compared to alternative A, with negative effects on visitors observing wildlife.

Alternative C

Same effects as alternative B. In addition, the refuge would get more data about the role of the refuge within the Greater Yellowstone Ecosystem and the effects of natural processes on plant communities and wildlife populations. This would improve data quality and likely improve decisionmaking at regional or larger scales (Carpenter et al. 2006), but would detract from research and monitoring that would inform decisionmaking at the refuge level.

Cost and staff time for biological monitoring and research would be substantially higher than alternative A and comparable to alternative B.

5.10 Cultural Resources Effects

The effects of the alternatives on cultural resources are described below.

Alternative A

The refuge staff would make sure that known cultural resources were protected from vandalism and theft.

Because stopping construction can be expensive, preconstruction cultural resource inventories and assessments would reduce the probability of work stoppage to make sure any archaeological resources were protected.

By limiting public access and providing only supervised visits, the refuge would reduce disturbance or loss of artifacts at known archaeological sites.

Keeping the Miller Ranch open to the public during summer months would give the public an opportunity to visit a historic site and learn about refuge history and homesteading in Jackson Hole. However, if an adequate number of volunteers to staff and run the Miller House were not maintained, the Service would have to substantially reduce the hours of operation or close the house to public viewing, resulting in the loss of a valuable community historic and cultural resource. The Grand Teton Association and refuge would lose money from the sale of the turn-of-the-century items sold in the Miller House bookstore if it were closed. In addition, allowing the continued deterioration of the Miller Barn could result in the loss of a valuable community and State cultural resource.

Alternatives B, C, and D

Same effects as alternative A. In addition, with a new interpretive trail near the Miller Ranch buildings, visitors could take leisurely walks while learning about the historic value of the ranch. If the trail was made accessible to persons of all physical abilities, a more substantial trail would be needed and would disturb more soil and vegetation. In addition, there would be some disturbance from installing signs that directed visitors to the various buildings. Visitors allowed to walk unescorted around the Miller Ranch buildings might not respect the adjacent closed areas. A substantial number of visitors currently leave Elk Refuge Road and walk down to a series of nearby ponds that are in a marked closed area. Putting visitors closer to these closed areas might increase the amount of trespass, resulting in disturbance to waterfowl and other animals.

Rehabilitation of the Miller Barn would expand the interpretive opportunities by having another restored building on site that the public could view and could be an alternate site for holding programs indoors when needed. The barn is in fair condition overall, but several aspects require attention to ensure its preservation including foundation stabilization, improved drainage, repair of split or loose battens in the walls, and possible roof repairs. The refuge budget would not likely be able to accommodate a rehabilitation project of this scale. Working with partners to rehabilitate the barn would give us more chance of success by stretching funding and sharing resources.

A USDA Forest Service cabin is the third building on the Miller Ranch property that is not open to the public now and would need substantial rehabilitation before it could be opened to the public.

If money were available for permanent or seasonal interpreters to maintain and enhance programs at the Miller House, Miller Barn, and USDA Forest Service cabin, the refuge could provide consistent opportunities for the public to experience cultural resources on the refuge.

5.11 Visitor Services Effects

This section discusses the effects of alternatives pertaining to the following:

- hunting
- fishing
- wildlife observation and photography
- environmental education and interpretation
- Jackson Hole and Greater Yellowstone Visitor Center
- other uses
- access
- public outreach

Hunting

The effects of each alternative on hunting are described below.

Alternative A

Both historically and presently, harvest has been insufficient to meet the herd objectives in the Bison and Elk Management Plan. Contributing factors include season structure, hunting effort, available licenses and permits, timing of elk migration, and access on the refuge and on surrounding land jurisdictions. The decline in elk and bison use of grasslands and sagebrush shrublands on the northern end of the refuge would also contribute to the decreased likelihood of meeting population objectives for elk and bison and decreased hunter opportunity.

Current monitoring and analysis of elk GPS collar data will provide information and inform management recommendations to adaptively modify elk hunting seasons to better achieve elk population objectives. The adaptive management process to reduce reliance on supplemental feeding is an interagency effort that is currently underway. This process might also result in modifications to the elk and bison hunting seasons that would allow us to meet elk and bison population objectives over the life of the CCP.

Elk harvest on adjacent Hunt Area 80 on national forest land is an important component of meeting herd objectives, and allowing retrieval of harvested elk through the refuge makes hunting in Hunt Area 80 much easier than it otherwise would be, which encourages more hunters to hunt there.

The program for voluntary use of lead-free ammunition, promoted by the refuge and area land management agencies and conservation partners, has resulted in up to a 47-percent reduction in blood-lead levels in ravens. Hunter education and information efforts would continue to promote participation in this program and increase these positive results.

Hunting opportunities for hunters with disabilities and for young people are popular; however, changing elk migration patterns would continue to negatively affect young hunters, often resulting in no available elk on the refuge during their special hunt held early in the season.

Accommodating the annual American Indian ceremonial bison hunt would continue to support tribal cultural tradition and provide access to culturally important historic lands.

Alternatives B and D

Effects would be the same as alternative A. In addition, more opportunities for hunting could create hunter interest, attract more refuge hunters, and increase the pool of nonlocal hunters over time. Opening closed areas on the southern end of the refuge to archery hunting could provide for greater harvest opportunity by denying elk access to safe zones while, at the same time, protecting crucial winter forage. More hunter access points for bison hunters could increase harvest and help achieve herd size objectives, but the extra traffic might not be well received by residents of the Teton Valley Highlands subdivision.

Increased quality of wet meadows, and subsequent higher elk and bison use, would increase hunter opportunity, harvest rates, and the likelihood of meeting the population objectives for elk and bison compared to alternative A. In addition, more grass- and sagebrush-dominated areas would increase elk and bison use of the northern end of the refuge and increase hunter opportunity for a greater likelihood of achieving population objectives for elk and bison compared to alternative A.

Expanded youth-mentoring programs could attract and keep more young hunters and would support programs such as the Department of the Interior's "Connecting Youth with Nature" initiative. Adjusting the hunt season for young people would give young hunters better opportunities for viewing and harvesting elk. However, scheduling this season for the middle of the existing hunting season would

decrease the hunting opportunity for adult hunters and potentially reduce the elk harvest for the season.

We may alienate some nonhunters with the more visible archery harvest in currently closed areas, a bull harvest that includes a trophy value, or the harvest of predatory species such as mountain lion or wolf. In addition, opening the closed areas could negatively affect wildlife-viewing opportunities along Highway 89 and Elk Refuge Road during the hunting season. Disturbance of elk by hunters next to roads and to Jackson would move elk to other areas and limit viewing opportunities.

Regulations on proper storage of bear attractants and bear-deterrent practices could provide a safer environment for refuge hunters, neighboring communities, and bears but could also cause inconvenience and higher costs for hunters.

Gaining information from hunters would help the staff improve management of the hunt program, but collecting data might inconvenience and alienate hunters.

Outreach on the Service's position of allowing hunting on refuges would educate the public on the need and purpose for this recreational activity.

There would be higher equipment costs and more labor and personnel needed to develop and manage the added programs.

Alternative C

Effects would be the same as alternative A. In addition, more opportunities for hunting could create hunter interest, attract more refuge hunters, and increase the pool of nonlocal hunters over time. Opening closed areas on the southern end of the refuge for archery hunting could provide for greater harvest opportunity by denying elk access to safe zones while, at the same time, protecting crucial winter forage. More hunter access points for bison hunters could increase harvest and help achieve herd size objectives, but the extra traffic might not be well received by residents of the Teton Valley Highlands subdivision.

We might alienate some nonhunters with the more visible archery harvest in currently closed areas, a bull harvest that includes a trophy value, or the harvest of predatory species such as mountain lion or wolf. In addition, opening the closed areas could negatively affect wildlife-viewing opportunities along Highway 89 and Elk Refuge Road during the hunting season. Disturbance of elk by hunters next to roads and to Jackson would move elk to other areas and limit viewing opportunities.

Elk and bison use of wetland plant communities and effects on hunter opportunity, harvest level, and populations would be intermediate between alternatives A and B. As the bison herd grew and distribution changed because of hunting practices, bison might be more frequently seen in the southern sections of the refuge.

Lead-free ammunition requirements would protect scavenging birds from being poisoned by lead contained in the elk and bison gut piles and would help to further reduce blood-lead levels in these birds. Hunters would incur higher costs from the more expensive lead-free ammunition, and this requirement might alienate some hunters.

Bear-deterrent regulations and practices could provide a safer environment for refuge hunters, neighboring communities, and bears but could also cause inconvenience and higher costs for hunters.

Gaining information from hunters would help the staff improve management of the hunt program, but collecting data might inconvenience and alienate hunters.

Outreach on the Service's position of allowing hunting on refuges would educate the public on the need and purpose for this recreational activity.

There would be higher equipment costs and more labor and personnel needed to develop and manage the added programs.

Fishing

The effects of each alternative on fishing are described below.

Alternative A

Stream morphology, fisheries habitat, access, and angler opportunity would be similar to current conditions. The fishing program would continue to offer anglers access to quality trout waters while protecting waterfowl nesting areas from human disturbance.

Alternative B

Same effects as alternative A. In addition, fisheries habitat improvement and angler opportunity in Flat Creek would be greater than alternative A in Flat Creek but similar to alternative A in the Gros Ventre River. Failure to devote adequate resources to the refuge fisheries might result in a serious decline in the native Snake River cutthroat trout population.

Offering more fishing opportunities for young people would perpetuate this traditional use of the refuge but would also need more time from staff and partners.

The change to morning access, not the night before, to lower Flat Creek on opening day would be consistent with a refuge regulation allowing access during daylight hours only. However, this would deny a few anglers the opportunity for an early start to fish during predawn hours on opening day.

More people would be able to access Flat Creek to fish by using an accessible platform.

With limits set in the permits for fishing outfitters, the refuge would restrict group size and reduce crowding. Adding use limits to guiding permits and allowing guided trips to access the Gros Ventre River could reduce streamside crowding on lower Flat Creek. The refuge would keep fee revenue from fishing outfitter permits and use it for access maintenance, signing, regulation brochures, and other aspects of the fishing program. Use limits and fees might have a financial impact on permitted fishing outfitters.

The design and installation of fish screens or barriers would require time, effort and money by the Service, WGFD and partners. Continued suppression of the rainbow trout population in the Gros Ventre River would support the native cutthroat trout.

Alternative C

Same effects as alternative B. In addition, because of riparian area improvement, the fisheries habitat quantity and quality and angler opportunity would be the highest among the alternatives in the Gros Ventre River. In Flat Creek, these effects would be similar to alternative A.

Alternative D

Same effects as alternative B. In addition, because of riparian area improvement, the fisheries habitat quality and quantity and angler opportunity would be higher in Flat Creek than alternatives A and C. In the Gros Ventre River, these effects would be similar to alternative A and lower than alternative C.

Wildlife Observation and Photography

The effects of each alternative wildlife observation and photography are described below.

Alternative A

Wildlife viewing is an important activity by both local and nonlocal refuge visitors that would continue to support the mission of the Refuge System. Visitors would continue to have opportunities for wildlife observation and photography at existing trails, observation sites, and the visitor center. Visitors might stay longer at the visitor center and enhance their refuge experience with the easily accessible wildlife-viewing opportunities offered. However, use of the remote-viewing platform is low because visitors are reluctant to cross the lawn or are not aware of the platform. By encouraging visitors to use areas that are already disturbed, such as turnouts, wildlife would be affected less.

Allowing commercial operations, with required safety and wildlife-viewing practices, would provide a service to the public that allows visitors to safely enjoy the refuge and provide a financial benefit to local companies. All traffic on Elk Refuge Road is currently unlimited in regard to the number of vehicles allowed, including the number of commercial tour companies that are allowed to operate on the refuge through a special use permit. Because special use permits have contact information, the refuge staff would be able to contact permittees if they were not following permit stipulations.

Sleigh rides would increase refuge visitation and continue to provide a unique winter wildlife-viewing opportunity that raised awareness of the refuge and received national as well as international attention. Because the refuge does not have the resources to offer sleigh rides, this opportunity would continue to be contracted to local companies, which would help the local economy. Contracted sleigh rides would reduce stress to wintering wildlife, particularly elk, by including stipulations in special use permits that require contractors to follow acceptable viewing practices. The increased visitation would contribute to the local sales tax revenue.

The refuge would continue to receive a percentage of the revenue generated by the sleigh ride operation, which provides money for winter naturalists. This seasonal staff would continue to be the only means to respond to a large number of program requests from schools and other groups. The winter naturalists would also help the refuge in offering a range of programs and events at the visitor center that could not be provided with the refuge's current budget and permanent, visitor services staff.

The public—individuals, organizations, and the media—would have access to refuge photos posted by visitors, photographers, and refuge staff on the Web-based photo-sharing site, reducing staff time to address individual requests. A Web-based photo gallery would be a contemporary way to share images, allowing users to view and download photos. A photo gallery would also help media looking to promote the Jackson area, resulting in benefits to the local economy.

Lori Iverson / FWS

There are opportunities for wildlife observation on the refuge for all age groups.

Alternative B

Same effects as alternative A. In addition, the narrow North Highway 89 Pathway would have pull-offs that would allow visitors to conveniently and safely stop and view wildlife and scenery. Conflicts among visitors, cyclists, runners, or other users would be reduced.

More visitors would be able to observe birds and other animals by using a designated route through the visitor center lawn to the existing remote-viewing platform behind the visitor center. Construction of the path would temporarily affect wetlands and soil in the immediate area and might disturb nesting geese using the lawn in spring and early summer.

Developing a boardwalk through already-disturbed wetlands near the visitor center would increase wildlife-viewing opportunities. The visitor experience would be greatly enhanced by having a longer route that allows people to walk through wetland habitat rather than just viewing it from the platform. In addition to a variety of bird species, deer and moose use the wetlands in the winter. Construction of the boardwalk might temporarily disturb wildlife, and there would be seasonal disturbance of wildlife when people used the boardwalk. There would be a substantial cost for the boardwalk, but this type of project might be appealing to local interest groups and the cost might be offset by partners. The photo blind would increase wildlife photography opportunities; there would be fewer construction effects if the blind were installed during initial construction of the boardwalk. Additional maintenance time would be needed in the winter for snow removal if the boardwalk was open year-round.

Webcams at key sites would reach a wider audience because they would allow viewing experiences for people that are unable to visit the refuge. The installation and maintenance of webcams could have minor soil effects. No information technology support would be available at the refuge for repairs to the equipment or system.

Alternative C

Same effects as alternative A. In addition, increased visitation and the number of people requesting wildlife tours, especially during the winter season when abundant wildlife is visible, could lead to increased traffic and congestion on Elk Refuge Road. This could reduce the quality of the wildlife-viewing experience and cause possible economic impacts to tour operators. Limiting the number of commercial operators could mitigate these issues and reduce wildlife disturbance. Limiting the number of available permits could have negative economic impacts on tour companies not selected to receive special use permits. The demand for commercial tours on the refuge could exceed the capacity of the limited number of permittees. There would be higher law enforcement costs to ensure compliance.

Webcams would reach a wider audience because they allow viewing experiences for people that are unable to visit the refuge. The installation and maintenance of webcams could have minor soil effects. No information technology support would be available at the refuge for repairs to the equipment or system.

A photo gallery on the refuge's Web site would provide a contemporary way to share images, allowing users to view and download photos. Easily accessible photos would reduce staff time to address individual requests. A photo gallery would also help media looking to promote the Jackson area, resulting in benefits to the local economy.

Alternative D

Same effects as alternative B. In addition, increased visitation and the number of people requesting wildlife tours, especially during the winter season when abundant wildlife is visible, could lead to increased traffic and congestion on Elk Refuge Road. This could reduce the quality of the wildlife-viewing experience and cause possible economic impacts to tour operators. Limiting the number of commercial operators could mitigate these issues and reduce wildlife disturbance. Limiting the number of available permits could have negative economic impacts on tour companies not selected to receive special use permits. The demand for commercial tours onto the refuge could exceed the capacity of what the limited number of permittees could provide. There would be higher law enforcement costs to ensure compliance.

Environmental Education and Interpretation

The effects of each alternative on environmental education and interpretation are described below.

Alternative A

By allowing nonmotorized use of the North Highway 89 Pathway, we would increase opportunities for environmental education and interpretation during the season the pathway is open.

By using nongovernmental money to hire seasonal naturalists, the refuge could hire needed staff to provide environmental education for schools and other groups and conduct a wide range of programs and events at the visitor center that we could not provide with our current funding and staff. The nongovernmental hiring process would also help the refuge to quickly fill vacancies, rather than increasing the workload of staff during an extended vacancy that is common with the Government hiring process. However, nongovernmental money would continue to be based on bookstore sales and sleigh ride proceeds, which are unpredictable from year to year. Many factors can negatively affect the amount of revenue generated annually such as the national economy, a Government shutdown, a natural disaster, and equipment failure. Therefore, the refuge staff could not do any long-term planning for environmental education or interpretive programs because there would not be a reliable estimate for nongovernmental money that might be available. Seasonal positions through a nongovernment funding source are less desirable than Government seasonal positions because the employees do not get benefits or contribute toward years of service if the employee is seeking eventual permanent status with the Federal Government.

Using a volunteer workforce to meet the demand for environmental education and interpretive programs during the school year would not be a reliable and stable staff source. Jackson has a relatively small population and is located in an isolated area, so it would be difficult to recruit volunteers from local communities. Many of the refuge volunteers provide their own housing in the form of recreational vehicles, motor homes, or other mobile residences. Because of the snow and cold temperatures common during Jackson's long winters, this type of living situation would not be practical. The refuge has limited housing to offer to residential volunteers, and the high cost of living and rental market shortages in the Jackson area preclude most from finding or paying for offsite housing. Furthermore, trends at the refuge show that volunteers working in unpaid positions are more likely to leave their positions because of unplanned situations, family matters, heath issues, unexpected weather, or other changes. Requests for educational field trips in the spring may not be accommodated because volunteers are not available until later in the season.

The refuge relies solely on a volunteer staff to staff the information desk at the interagency visitor center. When volunteers were available beyond the minimum needed to staff the desk, volunteers would also provide formal and interpretive programs. However, because of the turnover in volunteers, the number of volunteers needed to cover basic operations, and the variety of work shifts and days off, the refuge would not be able to provide training to develop the skills of these volunteers.

Service money to cover costs for a volunteer program has been reduced and, in 2011–2014, eliminated. The refuge's base funding has had to cover the expenses for items and services such as uniforms, utilities, phone and Internet service, laundry facilities, and recognition items to run the volunteer program. Because of the large number of volunteers needed to provide basic services, the current volunteer program may not be sustainable if money becomes even more limited, meaning a reduction or elimination of services and programming.

Contracted sleigh rides would provide unique learning opportunities while reducing stress to wintering wildlife, particularly elk.

Alternatives B and D

Using the North Highway 89 Pathway for interpretation would increase opportunities to interpret wetland values in an already disturbed area.

A self-guided interpretive tour route would provide more interpretive opportunities to increase public knowledge and awareness of the refuge purposes and the Refuge System mission. This would also provide another free opportunity for visitors to the refuge. Commercial sleigh rides require a fee. Refuge staff would need time to develop and maintain the route as well as needing money for interpretive materials such as signs or brochures or both. An interpretive route might increase traffic on Elk Refuge Road and create conflicts with hunters or other users.

The winter opportunities already attract a substantial number of visitors to Elk Refuge Road, which has created the need to enhance road and traffic safety and education and interpretation programs. Brochures associated with numbered turnouts or interpretive panels (some equipped with spotting scopes) would attract visitors to the turnouts, minimizing the number of vehicles parked in the roadway. This scenario would create an opportunity to educate the public about wintering wildlife, the National Elk Refuge, and our agency.

Replacing a longer length video with shorter video segments on various topics would respond to visitors' needs and preferences as well as allow the refuge staff to update segments with substantially less cost and staff time. Shorter segments stored on the refuge's Web site would let viewers to watch them at a more convenient time, thus increasing viewership. Replacing the video would help us to emphasize the role of refuges versus national parks and national forests and differentiate our agency missions. The refuge would continue to offer visitors to the Jackson Hole and Greater Yellowstone Visitor Center a wide range of information and services, but many visitors do not sit in the theater to watch an entire film. While a well-produced video could be an effective and popular outreach tool, it would be an expensive and labor-intensive project. An updated video could enhance the information in the visitor center. However, the visitor center only has a small theater in which to show a longer length film, and seating and acoustics are inadequate. Because traditional-length videos take a substantial amount of time to produce, they are not easily updated to reflect changes in management practices, wildlife species or numbers, or new issues or developments. Furthermore, longer videos are not the prevalent method for people to get information, as this is a somewhat outdated approach. Studies clearly indicate that people now prefer shorter video, film, smart phone, and tablet applications that they can view at their convenience or docking stations to download needed information such as for self-guided tours.

Environmental education and interpretive programs could include the following:

- Promoting understanding of invasive species control and prescribed fire as a management tool.
- Increasing public education about migratory bird use of the refuge and reasons for closing areas during bird breeding.
- Offering improved programs at the visitor center, Miller House, and offsite areas with more permanent or seasonal interpreters.
- Emphasizing the role of national wildlife refuges versus national parks and national forests and differentiating our agency missions.
- Discussing the complexities of management on the refuge, including describing the supplemental feeding program and the goals of the Bison and Elk Management Plan.

A reliable source of money to hire permanent and seasonal interpreters could attract people trained and experienced in the fields of environmental education and interpretation to improve the quality of the programs. People looking for or developing permanent careers with the Federal Government are more apt to apply for Government positions than nongovernmental positions that do not offer grade increases, benefits, and insurance. This would increase the applicant pool and help us mentor and develop future career employees in our agency.

Alternative C

Same effects as alternative B. In addition, disturbance would be limited to areas that include nonnative vegetation.

Jackson Hole and Greater Yellowstone Visitor Center

The effects of each alternative on the visitor center are described below.

Alternative A

The refuge would be unable to provide educational and interpretive programs along with the tasks of keeping the visitor center open. The daily demands on the visitor center would continue to grow as (1) new visitation records were set during both winter and summer, (2) the visitation season was

extended through local aggressive marketing efforts by the tourism industry, and (3) the building ages. Peak visitation would reach 3.6 visitors per minute during the summer season, intensifying the operational workload of the visitor center manager and leaving no time for planning and scheduling environmental education programs, guest speakers, special events, or interpretive programs.

If no money was received from visitor center partners for operational expenses and routine supplies, the refuge might need to reduce hours or look at alternative ways to offset costs, such as a single-agency facility. Reducing the hours would decrease services for the visiting public. This could have financial impacts on the local economy. A 2010 survey noted that out of 100 people who stopped at four Wyoming visitor centers, one-quarter, or 26 people, stayed longer and stayed at least 1 additional day in Wyoming. Although the visitor center was not one of the centers in the survey, the statistics show the effect a visitor center operation can have on the local economy. Reduced visitor center hours might also decrease revenue from sales at the Grand Teton Association's retail outlet. Because the refuge would receive a portion of the sales revenue, decreased visitor center hours would also decrease the amount of money we could receive, which is an important source of money for seasonal staff and other support for educational, interpretive, and research programs.

Alternatives B, C, and D

Sharing the financial burden among the agencies for operating the center and purchasing supplies would make it more equitable than having the refuge cover all or most of the annual costs. Partners would continue to gain substantial financial benefit from helping staff the interagency center and using it as their primary visitor services contact location, rather than providing and staffing their own centers.

A new or renovated visitor center would address the current building's safety and maintenance issues and accessibility deficiencies and lack of space adequate for requested programs. Furthermore, a new visitor center would enhance the flow of visitors as they came into the center, distinguishing between the types of services and agency-specific information available at the facility and increasing staff efficiency. It could be designed to meet accessibility standards that are deficient in the current facility.

North Highway 89 Pathway

The effects of each alternative for the North Highway 89 Pathway are described below.

Alternative A

By allowing nonmotorized and pedestrian use and connecting to other pathways, the public would have more opportunity for wildlife observation, photography, environmental education, and interpretation. The pathway would also encourage a safe transportation option for workers and visitors to and from the town of Jackson to Grand Teton National Park and provide a connection to other pathways and cycling routes for most of the biking season.

The seasonal closure (November 1–April 30) would continue to protect elk migration corridors and prevent disturbance to wintering elk and other wildlife. Prohibiting pets would limit disturbance to wildlife, particularly nesting waterfowl and other wildlife that use the area between the fence and Highway 89. The pet prohibition would also reduce the accumulation of fecal matter from pet owners that do not clean up after their animals.

The refuge would need substantial staff time to coordinate regulation enforcement by Teton County and to conduct public outreach on our mission and how it differs from the mission of the surrounding National Park Service and USDA Forest Service.

Alternatives B, C, and D

Same effects as alternative A. In addition, people would have more opportunity for interpretive experiences, and the refuge would be better able to promote our agency mission. Refuge staff would get data about wildlife movement across the pathway that would help us to adjust public use, if needed, to protect wildlife and keep people safe. There would be more staff time needed and higher costs for associated facilities and signage. Increased use of the pathway could adversely affect the success of trumpeter swan nests.

To effectively manage the pathway, we would address the following situations:

- Because the pathway is narrow, it might be difficult for cyclists, runners, or other users to safely pass visitors that are focused on wildlife- and habitat-viewing. This is common on other parts of the Jackson Hole Community Pathways when users are distracted by talking, using cell phones, or engaging in other activities that detract them from being conscious of their position on the pathway or limits their reaction time to oncoming users. It might cost us more to add needed signage and facilities for safety and interpretation.

- The refuge, in coordination with Teton County, could adjust the dates for the seasonal closure (increase the number of weeks the pathway is open) if data collected by either the refuge or the county provided solid justification for a change. Use must remain compatible with the purposes of the refuge and the "wildlife first" mission of the Refuge System.

North Park

The effects of each alternative for North Park are described below.

Alternative A

The current fee collection and reservation system used by the Teton County Parks and Recreation Department for reserving the site is not in compliance with Service policy. Weddings, family reunions, and other non-wildlife-dependent events would continue to be common at North Park. Depending on the size of the party, a wedding at North Park or the visitor center could reduce or eliminate parking spaces for visitors using the center to learn about the area and get visitor service information. The wedding prohibition would be a largely unenforceable situation.

Alternative B

Revising the memorandum of understanding with the town of Jackson for North Park to exclude activities such as weddings and reserving picnicking sites through a fee-based system would comply with our agency's policies. There potentially could be negative public relations about the new restrictions. Jackson might be affected by having one less picnic shelter within the town limits that can be rented and reserved. However, Jackson has many designated picnic sites and public parks available through a fee-based reservation system, including some close to North Park, for these activities.

Weddings, family reunions, and other non-wildlife-dependent events would continue to be common at North Park. Depending on the size of the party, a wedding at North Park or the visitor center could reduce or eliminate parking spaces for visitors using the center to learn about the area and get visitor service information. The wedding prohibition would be a largely unenforceable situation.

Alternatives C and D

Same effects as alternative B. In addition, by converting North Park to native habitat, the refuge could add to the visitor experience by providing a more natural setting, rather than a manicured lawn, along with interpretation. The refuge would incur costs to restore the park and maintain the area. Most breeding birds, except Canada geese, would benefit from the increased habitat value.

Special Uses

The effects of each alternative on special uses are described below.

FWS

The visitor center hosts exhibits and allows staff to offer interpretation.

Alternative A

Additional activities that the refuge could not provide because of lack of funding and staff follow: guided hunting and fishing, hunting retrieval services, wildlife-viewing tours, commercial photography and videography, and research. However, commercial services could provide some of these activities. These activities promote wildlife-dependent recreation and increase outreach about the refuge. Guides offer services that might bring visitors, who would not otherwise engage in the activity without assistance, to the refuge. The refuge would continue to accommodate commercial photographers and film companies, depending on the potential effects and staff available at the time of filming.

We might approve certain special requests, such as accompanying staff during management operations on a very limited basis that takes into account equal treatment of requestors, setting precedents, safety, and the availability and priorities of our staff.

Special permit conditions would reduce effects on resources and other activities. In many cases, we would require permittees to report their use at the end of the permit period, documenting the number of clients and trips onto the refuge. Staff would spend a substantial amount of time on contacting the permittee, writing the special conditions, completing the permit, recording the information in a register, monitoring the permitted use, filing the use reports, and compiling annual use results. In the case of commercial filming, staff would spend more time making logistical arrangements and accompanying the film crew.

The refuge would deny requests for holding weddings at Miller House.

Commercial, non-wildlife-dependent horseback trail rides along a 1-mile segment of the Gros Ventre River would continue as long as staff was available manage the use. This effort would divert limited staff resources away from critical refuge programs. More commercial horseback trail riding would be prohibited, which would prevent the diversion of additional staff time to this activity.

Alternative B

Same effects as alternative A. In addition, the fees charged for special use permits for commercial activities would help cover some of the associated administration and enforcement. Companies who violate refuge regulations or permit conditions could have their permits revoked by refuge management or be assessed fees.

The use of wildlife-viewing tours to provide interpretation to visitors could increase public understanding of refuge resources and management.

By restricting weddings on all refuge land, we would help reduce disturbance to visitors using the refuge for wildlife-dependent activities, as well as comply with our agency policy. There might be some negative public relations related to restricting weddings.

Phasing out commercial horseback trail riding would reduce the risk of new invasive plant infestations and allow staff time devoted to managing this activity to be used on higher priority programs.

Alternatives C and D

Same effects as alternative B. In addition, limiting the number of commercial operators could help mitigate traffic congestion and reduce wildlife disturbance on Elk Refuge Road. On the other hand, fewer tours could reduce the quality of the wildlife-viewing experience and might not meet public demand. There might be negative economic impacts to the tour companies not selected to receive a special use permit.

General Access and Elk Refuge Road

The effects of each alternative on general access to refuge lands are described below.

Alternative A

By keeping open Elk Refuge Road, Flat Creek Road, and Curtis Canyon Road, visitors would be able to see more of the refuge. For winter wildlife viewing, visitors would have opportunities along the 3.5 miles of Elk Refuge Road that we would keep open.

Alternatives B, C, and D

Same as alternative A. In addition, the refuge would consider adding more access and designated parking lots for hunters. This could include access on the northern end of the refuge for bison hunters and access on the western boundary of the refuge for archery hunters.

Access to the National Forest

The effects of each alternative access to the Bridger-Teton National Forest are described below.

Alternative A

By providing access to national forest lands at designated locations, the refuge would exhibit good cooperation between the two Federal agencies and extend a convenience to national forest users. Closure of the "jump cliff" access to the national forest would decrease use in this area. Limiting access to designated locations would reduce disturbance to wildlife and habitat, reduce trespass onto the refuge, and provide an opportunity for public outreach on our agency's mission and how it differs from that of the USDA Forest Service, where more recreational opportunities exist. There would be some disturbance to wildlife, mainly elk, from people passing through the refuge.

The refuge has allowed people to park overnight on Elk Refuge Road one night each year; these are people interested in accessing national forest lands as soon as the winter closure is lifted on May 1 to look for antlers and has involved hundreds of cars. The resulting congestion would continue to reduce access by other road users, interfere with egress and ingress for residents of the Twin Creek subdivision, and impair access by emergency vehicles responding to private property owners. There would also continue to be some impacts to the areas next to the roadway from foot traffic and horses. The refuge would continue to have substantial costs (up to $30,000 annually) to provide more law enforcement.

Because the travel distance across the refuge for winter users of the Goodwin Lake Ski Cabin (on national forest land) is several hundred yards and the designated route is next to a fence, only minor wildlife disturbance would occur. Refuge staff would administer the permits for access to the cabin, which is off refuge land. Staff duties and costs would increase in late April to manage the May 1 event.

Alternatives B, C, and D

Same effects as alternative A. In addition, signing for an egress route would decrease trespass on private land in the Twin Creek subdivision. Since skiers would predominantly recreate on national forest lands, moving special use permit administration to the national forest would shift the workload to the agency that is most involved.

Prohibiting overnight parking and staging on April 30 would reduce congestion and effects on other road users, local residents, and emergency and service vehicles. Effects on the areas next to the roadway would be reduced because of less use by pedestrians and stock, mainly horses. There would be substantial savings for expenses previously related to the event (up to $30,000 annually) that could be used for priority refuge management. The prohibition of overnight camping and staging on Elk Refuge Road could create other law enforcement issues, such as increased poaching and illegal access. The local economy might see increased revenue from lodging and dining if people were not allowed to spend the night on the refuge camped in vehicles and trailers. However, these "campers" instead might choose to stage their vehicles in the streets and parking lots of Jackson, resulting in complaints from the local police department and residents. In addition, with a later refuge gate opening time than at other access points to the national forest, refuge staff might be able to reduce or eliminate people interested in staging on Elk Refuge Road. Users that learned other accesses onto the national forest would be opening before the refuge access might be discouraged from using Elk Refuge Road, knowing other antler collectors would be reaching the same destinations sooner.

Public Outreach

The effects of each alternative for public outreach are described below.

Alternative A

Sending out news releases and refuge articles, maintaining the refuge Web site, and using social media would keep a wide variety of audiences current on visitor opportunities and management activities and would serve both internal and external audiences. Maintaining an email contact list to distribute refuge information would help the refuge to reach a wide and diverse audience.

Working with the media would increase the presence of the refuge and its attraction as a destination site, but is an activity that requires a large amount of staff time because the refuge receives so much regional and national coverage.

More hunt program outreach would help refuge users and critics understand both the wildlife management and the priority recreational use aspects of hunting on a national wildlife refuge.

The staff's educational outreach to anglers would increase harvest of nonnative species and supplement our efforts to suppress populations of the nonnative rainbow trout, brown trout, and brook trout.

The amount of indepth outreach information would be limited because of limited staff and the reliance on seasonal naturalists and volunteers. With high turnover in the seasonals and volunteers, staff would be constantly training new people who would lack the institutional knowledge that comes with long-term employees.

FWS

Public meetings are a good form of outreach.

Alternatives B and D

Same effects as alternative A. In addition, by using more electronic media, the refuge would reach a greater number and diversity of people. Unlike Web sites, new media sites are an outreach tool that requires a designated person that can regularly post updates, add to previous information, check the sites and public responses, and respond to questions and comments on a regular basis. The size of the visitor services staff in relation to the workload would dictate the level of electronic media used.

The staff outreach about migratory birds would increase public understanding of our habitat management to help these birds. Likewise, outreach about the comprehensive wildlife disease plan would increase public understanding of our habitat management as it relates to dispersion of elk and bison herds to reduce the risk of disease.

Alternative C

Same effects as alternative B. In addition, the public would have more understanding of the role of the refuge in the Greater Yellowstone Ecosystem.

Cost and staff time associated with outreach related to migratory birds would be higher than alternative A but less than alternative B.

5.12 Safety Effects

The effects of each alternative for visitor and employee safety are described below.

Alternative A

Visitors would have safe conditions when using the refuge, and employees would have safe working conditions. By reducing workplace hazards and focusing on safe work practices, the refuge would have a secure workforce and substantial financial savings.

Alternatives B, C, and D

Same effects as alternative A. In addition, to keep pace with the hunting program, more law enforcement presence during hunting season would increase enforcement of refuge regulations emphasizing safe practices. Continued efforts by WGFD and the refuge would keep a good safety record in the refuge hunt program. Hunters observed by law enforcement committing safety violations could have their refuge hunting permits revoked. This could improve hunt area safety by removing unsafe hunters from the refuge. Failure to check and improve safe hunting practices might result in more hunting-related accidents. More staff would increase costs

5.13 Resource Protection Effects

The effects of each alternative for resource protection are described below.

Alternative A

The current suboptimal law enforcement presence would prevent most major wildlife resource violations. Limited patrol activities would continue to miss significant violations such as those that occurred in backcountry areas during hunting season, fishing violations, trespass, theft of shed antlers, and illegal road and parking use that occurred during night hours and was associated with public use activities on the adjoining Bridger-Teton National Forest. Failure to supply an increased law enforcement presence might result in the degradation or loss of refuge resources.

Since hunter densities and animal harvest are concentrated near roads and parking areas, covering these activities would consume the law enforcement staff to the exclusion of having a presence on the refuge boundary or in backcountry hunt areas. Consequently, few hunters would be checked away from roadways, and several hunting violations would remain unresolved each season.

Alternative B

As visitor services were expanded, the ability to protect refuge resources would decline. However, more law enforcement staff and equipment would help us deter refuge trespass and theft of shed elk antlers and other wildlife parts. Increased patrol activity involving staff and equipment would have a higher cost. More staff could increase data gathered about hunter and angler use, which could be used to guide future management.

Alternatives C and D

Same effects as alternative B. In addition, land exchanges between the refuge and adjacent Federal agencies could be used to simplify (straighten) the refuge boundaries. Hunters would benefit from a simplified refuge boundary because they are required to comply with refuge-specific regulations within the refuge boundary. Land exchanges would be an expensive and time-consuming process for our agency realty divisions and would not result in a net increase in protected acres. There would be a change in mandate for those acres, from multiple use or wilderness on national forest lands, to a wildlife-first mandate as U.S. Fish and Wildlife Service lands. A simplified boundary might increase compliance with regulations and have a corresponding decreased need for law enforcement.

5.14 Administration Effects

This section discusses the effects of alternatives pertaining to funding, staff, and facilities and real property assets.

Funding and Staff

The effects of each alternative for funding and staff are described below.

Alternative A

Low base funding and lack of staff has limited management on some units and reduced emphasis for some programs. Current funding and staff levels (10.5 FTEs) would continue to be insufficient to conduct programs and achieve the refuge goals. A staff of 10.5 FTEs is 42-percent lower than the 18 FTEs recommended for the refuge during a nationwide (adjusted by region) minimum staffing exercise completed for the Refuge System in 2008 (FWS 2008). The workload and complexity of refuge programs has continued to increase since that time.

Today, the refuge can only achieve its critical work through the additional money from private organizations and the efforts of one of the region's largest volunteer programs. A reduction in private money would prevent the refuge from successfully conducting its programs and substantially reduce the service and benefits the refuge provides to the public and wildlife populations.

Private money could enable the refuge to hire approximately 4.8 FTE positions, and volunteers would continue to contribute approximately 9.3 FTEs of assistance each year. There would continue to be high turnover in these positions, resulting in staff with limited experience, which would require more training and oversight of workers and volunteers. This would make a higher supervisory workload for the permanent staff and would reduce their ability to address other refuge priorities. Volunteers are limited in the type of work they can do because of Service policies for use of Government computers. Volunteers are often not hired far enough in advance to get the credentials needed for Government computer use during their scheduled season. Because of the high turnover in volunteers, staff would need to continually get credentials for volunteers that may not assist the refuge for an extended period of time.

Reliance on partnerships that provide nongovernmental money would continue to be an excellent way of involving private citizens in supporting the management of the refuge. The refuge relies on money received from the Grand Teton Association and the Jackson District Boy Scouts to accomplish programs:

- Financial support from the Grand Teton Association would continue to enable the hiring of three temporary winter naturalists from November through March (1.5 FTEs). These naturalists would provide winter interpretive programs during a key period when herds of elk and bison are on the refuge. Without this money, the refuge would eliminate popular and requested environmental education and interpretive programs, substantially reducing the positive effect these programs have on public understanding of the refuge mission.

- A minimum of 2.6 FTE temporary employees would continue to be hired to operate the irrigation system using money from the Boy Scouts of American Elk Antler Auction. Use of irrigation to increase winter forage and reduce the need for supplemental feed-

ing is a primary strategy in the management of elk and bison. If this money were not available, the acres irrigated would be severely limited, substantially reducing the amount of natural winter forage available for elk and bison. Reduction in forage would increase the seasonal length of the supplemental feeding program, increase the cost for alfalfa pellets, and put elk and bison at greater risk of disease transmission because of longer periods of concentration.

Seasonal law enforcement officers would continue to be critical to safely and successfully conducting the refuge hunting programs. These officers would continue to be funded each year from the annual sales of "America the Beautiful—National Parks and Federal Recreational Lands Passes," also called Interagency Passes. This is an unreliable source of money for a critical refuge program. If money for seasonal law enforcement officers was unavailable, the hunting program might need to be scaled back for public safety reasons. This would likely reduce the harvest of elk and bison and have an adverse effect on refuge efforts to achieve a balance between habitat and herd sizes and meet the objectives in the Bison and Elk Management Plan.

The integrity of long-term, biological monitoring programs would require annual consistency. If money for staff was unavailable or volunteers were unable to collect specific biological data, the value of the long-term monitoring efforts could be severely reduced. This could negatively affect our ability to make reliable management decisions based on sound science.

Alternative B

Increased base funding would enable the refuge to add 14 FTE positions, which would have the following benefits:

- The combination of adding a permanent biological technician to collect field survey information and the addition of a permanent rangeland specialist would substantially enhance the refuge's ability to manage refuge lands for the greatest benefit to the elk and bison herds. These positions would also lead to improved management of native plant communities for the highest diversity, which would benefit other wildlife species. Establishing native plant plots would provide a long-term source of desirable seed for management purposes.

- The addition of permanent seasonal irrigators would reduce training, orientation time, and the need for annual utility vehicle certification. By using primarily trained and experienced irrigators, the efficiency of the program would improve and ultimately increase the amount of forage produced. This would have a positive effect on reducing the need for supplemental feeding and the potential for disease transmission, which would make a positive contribution toward the refuge goal of managing for healthy herds.

- The addition of a permanent law enforcement officer would help enforce regulations across the refuge, respond to public safety incidents promptly, and improve wildlife protection during the hunting season.

- An environmental education specialist would dramatically improve the amount of educational programming offered to the public. Currently, the visitor center manager works primarily on the interagency coordination of the facility, visitor center supplies and expenses, license sales, facilities maintenance, scheduling, and extensive volunteer recruitment coordination. This leaves little time for educational programming including interpretation, environmental education, special events, and family activities. An environmental education specialist would increase the number of public activities; promote high priority, wildlife-dependent activities such as wildlife observation, photography, environmental education, and interpretation; and help coordinate volunteers. Permanent seasonal staff for the visitor center desk would provide consistent and reliable service to nearly 300,000 visitors annually and reduce the staff workload of training short-term volunteers and temporary employees. The addition of this staff would reduce the current workload demand on the visitor center manager.

- The reestablishment of three permanent seasonal winter naturalists would enable the refuge to regularly provide interpretative presentations on a variety of topics specific to the Service mission. In addition to elk biology and management, these presentations could emphasize the mission of the National Wildlife Refuge System, the refuge, and other refuge wildlife.

Private funding would be subject to the annual success of fundraising efforts primarily by the Grand Teton Association and the Jackson District Boy Scouts. The refuge would use this money to enhance refuge management and conduct volunteer programs. However, there would be no guarantee on the availability of this money.

Alternatives C and D

Same effects as alternative B. In addition, an environmental education specialist would elevate the quality and quantity of environmental education and interpretive programs. Through this specialist's focused efforts, the public, especially students, would better understand ecosystem functions in the Greater Yellowstone Ecosystem and the changes that threaten the integrity of this area.

The addition of three seasonal naturalists would enable the refuge to increase the number of programs provided to the public when demand for programs is high. These programs could broaden the public's understanding of the mission of the Refuge System and the refuge by focusing programs on wildlife species other than elk and bison.

With the work of added visitor services staff, the refuge staff could improve basic programming outreach, and the public would gain a better appreciation and understanding of wildlife and the natural resources that support them. This would build public support for the agencies that protect and manage natural resources such as our agency, the National Park Service, and the USDA Forest Service.

Facilities

The effects of each alternative for facilities and infrastructure are described below.

Alternative A

The refuge has two primary visitor services facilities, the Jackson Hole and Greater Yellowstone Visitor Center and the Miller House. The continued maintenance and use of these facilities would be vital in achieving the environmental education and interpretation aspects of the visitor services goal.

The refuge was established in 1912 and is one of the oldest national wildlife refuges in the Refuge System. The continued maintenance and use of refuge buildings that are more than 50 years old (and qualify for protection under the National Historic Preservation Act) would preserve their historic value and would help us achieve the spirit of the act while providing the public with a connection to refuge history.

The option for refuge staff to rent Government (refuge) housing would have several benefits:

- The high cost of both permanent and temporary housing is a significant impediment to recruiting and retaining staff to work at the refuge. Renting a refuge house would provide a reasonably affordable alternative to purchasing a home in the Jackson area, though Jackson has experienced severe rental shortages. This housing would also be slightly more affordable than area rentals and would locate the employee near the refuge, thus eliminating the need for a long and difficult commute from other communities. Providing the option of renting a refuge house has been vitally important in recruiting highly qualified staff, especially at times when there is a strong housing market. Even with this option, it is common for candidates who are considering filling a staff vacancy to decline the position because of the high cost of housing (Government housing, private rental, and home purchase).

- Wildlife observations by staff after normal work hours could provide valuable information about wildlife use of habitat, movements, and wildlife interactions. Refuge houses located at various places on the refuge could provide these after-hour wildlife observations, and this information could be especially helpful in conducting the supplemental feeding program.

- Key refuge staff such as equipment operators would continue to be located in houses that are near the refuge's heavy equipment. Operators could quickly access their heavy equipment to keep hunter parking lots accessible and conduct the supplemental feeding program, even during winter storms.

- Security for resources would be enhanced by providing staff housing at various refuge locations. Refuge facilities and equipment would less likely be vandalized or burglarized if located near an occupied refuge house. Public actions that violate refuge regulations such as trespass or wildlife harassment could be observed by refuge employees from their houses and reported to the county sheriff or the refuge law enforcement officer.

- Staff that live in refuge housing would provide an economic benefit to the town of Jackson. These employees would buy many of their daily living items such as groceries, vehicle fuel, and entertainment in Jackson, thus supporting the local economy.

Attracting bears to refuge houses could result in damage to personal or refuge property. Lack of regulations to prevent bear habituation and food conditioning, in which bears learn to associate humans with easily available food sources, could result in the destruction of bears, which would be inconsistent with the purpose of the Refuge System.

Alternatives B, C, and D

Same effects as alternative A. In addition, more refuge housing for permanent and seasonal refuge staff would help us to effectively recruit highly qualified candidates for staff vacancies, especially for lower graded positions. Three to four (up to five) new family houses would reduce the amount of open space on the refuge headquarters campus and could be perceived as negative by some surrounding residents. Dog owners from the local community who have illegally allowed their pets to roam on the refuge campus might also complain.

Refuge regulations for refuge houses and volunteers' recreational vehicle sites could prevent bears from becoming habituated and seeking out humans to obtain food rewards, resulting in safe living conditions and limited need to relocate bears.

The relocation of the Calkins House would allow the refuge to expand the zone where hunters could use high-powered rifles for hunting elk and bison. This might lead to a minor improvement in harvest, which would help the refuge to achieve herd size objectives. Removing the house would create a minor visual improvement in the viewshed for some hunters and the public when they travel through the refuge to access the Bridger-Teton National Forest. Another acre (plus driveway) of habitat would be available to produce winter forage, which would have a negligible positive effect on wintering elk and bison. Relocation of the Calkins House would eliminate (1) the benefit of obtaining after-hours wildlife observations from the refuge employee living there, and (2) that employee's opportunity to observe and report violations.

Elk Refuge Road

The effects of each alternative for Elk Refuge Road are described below.

Alternative A

Elk Refuge Road provides safe, reasonable, uninterrupted access (ingress and egress) for our agency staff, the public, and private landowners year-round.

Increases in visitation and traffic during either the summer or winter seasons could increase the potential for more traffic-related incidents. Refuge staff has noted increased congestion during both seasons, which impacts refuge vehicles and equipment, general traffic on the road, pedestrians, private adjacent landowners, and service and utility vehicles such as delivery trucks, propane trucks, gas and electrical service vehicles, and phone service vehicles. There could be increased traffic and congestion on the road from increasing numbers of permitted commercial tours, especially during the winter when abundant wildlife is visible. This could reduce the quality of the wildlife-viewing experience and cause possible economic impacts to tour operators. In addition, an increase in the use of Elk Refuge Road could cause moderate impacts by increasing the spread of invasive species such as perennial pepper plant and spotted knapweed from vehicles, especially during the summer season.

Refuge managers anticipate a time when the summer and fall months might include an increased use of the refuge by grizzly bears, which might draw more visitors and photographers to use Elk Refuge Road. Leaving only the first 3.5 miles of Elk Refuge Road open from December 1 through April 30 and restricting all traffic beyond that point would offer critical protection to wintering animals during a time of year when minimizing encounters with humans is key to their survival. However, despite this closure, there would still be outstanding, wildlife-viewing opportunities for the public on the open stretch of road during the winter months. Enforcing a no-stopping regulation to prevent the obstruction to other vehicular traffic along the road would improve safety along the road. The regulation prohibiting stopping or parking on the roadway would prevent the creation of unwanted parking areas and associated disturbance to vegetation. The refuge is located within the Greater Yellowstone Ecosystem, which includes two nearby heavily visited national parks where frequent stopping in the road to take photographs or view wildlife is common. Many of those same visitors come to Elk Refuge Road, bringing with them the same habits and viewing practices they exhibited in those areas during their same vacation stay. The current capacity in the turnouts might not be adequate to accommodate all the visitors. The county road easement would continue to be treated for dust abatement during summer months using magnesium chloride

(salt)-treated water, which is an attractant to bighorn sheep.

Plowed turnouts in the winter would give wildlife viewers an alternative to stopping in the road to photograph or view wildlife. Depending on the location of the bighorn sheep, the turnouts might not be in the best viewing locations and thus not used by wildlife viewers. While this would let the public closely view bighorn sheep, it could lead to increased vehicle–wildlife collisions. The bighorn sheep would become acclimated to vehicles using the road, but there would be potential for human–wildlife conflicts if wildlife viewers approached too closely on foot. Bighorn sheep close to the road could increase the potential for disease transmission to livestock or vice versa or lead to the spread of disease among the bighorn sheep herd itself.

Opening parts of Elk Refuge Road would allow the public seasonal access to national forest lands on foot or by vehicle and shows good cooperation between the two Federal agencies. Because the number of foot trails to the national forest boundary is limited, disturbance to soils and vegetation would be minimal. Trailhead parking could spill over onto Elk Refuge Road during times of peak use, especially during hunting season. This would occur infrequently enough that it would have only a minor effect. However, allowing spillover parking onto Elk Refuge Road by hunters might conflict with future management decisions to be stricter on enforcing a regulation of no parking on the road. It could also lead to the public perception that hunters have special privileges on the Elk Refuge Road over other user groups, which could lead to conflicts between wildlife observers and hunters.

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Roads on the refuge are used by staff and visitors alike..

Alternatives B and D

Same effects as alternative A. In addition, the regulation prohibiting stopping or parking on the roadway would prevent the random creation of unwanted parking areas and associated disturbance to vegetation. Increased signing could lead to better compliance with these regulations and improve safety for a variety of road users; however, increased signage does not always result in better compliance. More signs would detract from the aesthetics of the scenic, rural setting and would have installation and maintenance costs. Depending on the location of the signs, the signs could interfere with snowplowing operations. A roadside parking ban that would prohibit hunter retrieval of harvested game would not be desired by the refuge or by refuge hunters because it would greatly increase the amount of time to haul the animal out and could lead to spoilage of meat.

Visitors would learn about refuge wildlife and management issues by traveling the interpretive auto tour route. It would take substantial staff time initially to develop the auto tour route along with money for signs and printed material. We would update and reprint the brochure to include current information. Adding this interpretive experience could increase the amount of traffic on Elk Refuge Road, resulting in the effects discussed in alternative A. There would be higher costs and more staff time to develop and maintain the route.

Increased visitation for wildlife viewing would elevate the potential for accidents between vehicles, pedestrians, and wildlife. Widening strategically located segments of Elk Refuge Road would improve the line-of-sight for vehicles and reduce the possibility of accidents involving vehicles. Minor habitat loss at these sites would cause temporary disturbance of vegetation but would not adversely affect long-term wildlife populations.

Improving and increasing the number of turnouts on Elk Refuge Road and strategically placing them in areas commonly used by wildlife might encourage more visitors to use the turnouts than to stop in the road and create traffic hazards. This would enhance the public's visit by providing a safer experience on the road as well as improving wildlife-viewing opportunities. Directing wildlife watchers into maintained parking areas would reduce the number of instances

when their vehicles became stuck in the roadside ditch during winter months. However, increasing the number of turnouts or widening the road would create habitat loss. It would also add to the risk of new infestations from invasive species because of soil disturbance and the importation of fill material.

Observation scopes at turnouts would provide better opportunities for viewing wildlife close up and could encourage wildlife viewers to safely park and exit their vehicle to use the equipment. Scopes could make turnouts attractive destinations for refuge visitors, reducing the number of vehicles stopped or parked in the roadway. Scope could provide accessible wildlife-viewing opportunities. Physical and biological effects to the area where the scopes were placed would be minimal. The refuge would incur costs to maintain and replace the scopes, which could also be susceptible to vandalism or theft. The scopes could impede snowplowing operations to clear out the turnouts, and they could result in vehicle or equipment damage if struck by cars during times of limited visibility or icy road conditions. Reducing dust abatement on Elk Refuge Road would decrease the attractiveness of the road to bighorn sheep, which would reduce potential conflicts with humans and reduce the likelihood of disease transmission in the herd and with domestic livestock. The dust during the summer months could negatively affect pedestrian and bicycle users on the road. Reduced dust abatement treatments would continue to attract bighorn sheep to the road during fall and winter months because road water runoff promotes tall, dense, green grasses even during the fall and winter.

Increased maintenance in the winter would improve safety on the road and decrease the potential for incidents such as slide offs, multivehicle collisions, vehicle–wildlife collisions, vehicle–pedestrian collisions, or getting stuck in snowbanks or ditches. Increased road maintenance would take more staff time and increase long-term costs. With only one law enforcement officer on staff to enforce current regulations and make contacts with traffic offenders, the refuge would need money for more law enforcement support or to increase the amount of time the current officer could spend on enforcement of refuge road regulations.

Alternative C

Same effects as alternative A. In addition, reducing the number of turnouts would decrease disturbance to soil and native habitats and reduce the risk of spreading invasive species. However, fewer turnouts would not address safety concerns on Elk Refuge Road. Visitors likely would still use the road but would not have a safe alternative to parking on the road to look at animals or take photographs. Fewer turnouts would mean less snowplowing, thus reducing cost and staff time.

Ending dust abatement would likely decrease the attractiveness of the road to bighorn sheep, dispersing the sheep away from the road and reducing their numbers around Miller Butte. This would reduce the potential for human–wildlife conflicts if bighorn sheep stay away from the roadway, and wildlife viewers would not have the opportunity to come close to the sheep on foot. Without the attraction of salt on the road, bighorn sheep might remain more dispersed and reduce the transmission of diseases. Without dust abatement, more dust on foliage might predispose bighorn sheep to the risk of pneumonia. Wind along the road can be significant, and the dispersal of dust could occur throughout the east slope of Miller Butte to the national forest on the east. Less visitor use of the road for viewing bighorn sheep would require fewer parking areas and less vegetation disturbed. There would be less potential for vehicle collisions, and the refuge would have lower installation and maintenance costs if winter visitation on Elk Refuge Road decreased. Fewer bighorn sheep on or near the road would reduce the wildlife-viewing opportunity for some refuge visitors. However, visitors would be able to watch the bighorn sheep in a natural, dispersed population. Dispersing the bighorn sheep away from the road might decrease business opportunities for wildlife-viewing companies that have a special use permit to operate on the refuge.

Partnerships

The effects of each alternative for partnerships are described below.

Alternative A

Working with partners would help us in meeting the refuge goals and objectives. Furthermore, partnerships would be an excellent way of involving private citizens in supporting the management of the refuge.

The refuge would maintain effective and professional relationships with Federal and State partners as well as community members, leaders, nongovernmental organizations, and business representatives to foster an understanding of a variety of concerns, impacts, perspectives, and needs of each of the organizations and partners. Refuge staff would be more efficient and effective by working with partners and combining resources. Building and maintaining a leadership role in the community and maintaining partnerships would require staff commitment and time.

The refuge would continue to rely on partner support in many aspects of refuge management, as described below.

Physical Environment Support

Water conservation in the Greater Yellowstone Ecosystem could affect water resources on the refuge. Efforts to prevent new water diversions for irrigation and fish ponds, projects to remove unnecessary low-head dams, and programs to protect streambanks from excessive livestock use would have positive effects on the streams and rivers that flow onto the refuge. Although specific programs to address these water conservation issues do not exist in the Yellowstone Ecosystem, the Greater Yellowstone Coordinating Committee is the likely organization to address these needs in the future.

Biological Environment Support

Intense scrutiny and often contradictory public opinions about management of some wildlife species would continue to require coordinated efforts among Federal land managers and WGFD. Each agency could contribute expertise and resources toward management of high-profile species, and combined efforts could ultimately provide better results than the disconnected efforts of the individual agencies. Sharing inventory and monitoring data, coordinating the timing and scope of habitat improvement projects, and synchronizing seasonal public access restrictions are examples of ways Federal land management agencies and WGFD work together. These efforts would improve wildlife management that benefits wildlife species and their habitats and would enhance the public's understanding and confidence in management efforts by wildlife and land management agencies.

Involvement with land management agencies and nongovernmental wildlife research organizations is essential for answering wildlife management questions because it combines expertise and resources that the refuge might not have. The Jackson Hole Cooperative Elk Studies Group and the local greater sage-grouse working group are collaborative efforts that would continue to combine agency resources to improve management of high-priority species (elk and greater sage-grouse). This sharing of expertise and resources would enhance the refuge's ability to find sound solutions to management questions in a way that should increase public confidence. It would also provide an opportunity for the refuge to contribute to wildlife and land management efforts off the refuge, which could benefit the ecosystem wildlife populations and the populations that might use the refuge seasonally.

Nongovernmental organizations can play an essential role in projects targeted for specific wildlife issues. The discovery of elevated blood-lead levels in scavenging birds on the refuge and Grand Teton National Park is a good example of positive involvement by a nongovernmental organization. Craighead-Beringia South, a private, nonprofit, wildlife research organization, not only conducted research that identified the blood-lead level problem, but they also obtained private money to help correct the problem. As a result of their involvement, a program for voluntary use of lead-free ammunition was established for these Federal lands and is showing positive results in reducing lead exposure to specific wildlife populations.

Fire is a natural ecosystem process but unplanned wildfires can be destructive to agency facilities and sometimes impede wildlife management efforts. For example, a wildfire in September that would remove most of the refuge forage intended for use by wintering elk and bison would be counterproductive to the refuge management strategy. Also, the refuge could be held responsible for wildfire damage to adjacent private lands if the fire originated on the refuge. Cooperative agreements between the refuge, the Bridger-Teton National Forest, and the Grand Teton National Park would continue to provide important wildfire suppression capability that the refuge does not have. This partnership could prevent damage to wildlife habitat, refuge structures, and adjacent private lands.

Invasive plants such as spotted knapweed and cheatgrass reduce natural vegetation diversity and are considered problems throughout Jackson Hole. Our participation with the Jackson Hole Weed Management Association has resulted in a partnership to address this landscape problem on and off the refuge. Control efforts in Jackson Hole, especially next to the refuge, would help prevent new infestations from becoming reestablished on the refuge. This landscape effort would continue to help protect and enhance native plant communities and preserve plant diversity on the refuge for the benefit of many wildlife species. It would also contribute to landscape resiliency, which would enable plants and wildlife to better withstand and adapt to climate change.

Social Interaction Support

The refuge and its management can be affected by challenges or issues that are ecosystem-wide. Infestations of mountain pine beetle and white pine blister rust might not directly affect refuge habitat, but the resulting changes to adjacent habitats can have a profound effect on refuge wildlife management. The Greater Yellowstone Coordinating Committee is well positioned to address problems across the ecosystem, and the information they distribute to the public can help Jackson Hole residents understand how ecosystem-wide issues affect refuge

resources. Refuge staff involvement with this committee provides an opportunity for refuge staff to help influence news releases that are effective for the Jackson area.

Partnerships would be essential for the continued operation of the Jackson Hole and Greater Yellowstone Visitor Center that serves more than 300,000 visitors each year. Information about wildlife and the use of Jackson Hole's Federal lands would continue to enhance public understanding about the purpose and importance of the refuge. The visitor center would continue to provide an important service to the visiting public by not only answering questions about wildlife and natural resources, but also providing information about area accommodations and available recreational activities.

Our coordination of the North Highway 89 Pathway project with Teton County has expanded public opportunities for wildlife observation, photography, and interpretation on the refuge. Collaborating with Teton County and other private, nonprofit organizations—to inform the public of use restrictions necessary for compatibility—has helped reduce conflicts with wildlife and reduce violations of the use restrictions. Public compliance with these restrictions would help ensure that use of the pathway remains a compatible use and that the pathway would remain open to the public in the future.

Interpretation as part of the winter sleigh ride program would continue to inform more than 20,000 visitors annually about the Refuge System and the refuge. The refuge does not have the resources to provide this program to the public, and it is only made possible through our partnership with the Grand Teton Association and the private sleigh ride contractor.

Economic Support

Sustainable operations is a priority goal for the Greater Yellowstone Coordinating Committee. They have helped inventory, analyze, and develop plans to improve energy efficiency and reduce the carbon footprint for all land management units in the Greater Yellowstone Ecosystem. This assistance would continue to help the refuge focus on reducing the cost and environmental impact of refuge operations.

Cost sharing with partner organizations for projects of mutual interest and benefit is a common approach to leveraging limited refuge money. An example is the cooperation between the refuge and the WGFD to monitor chronic wasting disease on the refuge and throughout Jackson Hole. The refuge has

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The barn at Miller Ranch.

contributed money to help defray the cost of seasonal technicians who collected and analyzed samples from hunter-harvested deer and elk. This cost-sharing partnership would continue to enable a disease detection program on the refuge that is vital to both agencies and likely could not be conducted at a high level of confidence without this collaboration.

The refuge has worked in partnership with the Jackson District Boy Scouts for more than 50 years. The Scouts periodically use the refuge to accomplish various Scouting programs as well as helping us by picking up shed elk antlers that pose a hazard to refuge equipment. Most of the proceeds from an auction of antlers held by the Scouts are returned to the refuge and used primarily for habitat projects benefitting elk.

The Grand Teton Association has shown exceptional leadership and remarkable assistance in providing support for the Jackson Hole and Greater Yellowstone Visitor Center, which is a tremendous asset to Jackson's tourist-based economy. Financial support from the association would continue to be invaluable in providing temporary staff to run the visitor center when the Government position is vacant. Proceeds from the visitor center sales outlet that is run by the Grand Teton Association, would be used to support environmental education, interpretation, and wildlife research programs on the refuge.

Historical Program Support

With help from the Grand Teton Association and other partner organizations, the historic Miller House was restored by removing or replacing contemporary fixtures and decorating with early 1900s period décor. The money leveraged by the Grand Teton Association was instrumental in completing this project. The association would continue to run a seasonal sales outlet in the Miller House that provided merchandise with a historical theme.

Alternatives B and D

Same effects as alternative A, except as noted below.

Biological Environment Support

Same effects as alternative A. In addition, the potential exists for a Friends group to provide volunteer assistance and or money to enhance the refuge's biological and visitor services programs. Increased focus in Jackson Hole by our Partners for Fish and Wildlife program could result in off-refuge projects with private landowners that have the potential of providing important benefits for refuge habitat and wildlife populations. The restoration and enhancement of private land wetlands near the refuge would help support nesting waterfowl on the refuge: (1) shallow wetlands can help provide early season invertebrates, which are an important source of protein for nesting hens; and (2) deeper wetlands can help to provide summer brood-rearing habitat.

Social Interaction Support

Same effects as alternative A. In addition, the establishment of a Friends group would expand public awareness and participation in wildlife conservation on and around the refuge. The focus of a local Friends group usually develops in response to refuge needs and membership interests.

Alternative C

Same effects as alternative B, except as noted below.

Physical and Biological Environment Support

Same effects as alternative B. In addition, the refuge would emphasize partnerships that support research focused on the natural resources and unique conditions found in the Greater Yellowstone Ecosystem. The results of this research would help land managers better understand and manage the natural resources found within their administrative boundary of responsibility.

Social Interaction Support

Same effects as alternative B. In addition, emphasizing partnerships that result in ecosystem-wide and landscape-level activities would reduce the time spent on and benefits received from partnerships that focus primarily on refuge projects and programs.

5.15 Socioeconomic Effects

Economic impact analyses are commonly used to determine how changes in spending resulting from changes in policy or management activities affect business sales, jobs and income in local economies. This analysis quantifies how Refuge Revenue Sharing Act (RRS) payments to states and counties, Refuge personnel salary expenditures, Refuge purchases of goods and services, and spending by refuge visitors affect the local two-county region.

The economic impacts of the alternatives were estimated using the IMPLAN software and data system supplied by IMPLAN Group LLC. (Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.) IMPLAN is a widely used input-output modeling system. The underlying data drawn upon by the IMPLAN system are collected by the

IMPLAN Group LLC from multiple Federal and State sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau. IMPLAN data profiles from 2012 for Teton County, Idaho, and Teton County, Wyoming, were used in this study.

Large management changes often take several years to achieve. The estimates reported for alternatives B, C and D represent final economic effects after all changes in management have been made.

Impacts from Refuge Revenue Sharing

We make revenue sharing payments to counties for land that is under our administration. Under provisions of RRS, local counties receive an annual payment for lands that have been purchased by full fee-title acquisition by the Service. Payments are based on the greater of 75 cents per acre or 0.75 percent of the fair market value. The exact amount of the annual payment depends on Congressional appropriations, which in recent years have tended to be substantially less than the amount required to fully fund the authorized level of payments. Only Teton County, Wyoming, received an RRS payment of $323,217 in 2013, which was much lower than in previous years. Table 15 shows the impacts of local RRS payments. They generate an estimated annual total impact of 2 jobs, $103,000 in labor income and $137,000 in value added to the local two-county area.

Table 15. Annual impacts of Refuge Revenue Sharing payments for all alternatives.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Direct effects	2	$86,600	$109,100
Secondary effects	less than 1	$16,400	$27,900
Total effect	2	$103,000	$137,000

Effects of Refuge Personnel Salary Spending within the Local Economy

Refuge employees reside and spend their salaries on daily living expenses in the local area, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals or households to industries for goods and services used for personal consumption. The IMPLAN modeling system contains household income consumption spending profiles that account for average household spending patterns by income level. These profiles also capture average annual savings and allow for leakage of household spending to outside the region. The IMPLAN household spending pattern for households earning $50,000-75,000 per year was used to reflect the average salary of full-time permanent employees at the refuge.

The current approved refuge staff consists of 11 permanent employees. This will remain the same under alternative A. Refuge staff is anticipated to increase by an additional 24 employees under alternative B, and 27 employees under alternatives C and D (including full time, part time and seasonal positions). See table 21 in section 6.10 for a full list of positions.

Refuge personnel estimate that current annual salaries total approximately $1,021,000 under alternative A. Staff needs are expected to increase to approximately $1,586,000 under alternative B, and $1,680,400 under alternatives C and D. The economic impacts associated with the spending of salaries in the local two-county area by refuge employees are summarized in Table 16. These impacts only include the secondary effects of non-refuge jobs created as refuge employees spend their salaries in the local two-county area. For alternative A, it is estimated that salary spending by refuge personnel would generate annual secondary effects of 3 jobs, $120,300 in labor income, and $225,200 in value added annually, in the local economy. Under alternative B, the annual impact of salary spending would increase to 4 jobs, $186,800 in labor income and $349,600 in value added. Under alternatives C and D, refuge salary spending would generate secondary effects of 4 jobs, $198,000 in labor income, and $370,500 in value added annually.

Table 16. Annual impacts of salary spending.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Alternative A			
Direct effects	0	$0	$0
Secondary effects	3	$120,300	$225,200
Total effect	3	$120,300	$225,200
Alternative B			
Direct effects	0	$0	$0

Table 16. Annual impacts of salary spending.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Secondary effects	4	$186,800	$349,600
Total effect	4	$186,800	$349,600
Alternatives C, D			
Direct effects	0	$0	$0
Secondary effects	4	$198,000	$370,500
Total effect	4	$198,000	$370,500

Effects of Refuge Purchases of Goods and Service within the Local Economy

A wide variety of supplies and services are purchased for refuge operations and maintenance activities. Refuge purchases made in the local two-county area contribute to the local economic impacts associated with the refuge. The refuge currently spends an average of $229,000 per year on nonsalary expenditures. Major local expenditures include office supplies, utilities, and equipment maintenance and repair. Table 17 provides a breakdown of current nonsalary expenditures by expenditure category. To determine the local economic impacts of nonsalary expenditures, only expenditures made within the local two-county area are included. This analysis assumes the percent of local spending will not differ across the alternatives.

Table 17. Breakdown of current purchases of goods and services.

Expense category	*Average annual percent of nonsalary expenditures*	*Percent spent in local two-county area*
Heavy equipment purchasing or leasing	4	0
Equipment Maintenance and Repair	26	83
Vehicle Purchase	9	0
Vehicle Maintenance and Repair	5	6

Table 17. Breakdown of current purchases of goods and services.

Expense category	*Average annual percent of nonsalary expenditures*	*Percent spent in local two-county area*
Habitat and grounds improvements and treatments	6	100
Travel	4	0
Construction of New Structures	8	83
Maintenance and Repair of Structures	7	57
All other expenses (for example: overhead, office supplies, utilities)	31	86

Average annual nonsalary expenditures are anticipated to be $229,000 for alternative A, $348,000 for alternative B, and $369,000 for alternatives C and D. Table 18 shows the economic impacts associated with nonsalary related expenditures in the local communities near the refuge. For alternative A, the purchase of good and services would generate an estimated total economic impact of 2 jobs, $68,600 in labor income, and $92,400 in value added, annually. Under alternative B, 2 jobs, $104,200 in labor income and $140,500 in value added would be generated annually by the purchase of goods and services by the refuge. Alternatives C and D are estimated to have a slightly higher economic impact than alternative B, annually generating 2 jobs, $110,500 in labor income and $148,800 in value added.

Table 18. Annual impacts of purchases of goods and services.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Alternative A			
Direct effects	1	$54,800	$70,000
Secondary effects	less than 1	$13,800	$22,400
Total effect	2	$68,600	$92,400
Alternative B			
Direct effects	2	$83,300	$106,400
Secondary effects	less than 1	$20,900	$34,100
Total effect	2	$104,200	$140,500

Table 18. Annual impacts of purchases of goods and services.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Alternative C			
Direct effects	2	$88,300	$112,700
Secondary effects	less than 1	$22,200	$36,100
Total effect	2	$110,500	$148,800
Alternative D			
Direct effects	2	$88,300	$112,700
Secondary effects	less than 1	$22,200	$36,100
Total effect	2	$110,500	$148,800

Effects of Visitor Expenditures

Spending associated with recreational visits to national wildlife refuges generates significant economic activity. The Service report, Banking on Nature: The Economic Benefits of National Wildlife Refuge Visitation to Local Communities, estimated the impact of national wildlife refuges on their local economies (Carver and Caudill, 2013). According to the report, more than 46.5 million people visited the national wildlife refuges in fiscal year 2011, which generated $2.4 billion of sales in regional economies. Accounting for both the direct and secondary effects, spending by national wildlife refuge visitors generated over 35,000 jobs and $792.7 million in employment income (Carver and Caudill, 2013). Additionally, spending on refuge recreation generated approximately $342.9 million in tax revenue at the local, county, state and federal levels (Carver and Caudill, 2013).

This section focuses on the local economic impacts associated with National Elk Refuge visitation. The refuge offers a wide variety of recreation opportunities including wildlife observation and photography, interpretation, environmental education, fishing and big game hunting. Currently, the refuge does not allow waterfowl or upland game hunting. In the winter, the refuge offers its guests horse-drawn sleigh rides to view the wildlife living on the refuge. Additionally, visitors can participate in the refuge's winter wildlife excursions; a refuge staff naturalist will take participants on a guided tour to view elk, bighorn sheep and waterfowl.

Annual visitation estimates for the refuge are based on several refuge statistic sources including visitors entering the refuge and general observation by refuge personnel. Annual visitation estimates are on a per-visit basis. Table 19 summarizes estimated visitation by type of visitor activity for alternatives A, B, C, and D.

Table 19. Estimated annual refuge visitation activity by alternative.

	Total number of visits	*Number of non-local visits*	*Average hours spent on refuge*	*Number of non-local visitor days**
Alternative A				
Fishing	3,800	1,140	4	570
Big game hunting	2,500	1,875	8	1,875
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	111,300	55,650	2	13,913
Total visitation	117,600	58,665	—	16,358
Alternative B				
Fishing	3,990	1,197	4	599
Big game hunting	2,750	2,063	8	2,063
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	122,430	61,215	2	15,304
Total visitation	129,170	64,475	—	17,965
Alternative C				
Fishing	3,990	1,197	4	599
Big game hunting	2,625	1,969	8	1,969

Table 19. Estimated annual refuge visitation activity by alternative.

	Total number of visits	*Number of non-local visits*	*Average hours spent on refuge*	*Number of non-local visitor days**
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	127,995	63,998	2	15,999
Total visitation	134,610	67,163	—	18,567
Alternative D				
Fishing	3,990	1,197	4	599
Big game hunting	2,750	2,063	8	2,063
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	133,560	66,780	2	16,695
Total visitation	140,300	70,040	—	19,356

* One visitor day equals eight hours.

The information in Table 19 does not capture the estimated annual number of visitors using the visitor center. The interagency visitor center is a complex issue for which socioeconomic effects are difficult to quantify.

To estimate visitor expenditures, we use average daily visitor spending profiles from the Banking on Nature report (Carver and Caudill, 2007) that were derived from the 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (FWS, 2008). The National Survey reports trip-related spending of State residents and nonresidents for wildlife-associated recreational activities. For each recreation activity, spending is reported in the categories of lodging, food and drink, transportation, and other expenses. Carver and Caudill (2007) calculated the average per-person, per-visitor day expenditures by recreation activity for each Service region. The

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Conducting a forage survey on the refuge.

spending profiles for nonresidents for Region 6 were used here, and the 2006 spending profiles were updated to 2013 dollars using the Consumer Price Index Inflation Calculator. Average daily spending profiles for nonresident visitors to Region 6 for fishing ($129.94 per-day) and big game hunting ($220.84 per-day) were used to estimate nonlocal visitor spending for refuge fishing- and hunting-related activities. The average daily nonresident spending profile for nonconsumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) was used for nonconsumptive wildlife viewing activities ($162.93 per-day).

Visitor spending profiles are estimated on an average per day (eight hours) basis. Because some visitors only spend short amounts of time visiting a refuge, counting each refuge visit as a full visitor day would overestimate the economic impact of refuge visitation. In order to properly account for the amount of spending, the annual number of nonlocal refuge visits were converted to visitor days. Refuge personnel estimate that nonlocal anglers spend approximately four hours (half a visitor day) on the refuge, while nonlocal big game hunters typically spend a full day, or eight hours. Nonlocal visitors who view wildlife on nature trails or participate in other wildlife observation activities typically spend two hours (one quarter of a visitor day). Table 16 shows the number of nonlocal visitor days by recreation activity for each alternative. Total spending by nonlocal refuge visitors was determined by multiplying

the average nonlocal visitor daily spending by the number of nonlocal visitor days at the refuge.

Table 20 summarizes the total economic impacts associated with current nonlocal visitation by alternative. Under alternative A, nonlocal refuge visitors would spend nearly $2,755,000 in the local economy annually. This spending would directly account for an estimated 19 jobs, $801,600 in labor income, and $1,148,800 in value added in the local economy. The secondary, or multiplier, effects would generate an additional 5 jobs, $262,600 in labor income, and $429,100 in value added. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative A would generate total economic impacts of 24 jobs, $1,064,200 in labor income, and $1,577,900 in value added.

Table 20. Annual impacts of nonlocal visitor spending by alternative.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
	Alternative A		
Direct effects	19	$801,600	$1,148,800
Secondary effects	5	$262,600	$429,100
Total effect	24	$1,064,200	$1,577,900
	Alternative B		
Direct effects	21	$880,700	$1,262,200
Secondary effects	6	$288,600	$471,400
Total effect	27	$1,169,300	$1,733,600
	Alternative C		
Direct effects	22	$909,100	$1,302,600
Secondary effects	6	$298,400	$487,400
Total effect	28	$1,207,500	$1,790,000
	Alternative D		
Direct effects	23	$948,200	$1,358,500
Secondary effects	6	$311,300	$508,400
Total effect	29	$1,259,500	$1,866,900

As shown in table 19, refuge nonlocal visitation for all activities is anticipated to increase by 1,607 visitor days under alternative B as compared to alternative A. Under alternative B, nonlocal visitors would spend approximately $3,026,800 in the local area annually. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative B would generate an estimated total annual economic impact of 27 jobs, $1,169,300 in labor income, and $1,733,600 in value added (table 20).

Refuge, nonlocal visitation across all activities is anticipated to increase by 2,209 visitor days under alternative C as compared to alternative A (Table 19). Under alternative C, nonlocal refuge visitors would spend approximately $3,119,400 in the local area annually. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative C would generate an estimated total economic impact of 28 jobs, $1,207,500 in labor income, and $1,790,000 in value added (Table 20).

Finally, under alternative D, refuge visitation is expected to increase by 2,998 visitor days as compared to alternative A. It is estimated that this would result in the annual spending of approximately $3,253,400 in the local area. This spending by nonlocal visitors would result in a total annual economic impact of 29 jobs, $1,259,500 in labor income and $1,866,900 in value added (Table 20).

Jackson Hole and Greater Yellowstone Visitor Center

In addition to the National Elk Refuge, the refuge also staffs and maintains the visitor center, located just outside the town of Jackson, Wyoming, within Teton County, Wyoming. It serves as a contact for six governmental, non-profit and private agencies, including Grand Teton National Park, Bridger-Teton National Forest, the Jackson Hole Chamber of Commerce, the Wyoming Game and Fish Department, the National Elk Refuge, and the Grand Teton Natural History Association. In 2012, an estimated 306,048 visitors came through the visitor center. Visitors can access information or make purchases related to trip planning, hunting and fishing licenses, annual park passes, off-road vehicle and snowmobile permits, firewood and Christmas tree permits, trail maps, bear canister rental and fires as well as view wildlife exhibits and tour the wildlife observation deck.

Economic impacts are generated through the spending of money within a local community, and while the information provided to visitors by the refuge staff at the visitor center has an associated economic value, specific economic impacts directly related to visitor center visitation is difficult, in part due to the interagency nature of the facility. Economic impacts may be generated by the visitor center if individuals are inspired by their visitor center experience to spend additional time and money in the area, thus generating additional nonlocal spending. A 2010 statewide survey of Wyoming visitor centers

conducted by Randall Travel Marketing indicated that after stopping at a visitor center and receiving information, a portion of visitors stayed in Wyoming at least one more day (Randal Travel Marketing 2010). This additional day spent within Wyoming by visitor center guests demonstrates that not only do visitor centers have an important educational component, but these centers can also help generate economic activity through increased visitor spending. Given that it is unknown where visitors may spend an additional day and in what activities they may participate, the economic impacts of visitation to the visitor center cannot be quantified. While directly quantifying the economic impacts of the visitor center is difficult, the importance of the center itself, as well as the value of the service and information provided to visitors by refuge staff, should not be overlooked or discounted.

Spending in the visitor center through the nonprofit cooperating association (Grand Teton Association) was not included in the study. In 2013, the Grand Teton Association generated over $700,000 in sales at the visitor center.

Summary of Economic Effects

Under alternative A, refuge management and visitation activities annually generate an estimated 31 jobs, $1,356,100 in labor income, and $2,032,500 in value added in the local economy. Given slight increases in refuge administration and an increase of over 1,600 in visitor days, alternative B would generate 4 additional jobs, $207,200 more in labor income, and $328,200 more in value added, as compared to alternative A. Under alternative C, refuge public use and administration activities would also increase. Alternative C would generate 5 additional jobs, $262,900 more in labor income, and $413,800 more in value added as compared to alternative A. Under alternative D, the refuge anticipates the greatest increase in visitation, an increase of nearly 3,000 visitor days. Alternative D would generate an additional 6 jobs, $314,900 in labor income, and $490,700 in value added compared to alternative A. These impacts do not include the additional economic activity generated by the visitor center, though its management and maintenance by the refuge is essential. Total economic impacts associated with refuge operations across all alternatives represent slightly more than one tenth of one percent of total income and total employment in the overall two-county local economy. Total economic effects of refuge operations play a much larger role in nearby communities where most of the refuge-related expenditures and public use-related economic activity occurs.

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Snow Goose

Chapter 6—Implementation of the Proposed Action (Draft Plan)

Ann Hough / FWS

Teton Mountain Range

This chapter contains the specific objectives and strategies that would be used to carry out our proposed action (alternative D), which reflects the draft CCP for the National Elk Refuge. We are recommending this as the alternative that could best achieve the refuge's purposes, vision, and goals while helping to fulfill the Refuge System mission. The stepdown management plans listed in section 6.11 near the end of the chapter would provide implementation details for specific refuge programs. In addition, appendix F contains the draft compatibility determinations (required) for public and management uses associated with the draft CCP.

If the Regional Director selected alternative D as the preferred alternative, the objectives and strategies presented in this chapter would become the final plan to be carried out over the next 15 years. The CCP would serve as the primary management document for the refuge until it is formally revised. We would carry out the final CCP with help from partner agencies, organizations, and the public.

As stated in the Improvement Act, the primary mission of our Refuge System is wildlife conservation. Multiple policies and guidance documents have been developed to accomplish this mission, including the policy on biological integrity, diversity, and environmental health and the 2011 "Conserving the Future" document developed in collaboration with our stakeholders and the public. The biological integrity, diversity, and environmental health policy provides directives for maintaining and restoring the biological integrity, diversity, and health of the Refuge System, whereas "Conserving the Future" articulates the desired roles for refuges and provides recommendations for the next decade and beyond (FWS 2011). This document states, "At the root of

these challenges [that the Refuge System must address] is the increasing consumption of natural resources, which has caused loss, degradation and fragmentation of habitat around the world. Habitat loss is largely responsible for the current extinction event, in which the Earth may lose half of its species in the next 100 years."

This chapter describes the management focus of this draft plan (alternative D, the proposed action), followed by the objectives and strategies to achieve the refuge goals. The last sections of the chapter describe the staff needed to carry out the plan (section 6.10), stepdown management plans (section 6.11), monitoring and evaluation (section 6.12), and plan amendment and revision (section 6.13).

6.1 Management Focus

Our focus and planning approach for the National Elk Refuge is consistent with the visions and principles promoted in the Improvement Act; the policy on biological integrity, diversity, and environmental health; and "Conserving the Future." This includes conserving native communities and species of concern and developing "quantifiable objectives" that "integrate the conservation needs of the larger landscape (including the communities they support)."

Vision for the National Elk Refuge

Nestled below the majestic Teton Range, adjacent to the historic gateway town of Jackson, the National Elk Refuge provides crucial big game wintering habitat in the Greater Yellowstone Ecosystem. Across the refuge's grassland, wetland, woodland, and sagebrush shrubland communities, visitors view wintering elk and other wildlife populations that are balanced with their habitats. The public enjoys quality hunting and fishing as well as year-round interpretative opportunities. Effective outreach and strong public and private partnerships ensure understanding and protection of refuge resources for future generations.

Promote Natural Habitats and Enhance Public Use

The vision, proposed action alternative, and goals for the National Elk Refuge collectively focus objectives and associated management strategies on achieving sustainable, diverse, native communities that would conserve native species of concern at landscape and local scales. Achieving this vision represents the greatest contribution we at the refuge can make in addressing current and future threats to natural resources in the Greater Yellowstone Ecosystem. Threats include, but are not limited to, increasing habitat fragmentation and decreasing landscape connectivity, adverse effects on water quantity and quality, and cumulative risks associated with a changing climate and energy production. To alleviate these risks and to meet the purposes of the refuge require us to consider multiple perspectives:

- Refuge System policies and guidance
- the current understanding of native community ecology
- increasing human demands on natural resources
- continued landscape change
- our need to collaborate with the public and our partners on projects that extend beyond refuge boundaries

6.2 Overview of Goals and Objectives

Under each goal in this section, we describe the objectives and strategies that would serve as the steps needed to achieve the refuge vision. While a goal is a broad statement, an objective is a concise statement that indicates what is to be achieved, the extent of the achievement, who is responsible, and when and where the objective should be achieved—all to address the goal. The strategies are the actions needed to achieve each objective. Unless otherwise stated, the refuge staff would carry out the actions in the objectives and strategies. The rationale for each objective provides context such as background information, assumptions, and technical details. The plan has objectives for the following:

6.3 Climate Change
6.4 Landscape-Scale Conservation
6.5 Habitat and Wildlife Goal
6.6 Cultural Resources Goal
6.7 Visitor Services Goal
6.8 Visitor and Employee Safety and Resource Protection Goal
6.9 Administration Goal

6.3 Climate Change

The following objectives deal with our involvement in the landscape-scale and local aspects of climate change.

Climate Change Objective 1

For the life of the plan, continue involvement with partner organizations, especially land management agencies in the Greater Yellowstone Coordinating Committee, to stay apprised of the developing science of climate change and the resulting information that can have Greater Yellowstone Ecosystem–wide application.

Strategies

- Take part in climate change conferences, webinars, and seminars.
- Engage in the Greater Yellowstone Coordinating Committee's climate change planning efforts.

Rationale

The refuge's limited staff would make it difficult for the refuge to remain current with the ever-growing knowledge of climate change and to conduct land management planning that reflects the latest science. The refuge could leverage our limited biological staff by staying involved with and relying on other Federal land management units in the Greater Yellowstone Coordinating Committee with large staffs to develop climate change expertise and coordinate ecosystem-wide planning efforts.

Climate Change Objective 2

For the life of the plan, participate in the climate change assessments and long-term monitoring efforts initiated by the Greater Yellowstone Coordinating Committee.

Strategies

- Conduct vulnerability assessments on the refuge that correspond and complement efforts of the Greater Yellowstone Coordinating Committee in predicting climate change effects.
- Collect long-term monitoring data for key habitats and wildlife populations, focusing on surrogate species when possible. (Note: Surrogate species is a recently adopted but yet to be implemented planning approach for the Refuge System. Surrogate species represent the needs of a wide array of wildlife species, and these needs will be used for conservation planning that supports multiple species and habitats within a defined landscape or geographic area.)

Rationale

Cooperation and coordination with surrounding Federal land management agencies through the Greater Yellowstone Coordinating Committee would enable us to collect long-term monitoring information that complements and adds value to ecosystem-wide efforts. Participation in climate change assessments conducted by other land management agencies on the committee would give the refuge the analysis expertise to address refuge-specific concerns.

Climate Change Objective 3

For the life of the plan, carry out mitigation actions identified in the Greater Yellowstone Area climate action plan (Fiebig 2011) to reduce the refuge's carbon footprint.

Strategies

- Continue to improve the energy efficiency of buildings and the vehicle fleet.
- Use a gravity-flow irrigation system to reduce the energy-related costs of pumping.

Rationale

The Greater Yellowstone Coordinating Committee completed a comprehensive assessment of greenhouse gas emissions and corresponding mitigation plans for each Federal land management unit in the Greater Yellowstone Ecosystem. Following the specific mitigation recommendations for the refuge would reduce our carbon footprint. Reduction of greenhouse gas emissions would support the goals of our agency's "Strategic Plan for Responding to Accelerating Climate Change, 2009" (FWS 2010).

6.4 Landscape-Scale Conservation

The following objectives describe our responsibilities for involvement in landscape-scale conservation.

Landscape-Scale Conservation Objective 1

For the life of the plan, participate in the Greater Yellowstone Coordinating Committee to support landscape-scale conservation in the Greater Yellowstone Ecosystem.

Strategies

- Participate on the board and committees of the Greater Yellowstone Coordinating Committee.
- Contribute money as available toward priority projects that provide ecosystem-wide benefits.
- Share information and resources such as equipment and staff.

Rationale

Working with others would improve our ability to coordinate management of Federal lands at a landscape scale.

Landscape-Scale Conservation Objective 2

Within 5 years, determine the feasibility of a Service conservation easement program, and if appropriate, pursue authority for conservation easements in Teton County.

Strategies

- Inventory and identify tracts of high biological value that support the refuge vision.
- Develop a preliminary project proposal.
- Develop a land protection plan.

Rationale

Off-refuge resources and activities affect our ability to achieve refuge goals. Wildlife often travel across administrative boundaries to meet their seasonal life cycle needs. Protection of off-refuge resources would help meet these seasonal wildlife needs.

Landscape-Scale Conservation Objective 3

For the life of the plan, work with partners to use non-Service (private, nongovernmental organization, or other agency) easements to support refuge-specific conservation goals in the CCP and Bison and Elk Management Plan.

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Spotted Sandpiper

Strategies

- Set up a program with the Jackson Hole Land Trust and others to establish conservation easements with refuge-specific conservation goals.
- Consider partnership opportunities to build wildlife crossings for Highway 89.

Rationale

Off-refuge resources and activities affect our ability to achieve refuge goals. Wildlife often travel across administrative boundaries to meet their seasonal life cycle needs. Protection of off-refuge resources would help meet these seasonal wildlife needs. Use of privately funded wildlife and habitat protection easements might be more desirable to some landowners than Government-funded easements. Furthermore, private money might be available to finance easement programs when Government money was unavailable. Wildlife crossings could reduce collisions between vehicles and animals.

Landscape-Scale Conservation Objective 4

Within 10 years, evaluate potential land exchanges with adjacent landowners (agencies and private landowners) to change the refuge boundary to improve the effectiveness of refuge programs.

Strategies

- Discuss potential land exchanges with adjacent landowners.
- Prioritize tracts for different refuge goals such as bison, elk, swan, bald eagle, or greater sage-grouse.

Rationale

Identifying and obtaining tracts of land that could improve wildlife benefits under our management would support refuge purposes. Some areas like the northeastern part of the refuge might better fit with other agency missions and provide benefits to the public (lands are managed by agencies according to different missions and policies).

Landscape-Scale Conservation Objective 5

Within 10 years, evaluate the effects of the potential sale of Wyoming State trust lands and Wyoming Game and Fish Commision-owned lands near the refuge and consider protection options.

Strategy

- Work with local community to share information and effects.

Rationale

The potential sale of State of Wyoming lands next to or near the refuge to private landowners might have serious consequences to the management of the National Elk Refuge. Before lands are under consideration for sale, the refuge needs to determine and address the possible effects of access, rights-of-way, and human disturbance to elk and bison herds during sensitive winter and spring seasons.

6.5 Habitat and Wildlife Goal

Adaptively manage bison, elk, and other wildlife populations and habitats as outlined in the Bison and Elk Management Plan. Contribute to the conservation of healthy native wildlife populations and their habitats. Restore and sustain a native fishery that provides quality fishing opportunities.

Native Grasslands Objective

Within 10 years, manage 500–1,000 acres of native grassland habitat on northern end of the refuge to increase elk and bison use of these areas.

Strategies

- Use wildland fire to help accomplish the objective and reduce hazardous fuel.
- Control invasive plant species.
- Seed sites with desired plant species.

Rationale

The Bison and Elk Management Plan calls for reduced reliance on supplemental feeding. Encouraging elk and bison use of grassland habitats on the northern end of the refuge would reduce forage use and conserve forage on the southern end of the refuge, reducing the need for supplemental feeding.

Sagebrush Shrublands Objective 1

Within 5 years, define existing structural characteristics of sagebrush shrubland communities on the refuge, and protect existing sagebrush shrubland communities from disturbance or degradation.

Strategies

- Cooperate with other agencies to obtain imaging for the refuge using the light detection and ranging (LIDAR) technology.
- Until the sagebrush shrubland habitat is defined, fully suppress wildfires in this habitat.
- Conduct prescribed burns only after the current characteristics of sagebrush shrublands are defined.
- Limit off-road vehicle use.
- Do not expand feedgrounds into sagebrush shrubland communities on the northern end of the refuge.

Rationale

Mapping of plant community types conducted between 2007 and 2009 identified 8,990 acres of sagebrush-associated plant communities on the refuge, but height and density of sagebrush within these areas has not been quantified at a fine scale. These communities on the refuge provide important habitat for the Jackson Hole greater sage-grouse population, and identifying and, when appropriate, protecting greater sage-grouse habitat is the highest priority for sagebrush-associated plant communities.

Sagebrush Shrublands Objective 2

Within 10 years, manage an estimated 1,000–3,000 acres of sagebrush shrubland communities to promote desired habitat conditions of sagebrush at least 11 inches tall with more than 15-percent canopy cover to assure no net loss of these sagebrush areas.

Strategies

- Manage sagebrush shrublands to prevent degradation, maintain native structural and compositional characteristics, and allow degraded areas to recover, especially areas used by greater sage-grouse and other sagebrush-dependent species.
- Use wildland fire to help accomplish the objective and reduce hazardous fuel.
- Minimize off-road vehicle use.
- Limit elk feeding to current areas.
- Conduct habitat treatments in greater sage-grouse core areas in accordance with Wyoming Executive Order 2011–5.

Rationale

Holloran and Anderson (2004) suggested greater sage-grouse wintering habitat was the principal limiting factor on the Jackson Hole greater sage-grouse population and recommended protecting mature sagebrush stands from disturbance. The Upper Snake River Basin Sage-Grouse Conservation Plan (WGFD 2008) recommended maintaining and protecting tall sagebrush (11- to 31-inch-high stands with more than 15-percent canopy cover) as forage sites for wintering greater sage-grouse. Because the refuge needs a detailed inventory of the sagebrush shrubland plant community structure, 1,000–3,000 acres is an imprecise estimate of the acreage that we would need to manage or provide special protection to meet management objectives. A more exact acreage will be determined through Sagebrush Shrublands Objective 1.

Wetlands Objective 1

Within 5 years, replace water control structures for the three existing Romney Ponds and Bill's Bayou, and over the life of the plan construct two new ponds in the Romney Pond complex.

Strategies

- Develop funding partnerships with WGFD and nonprofit organizations.
- Evaluate the current and replacement water control structures for fish passage and screening.
- Replace existing water control structures with inline water control structures with beaver-proof screens.
- Construct two new ponds to the north of the existing Romney Ponds and use inline water control structures and beaver-proof screens.

Rationale

The ability to manipulate water levels is necessary to meet habitat management objectives for trumpeter swans, but water control structures in the Romney Pond complex and Bill's Bayou are near the end of their operational life and vulnerable to beaver damage. The Gros Ventre River channel is shifting to the south and eroding the Pierre's Pond dikes; maintaining these ponds is no longer practical. Unlike the Pierre's Pond complex, the Romney Pond complex is not vulnerable to river damage. Construction of two new ponds in the Romney Pond complex would replace the swan habitat lost when Pierre's Ponds fail.

Wetlands Objective 2

Within 10 years, maintain 30–50 percent pondweed cover and 10–20 percent emergent vegetation in artificial ponds that have water management capability.

Strategies

- Gradually reduce water levels in spring and maintain low water levels until the following spring on a 4- to 7-year rotating schedule for each pond to increase pondweed cover.
- Use wildland fire to help accomplish the objective and reduce hazardous fuel.

Rationale

Water management would develop nesting and brood-rearing habitat for trumpeter swans. Squires and Anderson (1995) suggested that pondweed tubers ranked among the highest in nutritional quality for trumpeter swans, and water level manipulations have been shown to promote sago pondweed (Kantrud 1990). Some emergent vegetation is preferred for swan breeding sites (Lockman et al. 1987).

Wetlands Objective 3

Within 5 years, inventory and map invasive plant species in the Flat Creek wetland complex, and for the life of the plan limit cover of listed noxious weeds to less than 1 percent of the Flat Creek wetland complex.

Strategies

- Use high-resolution photography at peak flowering periods to search for large infestations of perennial pepperweed and purple loosestrife in inaccessible locations.
- Inventory invasive plant species in the Flat Creek wetland complex using watercraft.
- Pull, bag, and remove invasive plants if found.
- Use appropriately labeled herbicide where applicable.

Rationale

Early detection of invasive plants is critical to the effective control of infestations (Dewey and Andersen 2004).

Riparian Woodlands and Aspen Woodlands Objective 1

Within 5 years, identify and map sites within the lower Flat Creek riparian zone with the highest potential for willow restoration. Over life of the plan, restore 200 acres of willow communities in the lower Flat Creek riparian zone to class 1 or class 2 conditions (refer to page 49 of the Bison and Elk Management Plan for definitions).

Strategies

- Map areas with existing willow along fish-bearing stream channels in Flat Creek.
- Install exclosures around high-priority mapped areas.
- Remove fences to exclude elk and bison around mapped areas after recovery. Rotate fences to restore new areas.

Rationale

Willow restoration would support fish habitat and habitat for birds. The Bison and Elk Management Plan indicates that 800 acres of willow habitat will be restored to class 1 or class 2 condition using 500- to 1,000-acre exclosures, but the refuge has not begun any significant efforts to achieve this objective to date. Results from experimental exclosures (Smith et al. 2004, refuge unpublished data) suggest that, even with the complete exclusion of elk and bison, it will take at least 10 years for class 4 willow communities to recover to class 1 condition. Given these limitations, we need to limit restoration to areas with the greatest potential for restoration (existing class 4 willow patches along fish-bearing stream channels).

Riparian Woodlands and Aspen Woodlands Objective 2

Over the life of the plan, restore 100 acres of the riparian, narrowleaf cottonwood community to class 1 or class 2 condition in the upper Flat Creek riparian zone (refer to page 49 of the Bison and Elk Management Plan for definitions).

Strategies

- Use separate exclosures to allow movement of elk and bison between the McBride and Chambers management units.
- Consider using prescribed fire to stimulate regeneration in areas where exclosures are in place.
- Install exclosures around high-priority mapped areas.
- Remove fences used to exclude elk and bison after vegetation recovery.

Rationale

Elk and bison browsing has modified the cottonwood plant community in the upper Flat Creek riparian zone to class 3 and class 4 conditions (Smith et al. 2004). Even if elk and bison population objectives were met, the refuge would need to completely exclude elk and bison from these areas to recover to class 1 or class 2 condition.

Riparian Woodlands and Aspen Woodlands Objective 3

Within 10 years, inventory the class condition (refer to page 49 of the Bison and Elk Management Plan for definitions) of willow, cottonwood, and aspen stands in the Gros Ventre River riparian area and Gros Ventre Hills. For the life of the plan, maintain the existing acreage of class 1 and class 2 condition willows, cottonwood, and aspen.

Strategies

- Inventory existing structural characteristics using remote sensing (LIDAR) combined with field ground-truthing.
- Limit elk and bison browsing pressure in class 1 and class 2 willow, cottonwood, and aspen by limiting prescribed burning next to these stands, maintaining high hunting pressure on the northern end of the refuge, hazing elk and bison off the refuge during summer, using exclosure fences, and encouraging wolf activity on the northern end of the refuge.
- Consider using prescribed fire to stimulate regeneration in areas where exclosures are in place.

Rationale

The refuge would need a comprehensive class condition inventory to figure out where and when restoration efforts should occur. Objectives in the Bison and Elk Management Plan call for restoration of 800 acres of willow, 1,000 acres of cottonwood, and 1,000 acres of aspen to class 1 or class 2 condition, with the greatest opportunity for cottonwood and aspen restoration on the northern end of the refuge. Although the analysis for the Bison and Elk Management Plan predicted that large-scale exclosures would be neces-

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Scarlet Paintbrush

sary to restore aspen in the Gros Ventre Hills, new data for this area suggests limited recovery of aspen has occurred without exclosures since 2005 (Keigley et al. 2009).

Flat Creek Enhancement Objective 1

From 2014 to 2016, carry out the cooperative Flat Creek enhancement project by treating approximately 1.2 miles of Flat Creek each year.

Strategies

- Assess existing structures, tree revetments (streambank support), and other treatments for functionality and habitat values.
- Remove, rehabilitate, or replace previously installed treatments with more suitable treatments, including removal of deteriorating instream structures, riprap, and an old, broken walkway.
- Specify appropriate stream habitat structures based on lessons learned from failed structures.
- Enhance riffle and pool habitats to increase spawning, rearing, and juvenile habitats for native Snake River cutthroat trout.
- Modify meanders.
- Stabilize severe streambank erosion where it jeopardizes project success.
- Provide for continued irrigation and diversion activities such that habitat enhancement and channel restoration activities are not jeopardized.
- Map, remove, treat, and control infestations of reed canarygrass along both sides of Flat Creek.
- Install woody and sod vegetation.
- Schedule construction during September to November to avoid cutthroat trout spawning, Flat Creek opening to anglers, elk and bison hunting and feeding periods, and the winter range restriction period.
- Continue to cooperate with WGFD and allow ample access to the refuge for fisheries management activities.

Rationale

Instream treatments along with riparian area restoration are necessary to restore stream form and function to Flat Creek, which would provide increased hydrologic stability as well as more habitat for all stages of the native Snake River cutthroat trout. WGFD, as the lead for the Flat Creek enhancement project, and the refuge have support for this project from several partners: Rocky Mountain Elk Foundation, Teton County Conservation District Board, and Trout Unlimited.

Flat Creek Enhancement Objective 2

In 2015, after the initial enhancement work in Flat Creek (objective 1) is done, monitor the treatments for effectiveness and to make any needed adjustments.

Strategies

- Assess the stability and functionality of structures.
- Assess the bioengineering treatment (live material used in engineered treatments) establishment, such as willows used in bank stabilization.
- Assess the disturbed area reclamation and revegetation.
- Assess the achievement of overall project goals (described in chapter 3, "3.8 Alternative D" under "Flat Creek Enhancement" in the habitat section).

Rationale

Based on the results of monitoring, we can apply adaptive management strategies to adjust the treatments, as needed, to increase the ecological benefits and better achieve the goals and objectives for the Flat Creek enhancement project. Monitoring can provide case study information, educational materials, and learning opportunities that we can use to make sure that future projects are carried out as effectively and efficiently as possible.

Flat Creek Enhancement Objective 3

Within 10 years, fully restore at least 1 mile of lower Flat Creek to improve fish habitat, support productive native trout populations, and promote natural and stable river morphology characteristics.

Strategies

- Support and carry out the Flat Creek enhancement project as described in objectives 1 and 2.
- Continue to cooperate with WGFD and allow ample access to the refuge for fisheries management activities.

Rationale

Part of the habitat and wildlife goal is to restore and sustain a native fishery that supports quality fishing opportunities. Restoration of this portion of Flat Creek to promote natural and stable river morphology characteristics will enhance cutthroat trout habitat, potentially increase cutthroat trout populations, and provide quality fishing opportunities for native trout.

Invasive Species Objective 1

Throughout the life of the plan, treat more acreage as needed to ensure that the total of all noxious weed and other invasive plant infestations does not exceed the current 1,100 acres.

Strategies

- Control invasive plants using integrated pest management including biological, cultural, mechanical, and chemical methods.
- Prevent new infestations of invasive plants including noxious weeds, nonnative grasses, and aquatic invasive species by preventing the artificial transportation of seeds and materials onto the refuge through efforts like public education, weed-free-hay rules, and the cleaning of all excavation and angling equipment before entering the refuge.
- Increase monitoring and rapid response for new infestations including invasive species of aquatic plants and animals.
- Identify and consider removing invasive plants that are not considered noxious weeds, but are nonnative plant species such as crested wheatgrass, reed canarygrass, meadow foxtail, yellow sweetclover and cheatgrass.

Rationale

The National Elk Refuge has 1,100 acres of invasive plants, including noxious weeds, and no known occurrence of invasive animals or aquatic invasive species at this time. Noxious weed species threatening establishment and of greatest concern are Dalmatian toadflax, perennial pepperweed, and whitetop. Other weed species present and of concern include yellow toadflax; spotted, diffuse and Russian knapweed; sulfur cinquefoil; Dyer's woad; oxeye daisy; plumeless thistle; black henbane; houndstongue; and common burdock. Weed species such as Canada and musk thistle are well established and of lower prior-

ity but still require control to prevent dense stands that negatively affect native vegetation and wildlife forage.

Invasive Species Objective 2

Over the life of the plan, reduce the existing 420-acre spotted knapweed infestation along the Gros Ventre River corridor by 50 percent.

Strategies

- Develop large-scale invasive plant eradication programs (greater than 100 acres of infestation) where possible.
- Identify and develop suitable funding sources for monitoring, treatment, restoration, and public information.
- Use existing partnerships and private contractors.
- Focus efforts on proven methods with using effective herbicides and applicable mixes and insects.

Rationale

Spotted knapweed is localized, infests 420 acres within the National Elk Refuge, and is mostly contained within the Gros Ventre River corridor and adjacent lands. The spotted knapweed population on the refuge represents a major risk for new infestations in other parts of the Greater Yellowstone Ecosystem. Within the refuge boundary, migration of spotted knapweed from the river corridor into the adjacent uplands would have a significant effect on existing greater sage-grouse populations and their habitat. Infestations would substantially degrade the vital, large ungulate, winter habitat and reduce the refuge's winter population carrying capacity.

Data from elk radio collars and GPS collars suggest that 90 percent of elk migration routes from the refuge transect the Gros Ventre River corridor (Cole and Ketchum 2011, Smith and Robbins 1994). There is considerable evidence that wild and domestic ungulates facilitate the transport of invasive plant species seeds (Schiffmam 1997) and might be responsible for colonization of invasive plant species into new areas (Boulanger et al. 2011). Seed ingestion and viability in feces has been documented in various studies (Malo et al. 2000, Olson et al. 1997), and seed transport in the coats of wild and domestic ungulates is also substantiated (Constible et al. 2005, De Clerke-Floate 1997). Because elk that winter on the refuge migrate as far as Yellowstone Lake, the risk of seed transport by elk and colonization of spotted knapweed in uninfested parts of the Greater Yellowstone Ecosystem is significant. A major reduction in spotted knapweed density in the Gros Ventre River corridor would reduce the threat of new infestations in Grand Teton National Park, Teton Wilderness, and the southern part of Yellowstone National Park.

Migratory Birds Objective

Within 5 years, institute a monitoring program for migratory birds to evaluate the effects of habitat management activities on trumpeter swan, long-billed curlew, and other migratory bird species potentially affected by refuge habitat management activities.

Strategies

- Conduct post-treatment migratory bird surveys in K-line experimental areas and compare to 2010 pretreatment data as defined by Dieni (2011).
- Continue monitoring trumpeter swans during nesting season to determine the number of breeding pairs, number of active and successful nests, number of cygnets hatched per nest, and number of cygnets fledged per nest.
- Continue monitoring long-billed curlews at a level sufficient to identify nesting territories and to avoid irrigating these areas until after birds have fledged.
- Conduct baseline surveys of breeding birds in areas subject to habitat management.

Rationale

Trumpeter swans and long-billed curlews are sensitive migratory species potentially affected by refuge management activities. Their small population sizes and relatively large breeding territories warrant species-specific monitoring. Large-scale habitat modifications are ongoing or planned in irrigated grasslands; sagebrush grasslands; and willow, aspen, and cottonwood plant communities. Baseline surveys of breeding birds in proposed treatment areas would allow managers to evaluate the effects treatments on

bird communities and adaptively adjust treatments if necessary.

Aquatic Species Objective

Within the life of the plan, decrease nonnative trout prevalence in Flat Creek by 25 percent.

Strategies

- Continue to cooperate with WGFD and allow ample access to the refuge for fisheries management activities.
- Remove all nonnative trout captured during fish surveys.
- Aggressively target brook trout for removal from Flat Creek during the fall spawning period using electrofishing and trapping techniques.
- Continue angler education efforts about the effect of nonnative species on the native fishery and encourage angler harvest of nonnative trout.

Eric Cole / FWS

Wolf

- Design and install a fish passage screen at the Southpark diversion to prevent nonnative trout in the Gros Ventre River from entering Flat Creek.
- Support and carry out habitat restoration of Flat Creek as described in the restoration plan (Biota 2013a) on file at the refuge.

Rationale

Nonnative trout populations can be substantially reduced by direct removal, preventing their introduction into irrigation systems, and by improving stream habitat conditions that provide a competitive advantage to native trout populations.

Disease Management Objective 1

Within 5 years, develop a comprehensive disease contingency plan in coordination with WGFD and Grand Teton National Park.

Strategies

- Identify current and potential wildlife diseases.
- Develop response plans for disease outbreaks.

Rationale

Wildlife populations and associated pathogens do not recognize land management boundaries or agency jurisdictions. Developing interagency response plans to disease outbreaks before occurrence increases the likelihood of mitigating negative effects (Mörner et al. 2002).

Disease Management Objective 2

Within 5 years, quantify baseline patterns of elk group size, distribution, and density for elk on the refuge.

Strategy

- Use high-resolution, photograph-based mapping to count elk groups on the refuge.

Rationale

There is considerable evidence that high animal density adds to disease risk (Gross and Miller 2001, Maichak et al. 2009), but there is no fine-scale data to evaluate current elk density conditions on the refuge. Quantifying elk density patterns would facilitate modeling to predict the potential effects of disease outbreaks and allow the refuge to adaptively manage elk density compared to baseline conditions (Gortazar et al. 2006).

Disease Management Objective 3

Retest fish for whirling disease in next 5 years.

Strategy

- Conduct whirling disease sampling during electroshocking operations conducted by WGFD.

Rationale

During routine monitoring in 2003, sampled sent to the WGFD laboratory tested positive for Myxololus cerebralis, the parasite that causes whirling disease. Infection levels were low and no population-level declines have been documented. No further testing has been done since 2003.

Federally and State-Listed Species Objective 1

Within 5 years, develop an inventory and monitoring plan for all federally listed threatened, endangered, and candidate species and State species of concern that potentially exist on the refuge.

Strategies

- Create a list of potential Federal threatened and endangered species and State species of concern that exist on the refuge.
- Document existing and historical records of occurrence and survey data for relevant species.
- For species with sufficient available data, document the species' status and trend.
- For species with insufficient data, develop monitoring plans to supply information needs.
- Follow and carry out Wyoming Executive Order 2011–5 for the greater sage-grouse.

Rationale

Habitat manipulations are proposed in many refuge plant communities, but the status and trend of Federal threatened and endangered species and State species of concern are unknown. Adequate baseline population information for these species would make sure that refuge actions could be adaptively managed to prevent negative effects on these populations.

Federally and State-Listed Species Objective 2

Within 1 year, develop a protocol to salvage, hatch, and return trumpeter swan cygnets to nests threatened by flooding in the Flat Creek Marsh.

Strategy

- Cooperate with WGFD and the Wyoming Wetland Society to develop and implement the swan egg salvage protocol and to install floating nest structures near breeding territories most at risk to flooding.

Rationale

Past monitoring suggests that water diverted from the Gros Ventre River combined with spring runoff causes flooding that destroys swan nests in the Flat Creek Marsh. Egg salvage and installation of floating nest platforms would mitigate this effect and improve nest success and cygnet survival.

Research and Monitoring Objective

Within 5 years, develop a comprehensive inventory and monitoring plan designed to evaluate habi-

tat management objectives, migratory bird populations, Federal threatened and endangered species, State species of concern, and Bison and Elk Management Plan objectives.

Strategies

- Rank information needs and identify areas where insufficient information exists.
- Develop study designs to answer questions of interest.
- Work with cooperating agencies, nongovernmental organizations, and volunteers to pay for inventory and monitoring projects and help with fieldwork.
- (Also refer to strategies for species of concern, migratory birds, and disease management.)

Rationale

The inventory and monitoring plan would help set priorities for research and monitoring tasks to make sure that critical information is being collected to guide management decisions.

Preserve and interpret cultural resources in a way that allows visitors to connect to the area's rich history and conservation heritage.

Cultural Resources Objective

Protect and preserve cultural resources on the refuge through coordination with the Region 6 cultural resources branch, which helps refuge staff in meeting the requirements of section 106 of the National Historic Preservation Act and other cultural resources–related legislation.

Strategies

- Inform the Region 6 cultural resources staff of refuge projects early in planning by using the Cultural Resources Review Form.
- Develop exhibits and signage to enhance educational opportunities.
- Encourage collaboration with interested tribes in developing relevant materials and correct interpretation of cultural resources.
- Identify facility needs for interpretive programs and assessment for any rehabilitation work done on the historic Miller Barn.

Rationale

It is important to protect the integrity of known cultural resources and make sure our activities do not affect unknown resources. Accurate information would help the refuge develop effective educational and interpretive materials for the public that would explain and encourage preservation of cultural resources.

6.7 Visitor Services Goal

Enable a diverse audience to understand and appreciate the refuge's wildlife conservation role in Jackson Hole, while safely enjoying year-round opportunities for wildlife-dependent recreation.

Visitor services are concentrated on the southern end of the refuge where most of the public use occurs because of the adjacency to the town of Jackson. Figure 12 shows this area, including several of the proposed uses. In addition, figures 13 and 14 reflect access and hunt areas during the elk hunting and bison hunting seasons, respectively.

Hunting Objective 1

Within 10 years, develop a hunting program for young people that provides quality hunting opportunities.

Strategies

- Cooperate with WGFD to develop hunting season proposals.
- Work with the Boy Scouts of America and other outdoor-focused youth groups to identify important traits for a youth hunt.

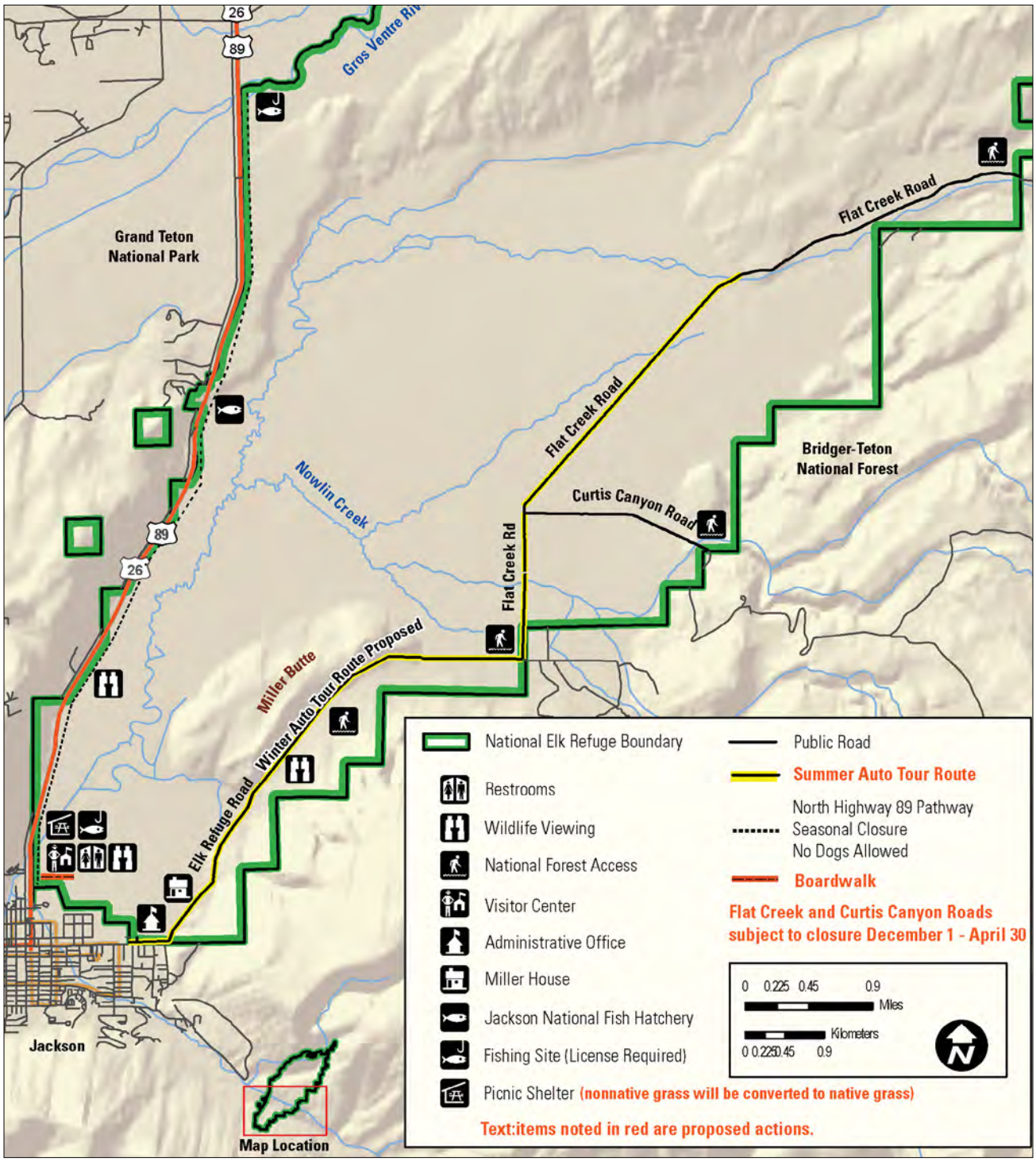

Figure 12. Map of visitor services on the southern end of the National Elk Refuge, Wyoming.

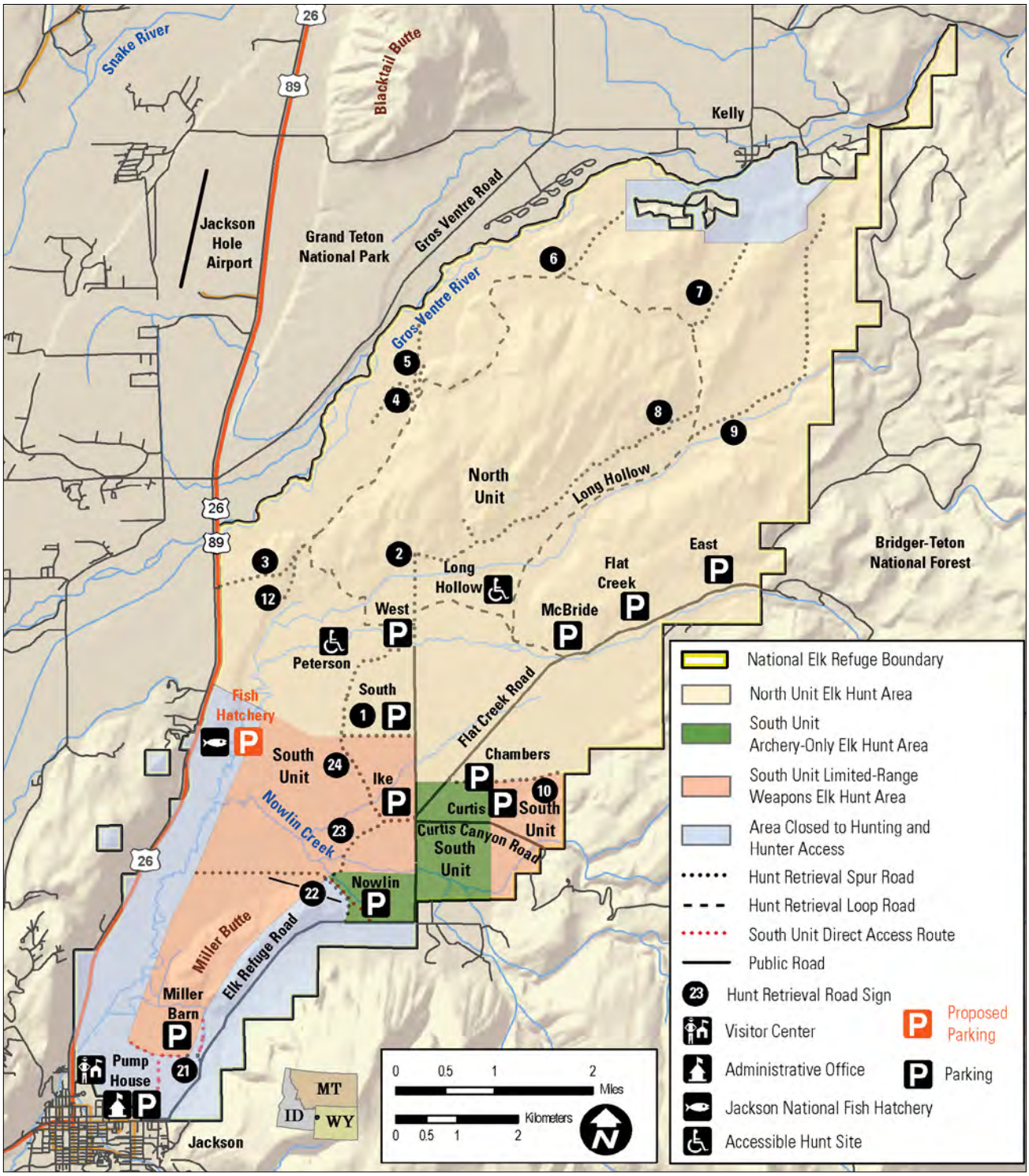

Figure 13. Map of the elk hunting program on the National Elk Refuge, Wyoming.

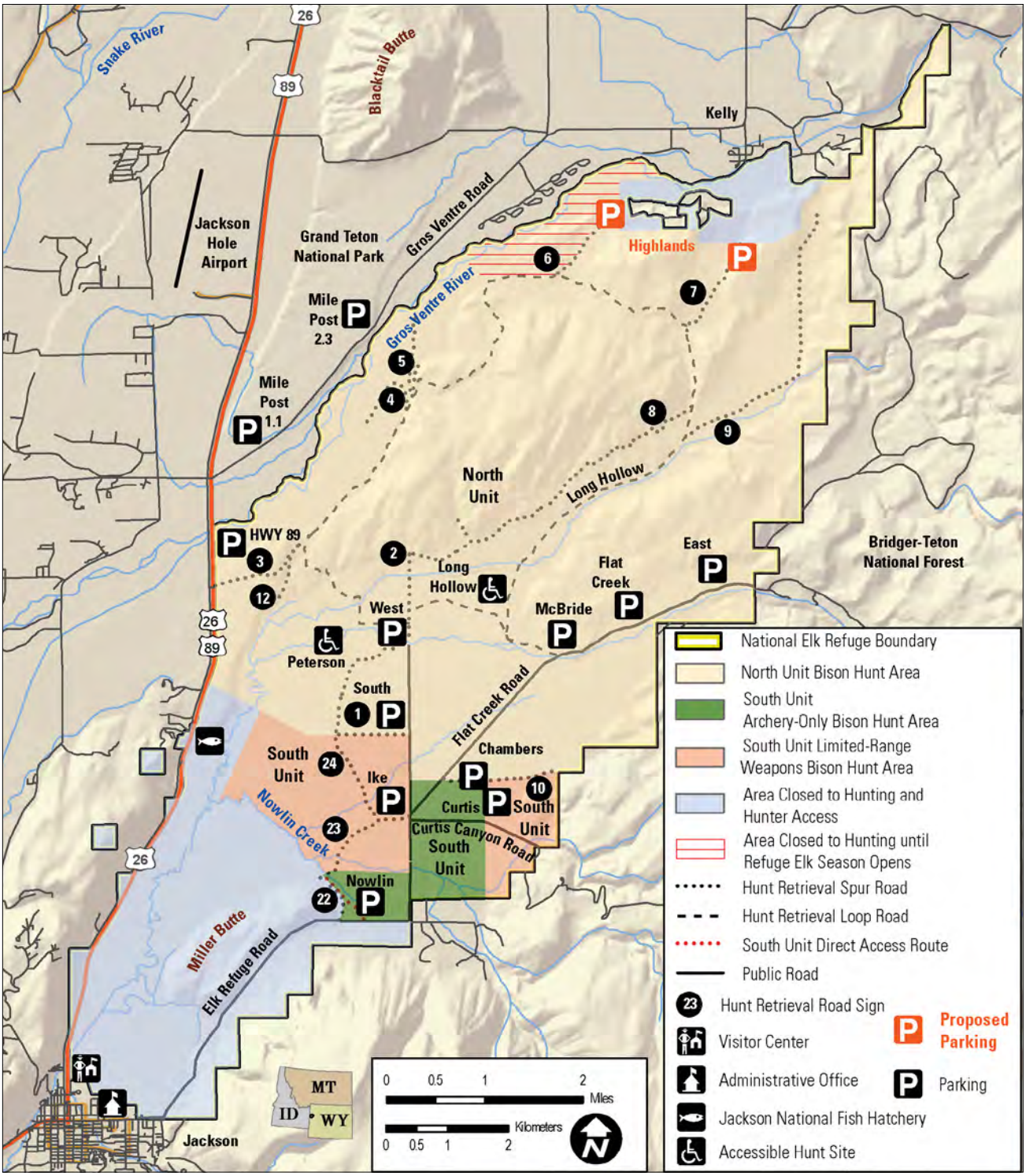

Figure 14. Map of the bison hunting program on the National Elk Refuge, Wyoming.

- Move the existing youth hunt to a time later in the hunting season when there are likely large elk numbers present on the refuge.

Rationale

Recruiting young hunters into the hunting culture is critical for continued public support of hunting as an accepted wildlife-dependent recreational activity, continued use as a wildlife management tool, and as the primary funding source for modern wildlife management. Key elements of any hunt for young people are preventing competition for game from adult hunters, adult supervision and mentoring, and quality opportunities to see and interact with wildlife.

Hunting Objective 2

Within 5 years, develop regulations for proper storage of bear attractants and for bear-deterrent practices on the refuge that address hunters and hunting practices.

Strategies

- Develop regulations that focus on reducing attractants to parking areas and vehicles.
- Provide guidelines for refuge staff when a bear is present on the refuge.
- Provide educational material and guidelines to hunters on bear behavior and what to do in the presence of a bear, including carrying and using bear spray.

Rationale

A significant population of grizzly bear lives at Grand Teton National Park and Bridger-Teton National Forest. The bears are habituated to hunter-killed elk and bison and gut piles, and these food sources are an important part of their fall diet. The refuge hunting program produces large quantities of both carcass remains and gut piles throughout the refuge. Grizzly bears have discovered this food source and were present on the refuge after the bison hunt began in August 2013.

Hunting Objective 3

Within 10 years, develop a hunting opportunity for trophy bull elk on the refuge.

Strategies

- Work cooperatively with WGFD to develop a bull elk license specifically for the refuge.
- Develop an antler point restriction to make sure only mature bulls are harvested.
- Provide educational and outreach material to other refuge users and the public to educate them about the Refuge System's mandate to provide recreational hunting opportunities when they are compatible with the purpose of the refuge.

Rationale

Congress has identified hunting as a priority wildlife-dependent use for the Refuge System. The National Elk Refuge uses hunting as an important wildlife management tool. Other opportunities such as a limited-quota bull hunt could be made available to hunters as long as these opportunities supported the purpose of the refuge. A limited-quota bull hunt would increase hunting interest in the refuge, attract more hunters to participate in the annual cow hunt, and introduce more hunters to the purpose and vision of the National Elk Refuge.

Hunting Objective 4

Within 10 years, develop hunter-use management tools to better manage hunt program opportunities.

Strategies

- Work cooperatively with WGFD to develop hunter checkpoints and hunter success surveys.
- Consider requiring mandatory reporting of tag use and harvest.

Rationale

Our current tools provide only minimum estimates of harvest and do not provide any data about hunter success or tag use on the refuge. More complete hunter use data would allow refuge staff to better manage refuge hunting opportunities and optimize refuge hunter use, distribution, and harvest management.

Hunting Objective 5

Within 5 years, develop and implement guidelines for a commercial guided hunting and retrieval.

Strategies

- Coordinate with WGFD.
- Set limits for the number of permits issued each season for guided hunting.
- Set limits for the number of trips, guides, and clients per day per company.
- Establish a permit fee for commercial hunting guides.

Rationale

Guided hunting and retrieval could increase hunter success and help meet population objectives for bison and elk.

Fishing Objective 1

Within 5 years, develop and implement guidelines for a commercial guided fishing program, with special attention to the lower Flat Creek area.

Strategies

- Coordinate with WGFD to conduct an angler survey.
- Set limits for the number of permits issued each season for guided fishing.
- Set limits for the number of trips, guides, and clients per day per company.
- Establish a permit fee for commercial fishing guides.
- Provide accessible opportunities for fishing.

Rationale

Unlimited commercial guiding has degraded the fishing experience for unguided individuals fishing on lower Flat Creek. Controls placed on the total number of guides permitted to work the refuge, as well as the total number of clients they are allowed to guide on each trip, would remove much of the congestion caused by large guided groups and improve the quality of experience had by all anglers on Flat Creek. Permit fees collected from commercial guides would help to pay for law enforcement activities and education and outreach materials.

Fishing Objective 2

Within 5 years, increase education of commercial guides and anglers on the negative effects of nonnative fish on the native Snake River cutthroat trout fishery and encourage angler harvest of nonnative trout.

Strategies

- Work cooperatively with WGFD and Trout Unlimited to develop support for this program.
- Through increased education of commercial guides and anglers, increase angler harvest of nonnative trout.

Rationale

Fish harvest systems have a powerful effect on fish populations. By encouraging guided anglers to remove all nonnative trout they catch, many more would be removed than by employing management activities alone. The refuge would focus on guided anglers because they generally have better fish identification skills than the average angler.

Fishing Objective 3

Continue angler education about the negative effects of nonnative fish on the native Snake River cutthroat trout fishery and encourage angle harvest of nonnative trout.

Strategies

- Work cooperatively with WGFD and Trout Unlimited to develop support for this program.
- Use public outreach to improve identification of fish species.

- Update fishing regulations and refuge brochures.

Rationale

Fish harvest systems have a powerful effect on fish populations. By encouraging anglers to remove all nonnative trout they catch, many more would be removed than by employing management activities alone. The 10-year timeframe would give us ample time to develop outreach materials and identification aides.

Wildlife Observation and Photography Objective 1

For the life of the plan, enrich existing wildlife observation and photography opportunities on the refuge (25 percent of people report an enhanced experience).

Strategies

- Maintain access to turnouts, trails, and other observation sites:
  - Second-story, visitor center viewing platform.
  - Bert Raynes Boardwalk and remote-viewing platform near the visitor center.
  - Turnout just north of the visitor center and Flat Creek Bridge.
  - Elk jump turnout along Highway 89 (seasonal summer use only).
- Support a contracted, winter interpretive sleigh ride program.
- Allow wildlife-touring companies to operate on the refuge through a special use permit that outlines special conditions for operation.
- Lead winter wildlife excursions.
- Loan equipment like binoculars, scopes, and backpacks through various Service initiatives and programs to increase opportunities for experiences and observation on the refuge.

Rationale

Visitor surveys conducted by the Jackson Hole Chamber of Commerce have consistently documented that 80–90 percent of valley tourists identify natural resource–based activities as their primary reason for visiting Jackson Hole. Viewing the mountains, bison, elk, birds, and other wildlife was rated as an important activity by local and nonlocal refuge visitors (Loomis and Caughlan 2004). Wildlife viewing and photography are two of the six priority public uses (wildlife-dependent recreational uses) of the Refuge System.

Wildlife Observation and Photography Objective 2

Over the life of the plan, implement at least five new, accessible wildlife observation opportunities on the refuge.

Strategies

- Develop a more prominent access route across the visitor center lawn to the existing remote-viewing platform.
- Develop a boardwalk through already disturbed wetlands near the visitor center.
- Build a photo blind along the boardwalk for noncommercial photography.
- Use webcams on the refuge to provide remote wildlife-viewing opportunities.
- Incorporate accessible opportunities into wildlife observation and photography programs.
- Develop a wildlife checklist.

Rationale

Public use would increase at area-specific, intensive use locations, resulting in increased development in some areas of the refuge. Visitors would have enhanced options to experience the refuge.

Steve Miller / FWS

Environmental education at the refuge occurs at a variety of locations and events.

Environmental Education and Interpretation Objective 1

For the life of the plan, provide a variety of opportunities for environmental education and interpretation.

Strategies

- Maintain and improve diverse and dynamic interpretive displays, new media, and handout literature that continually enhance and increase visitors' interest in exploring the refuge.
- Develop a self-guided, interpretive tour route on Elk Refuge Road.
- Offer improved programs at the Jackson Hole and Greater Yellowstone Visitor Center, Miller House, and offsite areas with more permanent or seasonal interpreters.
- Produce short video segments on a variety of topics related to the Service and share with audiences through multiple venues.
- Use the Miller Barn as an interpretive site once stabilization and restoration work is completed.

Rationale

Environmental education is a process designed to teach citizens and visitors of all ages the history and importance of conservation and scientific knowledge about the Nation's natural resources. Through improved facilities and increased displays and presentations, we could better help to develop awareness, knowledge, attitudes, skills, motivation, and commitment for the public to work cooperatively toward conservation.

Environmental Education and Interpretation Objective 2

For the life of the plan, use the North Highway 89 Pathway to interpret the refuge purposes and mission of the Refuge System.

Strategies

- Use the existing Jackson Hole Community Pathways to interpret wetland values.
- Coordinate with Jackson Hole Community Pathways about pathway traffic flow, develop trailside interpretive signage, and encourage wildlife viewing.

- Cooperate with Jackson Hole Community Pathways to evaluate pathway effects on wildlife and habitat and adjust seasonal use as appropriate.

Rationale

Refuge staff would use the pathway during the open season as an interpretive venue. This would maximize the season and opportunity for interpretation without affecting wildlife.

Visitor Center Objective 1

Within 5 years, secure annual funding from visitor center partners to help with operation expenses, and document the financial assistance in a signed multiyear partnership agreement.

Strategies

- Regularly meet with partners to provide an overview of visitor center visitation and expenses incurred for seasonal operational periods.
- Provide partners with expense reports that detail the annual costs of goods and services needed for critical visitor center operations.
- Use partner contributions as a sustainable way to pay for visitor center operations.
- Monitor information desk questions to document the benefits of the visitor center operation to each agency.
- Keep current a partnership agreement between the organizations and an annual operating plan.

Rationale

The Jackson Hole and Greater Yellowstone Visitor Center is an interagency facility, staffed and supported by area agencies and organizations. Each visitor center partner would continue to gain substantial financial benefit from our staff and visitor services rather than having to staff and provide a visitor contact location of their own. Sharing the financial burden among the agencies of operating the center, including purchasing supplies, would make it equitable for each of the partners.

Visitor Center Objective 2

Within 10 years, rehabilitate the existing building or build a new visitor center to address the aging building's maintenance deficiencies.

Strategies

- Document maintenance issues as they occur.
- Continually evaluate and keep current the building condition assessment through the Service's reporting procedures.
- Prioritize the maintenance needs in our agency maintenance reporting systems.
- Complete evaluations or surveys that would need to be done before new construction.

Rationale

The visitor center building was formerly owned by the Wyoming Department of Transportation and served as a State Information Center for the Wyoming Division of Tourism. The building is more than 50 years old and has many significant maintenance issues such as deficiencies in the electrical system, annual flooding in the crawlspace, rotted wood on the remote-viewing platform, and noncompliance with the Architectural Barriers Act Accessibility Standard (United States Access Board 2013). A rehabilitated or new visitor center would also address the lack of space for interpretive programs or presentations to school or other large groups.

North Park Objective

Within 3 years, manage North Park in accordance with Service policies, restore the park area to native habitat, and develop interpretive services.

Strategies

- Revise the memorandum of understanding with the town of Jackson to do away with the reservation and fee-collection system for the picnic shelter.
- Develop and provide public information about appropriate and compatible uses of the refuge.

- Develop interpretive displays to support and explain the refuge purposes and Refuge System mission.
- Renovate habitat to reduce the lawn and restore native vegetation.

Rationale

The refuge would work toward its goal of limiting public use to appropriate and compatible wildlife-dependent recreational uses as identified our agency policies. The refuge would shift away from fringe uses or those that are prohibited by agency policy.

Other Uses Objective

Throughout the life of the plan, provide proper and compatible opportunities for wildlife-dependent recreation and non-wildlife-dependent recreation that support the six priority public uses or contribute to public appreciation of the refuge.

Strategies

- Allow the following compatible and proper uses as long as wildlife is not disturbed and when areas are not closed for safety reasons:
  - access to the Bridger-Teton National Forest
  - North Park at the visitor center
- Allow under special use permit the following compatible and proper uses as long as wildlife is not disturbed:
  - commercial photography
  - commercial tours for wildlife viewing
  - commercial guiding and game retrieval for hunting
  - commercial guiding for fishing
  - ceremonial tribal bison hunt
- Prohibit the following incompatible uses:
  - general collection of shed antlers
  - collection of berries, fruit, roots, wildflowers, and mushrooms
  - collection of reptiles and amphibians
  - weddings
  - boating
  - swimming
- Phase out commercial horseback trail rides.
- Review requests for other non-wildlife-dependent activities for compatibility and appropriateness case-by-case.

Rationale

The Improvement Act states that other uses can occur within the Refuge System, but they must support or not conflict with a priority public use. Furthermore, a use might not keep a refuge from accomplishing its purposes or the mission of the Refuge System.

Special Use Permit Objective 1

Within 5 years, identify an appropriate level of commercial operations on the refuge. Within 10 years, manage commercial operations to achieve appropriate levels of use for guided fishing, guided hunting, and wildlife-viewing companies.

Strategies

- Monitor ongoing commercial uses.
- Limit special use permits for commercial operations (such as hunting, fishing, and wildlife-viewing tours) to reduce traffic and effects on the refuge.
- Charge fees for commercial companies (guided hunting and fishing, hunting retrieval services, operation of commercial wildlife-viewing tours, and professional photography and videography) to offset administrative costs.
- Include special conditions with each permit to reduce effects on resources and other activities.

FWS

Ciliate Bluebells

- Evaluate and potentially prohibit requests for special access that could be precedent-setting and would demand excessive refuge resources.

Rationale

We recognize that an appropriate level of commercial services can enhance visitor experience by providing programs that the refuge does not have the ability (resources) to provide. There would be no fee required when a special use is related to habitat improvement or wildlife research. If a special use permit resulted in a company profiting from the refuge, a fee to offset administrative costs would be justified. Charging a fee would help offset the costs of the administrative time involved in processing special use permits and compiling annual use information.

Special Use Permit Objective 2

Within 5 years, complete a special use permitting system that has a fee schedule for the processing of permits and the associated costs for accommodating commercial filming or photography activity.

Strategies

- Work with the regional office to implement national guidance on a fee schedule for collecting fees associated with commercial photography and filming.

- Communicate with the Grand Teton National Park permits office to make sure there is not a large discrepancy in the amount of fees charged on the refuge versus those same activities in the neighboring national park.

Rationale

The National Elk Refuge accommodates a large number of commercial photographers and film companies each year, especially during the winter months. Responding to media requests has become an increasing part of the winter duties for the visitor services staff. Making contacts with the permittee, evaluating the request, writing special conditions, completing the permit, and accommodating the request takes refuge staff a substantial amount of administrative time. A fee system would allow the refuge to recuperate some of the administrative costs associated with the activity.

Public Outreach Objective

For the life of the plan, disseminate information about elk and bison management, refuge management practices, and visitor services programs to increase awareness of the National Elk Refuge.

Strategies

- Maintain email contact lists for distribution of refuge information to elected officials, Federal and State partners, nonprofit conservation and partner organizations, key community and business leaders, and regional and national Service contacts.
- Prepare and send out news releases via established email lists.
- Prepare and send out articles via established email lists.
- Use electronic media, including maintaining and keeping current the refuge Web site as well as using our agency's new media and photo-sharing sites.
- Conduct media interviews and accommodate film crews for local, national, and international audiences as workload allows.
- Use refuge leaders in an ambassadorial and leadership role in the community, including extensive involvement in a variety of partnerships.
- Coordinate with the Bridger-Teton National Forest on a winter closure to the public beyond the Twin Creek subdivision.

Rationale

Outreach is critical because of the National Elk Refuge's high profile location, its "flagship refuge" status, and the complexity and controversial nature of many of the management issues. Effective outreach—by giving the media a source of readily available resources and material—would streamline our response to the demand for information from local, regional, national, and international media and decrease the inaccuracy of stories compiled by others.

6.8 Visitor and Employee Safety and Resource Protection Goal

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge.

Visitor and Employee Safety Objective 1

Over the life of the plan, eliminate lost-time worksite accidents and reduce all other accidents by 75 percent.

Strategies

- Continue to talk about safety procedures with employees and volunteers.
- Continue to develop job hazard analyses for new activities.

Rationale

Visitor and employee safety is the refuge's highest priority. We are required to provide a safe and hazard-mitigated environment for all refuge users and our employees.

Visitor and Employee Safety Objective 2

Within 5 years, document road hazards and vehicle accidents.

Strategy

- Monitor and report accidents.

Rationale

Visitor and employee safety is the refuge's highest priority. We are required to provide a safe and hazard-mitigated environment for all refuge users and our employees.

Visitor and Employee Safety Objective 3

Within 10 years, reduce road accidents in identified risk areas by 50 percent.

Strategies

- Enforce no stopping and no parking in the roadway.
- Improve signage.
- Incorporate safety conditions in all special use permits.
- Revoke special use permits when violations occur, and restrict or limit the ability of revoked permittees to obtain future special use permits.

Rationale

Visitor and employee safety is the refuge's highest priority. We are required to provide a safe and hazard-mitigated environment for all refuge users and our employees.

Visitor and Employee Safety Objective 4

Within 5 years, document hunting accidents, violations, and unsafe practices. Over the life of the plan, reduce hunting accidents, violations, and unsafe practices in risk areas and activities by 50 percent.

Strategies

- Revise hunt area boundaries.
- Incorporate safety conditions in hunting publications.
- Increase signage.
- Notify hunters of other public users that might be using the area (such as birders, cyclists, and users of the auto tour route).
- Increase the law enforcement presence during hunting season.
- Revoke hunting permits when safety violations occur, and restrict or limit the ability of hunters with revoked permits to obtain future hunting permits.

Rationale

Visitor and employee safety is the refuge's highest priority. We are required to provide a safe and hazard-mitigated environment for all refuge users and our employees.

Resource Protection Objective 1

Protect wildlife and other natural and cultural resources from damage, theft, or illegal taking to preserve resources for the public and to prevent their unnatural decline.

Strategies

- Enforce hunting, fishing, and other regulations in accordance with the CFR, State laws, and refuge-specific regulations to protect habitat and wildlife.
- Close areas to protect wildlife from human disturbance when necessary.
- Use law enforcement and education to protect cultural resources in accordance with Federal, State, and tribal laws, policies, and guidelines.
- Keep a minimum of two dual-function law enforcement officers or one dual-function and one full-time, permanent law enforcement officer.
- Provide ample and easy access to refuge regulations through various media such as printed leaflets, the Web site and social media, and six information kiosks located throughout the refuge.

Rationale

Adequately staffing refuges with sufficient officers to protect wildlife and habitat and to make refuges safe places for staff and visitors is a top priority for the Refuge System. "Conserving the Future" (FWS 2011), Recommendation 16, charges us to: Conduct a new, independent analysis of refuge law

enforcement to measure progress and to name needed improvements.

Resource Protection Objective 2

Within 5 years, increase law enforcement patrols by 25 percent and develop shift coverage for high-visitor-use seasons.

Strategies

- Detail (temporarily assign) officers from other refuges to the National Elk Refuge.
- Hire a law enforcement officer.
- Obtain a dual-function position.
- Develop special operations for hunting and antler collecting seasons.

Rationale

More law enforcement would be needed to manage the current public use as well as the additional use from increased visitor services programs.

6.9 Administration Goal

Provide facilities and effectively use and develop staff resources, funding partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge.

Funding and Staff Objective 1

Over the life of the plan, increase permanent staff by 16.5 FTE positions to help realize the enhancement potential of all refuge programs.

Strategies

- Include more positions in the Refuge Operation Needs System to get future funding.
- Brief our regional leaders about the refuge staff needed to accomplish the refuge goals and the effects of the current staff shortfall.

Rationale

Current Government staff levels are inadequate to accomplish the work of the refuge. The refuge relies on volunteers and positions paid by nongovernmental money to accomplish objectives. In 2011–2013, the refuge used more volunteer and nongovernmentally funded positions (12.5 FTEs) than Government-funded positions (10.5 FTEs). Although we are extremely fortunate to have volunteers and nongovernmentally funded positions, for the long term, the refuge cannot rely on these uncertain sources of assistance. The lack of a full-time assigned volunteer coordinator to conduct the recruiting, hiring, training, and logistics for the needed volunteers would continue to affect refuge programs. Providing necessary staff levels through Government-funded positions would provide the long-term consistency required for management excellence.

Funding and Staff Objective 2

Over the life of the plan, increase the refuge's annual base funding to cover all operational costs and increased staff costs while maintaining a 75:25 staff to maintenance capacity ratio.

Strategy

- Brief our regional leaders about the need for an increased and stable budget to eliminate the severe staff shortfall and be able to accomplish the refuge goals.

Rationale

Current annual base funding is a minimum of $200,000 short for funding adequate staff and management. Establishing an adequate annual budget would ensure long-term stability in management programs for the refuge.

Facilities Objective 1

Over the life of the plan, increase refuge housing to accommodate an increase in staff.

Strategy

- Brief our regional leaders about the need for increased refuge housing.

Rationale

The high cost of permanent and temporary housing in the Jackson area is an impediment to recruiting staff to work at the refuge. Having the option of reasonably priced, Government rental housing is an important factor in recruiting quality employees to fill lower-graded positions at the refuge.

The refuge would coordinate with Teton County when planning and constructing new buildings. However, we are under no legal obligation to follow county regulations; coordination with the county would be a courtesy rather than complying with a legal requirement.

Facilities Objective 2

Over the life of the plan, relocate the Calkins House to the Nowlin Gate area.

Strategy

- Move the Calkins House and all outbuildings to the Nowlin Gate area when money becomes available.

Rationale

Relocation of the Calkins House would consolidate refuge housing and eliminate the need to maintain communications and transportation facilities to an outlying facility. This would also allow that part of the hunt unit around the Calkins House to be open for firearms, which could result in a minor increase in elk and bison harvest.

Elk Refuge Road Objective 1

Within 5 years, monitor winter use of Elk Refuge Road to identify the magnitude of use, safety issues, and visitor experience.

Strategies

- Install traffic counters.
- Conduct visitor surveys.
- Share use information with Teton County and identify safety concerns.

Rationale

With baseline information on road use, the staff would be able to address safety concerns and other issues associated with the road.

Elk Refuge Road Objective 2

Within 10 years, manage year-round use of Elk Refuge Road to improve safety and the visitor experience.

Strategies

- Add new regulatory signing to prohibit stopping or parking on or along roadway.
- Permit parking only in designated lots and turnouts.
- Add mounted scopes at turnouts to encourage people to get out of their cars.
- Improve and increase the number of turnouts along the road for winter use.
- Add numbered turnouts (ending at the Twin Creek subdivision) and interpretive information to correspond with a winter auto tour brochure.
- Create and disseminate an interpretive brochure for a winter and summer auto tour route.
- Increase road maintenance (plowing, turnouts, sanding, and pulling ditches) in the winter for safety purposes.
- Work with Teton County to reduce dust abatement.
- Increase enforcement of current regulations.
- Consider moving the entrance kiosk and parking area to the west side of the Elk Refuge Road entrance.

Rationale

High traffic volume and numbers of people using Elk Refuge Road for recreation and exercise creates user conflicts that might lead to safety issues. More

BJ Baker / FWS

Osprey

signing, turnouts, and enforcement would increase user safety. Visitors would have more information available to learn about refuge resources.

Elk Refuge Road Objective 3

Within 5 years, eliminate overnight use of Elk Refuge Road for the opening of the national forest winter range.

Strategies

- Prohibit overnight parking, camping, staging, and tailgating on the refuge associated with antler collection on national forest lands.
- Consider alternate gate opening times, for example, opening the refuge access gate later than the other national forest access gates.
- Use educational outreach to explain the change in management to the public.

Rationale

Refuge System policy does not allow overnight camping on the refuge. This use creates a safety hazard because it obstructs the road for emergency vehicles and other users and substantially increases law enforcement costs for the refuge. Enforcing the restriction on overnight use would help protect roadside resources, reduce traffic congestion, improve visitor and employee safety, and reduce refuge costs.

Partnerships Objective

Work with partners to accomplish mutually beneficial projects including the nonmotorized pathway, aerial photography, GIS mapping, wildlife disease monitoring, and habitat and corridor protection and restoration.

Strategy

- Participate with the town of Jackson and Teton County, and provide data if available, to identify relatively important wildlife habitat and understand the cumulative impacts of development and different development types on wildlife.
- Continue to collaborate with Jackson Hole Trout Unlimited, Rocky Mountain Elk foundation, Snake River Fund, and WGFD to improve the fish-bearing streams for native cutthroat trout.

Rationale

Land use and habitat conditions off the refuge affect wildlife on the refuge. Teton County recently approved a comprehensive land use plan and will be developing regulations to carry out this plan. Sharing resources and close coordination between the refuge and the town of Jackson and Teton County through data sharing and project partnerships would help the refuge meet the habitat and wildlife goal.

6.10 Staff

Current staff within the complex consists of 10.5 permanent full-time employees. Table 21 shows the current staff and proposed additional staff required to fully implement the CCP. Because of the area of responsibility and added complexities of this plan, we would evaluate all grade levels for current staff. If all positions were funded, the staff would be able to carry out all aspects of the draft CCP, which would provide the most long-term benefit to wildlife, habitat, and ecosystems; improve facilities; and provide visitor services. Projects that have adequate budgets and staff would receive priority for accomplishment.

Table 21. Current and proposed staff at the National Elk Refuge, Wyoming.

Government-funded position	*Current position (full-time equivalents [FTEs])*	*Proposed added position (FTEs)*
Refuge manager (GS[1]–485–14)	1	—
Deputy refuge manager (GS–485–13)	1	—
Outdoor recreation planner (GS–0023–12)	1	—
Park ranger (GS–0025–9, visitor center manager)	1	—
Wildlife biologist (GS–486–12)	1	—
Refuge land management officer (GL[2]–1801–9)	1	—
Office assistant (GS–0303–5)	0.5	—
Heavy mobile equipment mechanic (WG[3]–5803–11)	1	—
Maintenance mechanic (WG–4749–9)	1	—
Engineering equipment operator (WG–5716–8)	—	1
Budget analyst (GS–0560–11, business team)	1	—
Rangeland management specialist (GS–454–9)	1	—
Biological science technician (GS–404–5/7)	—	1
Refuge land management officer (GL–1801–7/9)	—	1
Environmental education specialist (GS–0025–7/9)	—	1
Maintenance program supervisor (WG–5716–9)	—	1
Three permanent seasonal park rangers (GS–0025–5/7, winter interpretive naturalists)	—	1.5
Six permanent seasonal biological technicians (GS–404–4, irrigators)	—	3
Eight permanent seasonal park rangers (GS–0025–4, visitor center)	—	4
Two permanent seasonal engineering equipment operators (WG–5716–7)	—	1
Three permanent seasonal park rangers (GS–0025–5)	—	2

[1] GS=General Schedule classification and pay system.

[2] GL= General Schedule classification and pay system for law enforcement officers.

[3] WG= Wage Grade classification and pay system.

This CCP is a broad umbrella plan that provides general concepts and specific wildlife, habitat, visitor services, and partnership objectives over the next 15 years. Stepdown management plans, in turn, provide detail for our managers and employees so they can more effectively carry out the specific actions and strategies in the CCP. Table 22 lists needed plans.

Table 22. Stepdown management plans for the National Elk Refuge, Wyoming.

Stepdown plan	*Planned completion*
Comprehensive disease contingency	2014
Cultural resource management	2020
Fire management	2016
Habitat management	2017
Integrated pest management	2019

Table 22. Stepdown management plans for the National Elk Refuge, Wyoming.

Stepdown plan	*Planned completion*
Inventory and monitoring	2016
Visitor services	2015

6.12 Monitoring and Evaluation

Our agency proposes that the uncertainty surrounding habitat management can be dealt with most efficiently within the paradigm of adaptive resource management (figure 15) (Holling 1978, Kendall 2001, Lancia et al. 1996, Walters and Holling 1990). This approach provides a framework within which we can make objective decisions and reduce the uncertainty surrounding those decisions. The key components of an adaptive resource management plan follow:

- clearly defined management goals and objectives
- a set of management actions with associated uncertainty as to their outcome
- a suite of priority models representing various alternative working hypotheses describing the response of species or communities of interest
- monitoring and assessment of the response of target organisms
- use of monitoring and assessment information to direct future decisionmaking through the selection of a best model

The first three components (goals, actions, and models) are largely defined before initiating an adaptive resource management plan, while the latter two (monitoring and directed decisionmaking) comprise an iterative process, whereby each year the predictive ability of models are tested against what was observed during monitoring. This might result in a new best model, greater support for the existing best model, or new models constructed from emerging hypotheses. In this way, management can evolve as information is gained and uncertainty is reduced.

Development of adaptive resource management plans for habitat management would allow the refuge to "learn by doing," while maintaining a focus on objectives. Knowledge gained from assessing management actions is as integral to the process as the management actions themselves. Emphasizing gaining knowledge about the refuge creates a situation where we can refine its habitat management with feedback between management and assessment. Reducing the uncertainty of habitat management via adaptive resource management plans would greatly help us develop long-term habitat management plans.

6.13 Plan Amendment and Revision

The final CCP will be augmented by detailed stepdown management plans to address the completion of specific strategies in support of the CCP goals and objectives. To determine the need for revision, the CCP will be reviewed annually. A revision would occur if and when significant information became available, such as a change in ecological conditions. Revisions to the CCP and the stepdown management plans would be subject to public review and compliance with the National Environmental Policy Act.

At a minimum, the final plan will be evaluated every 5 years and revised after 15 years.

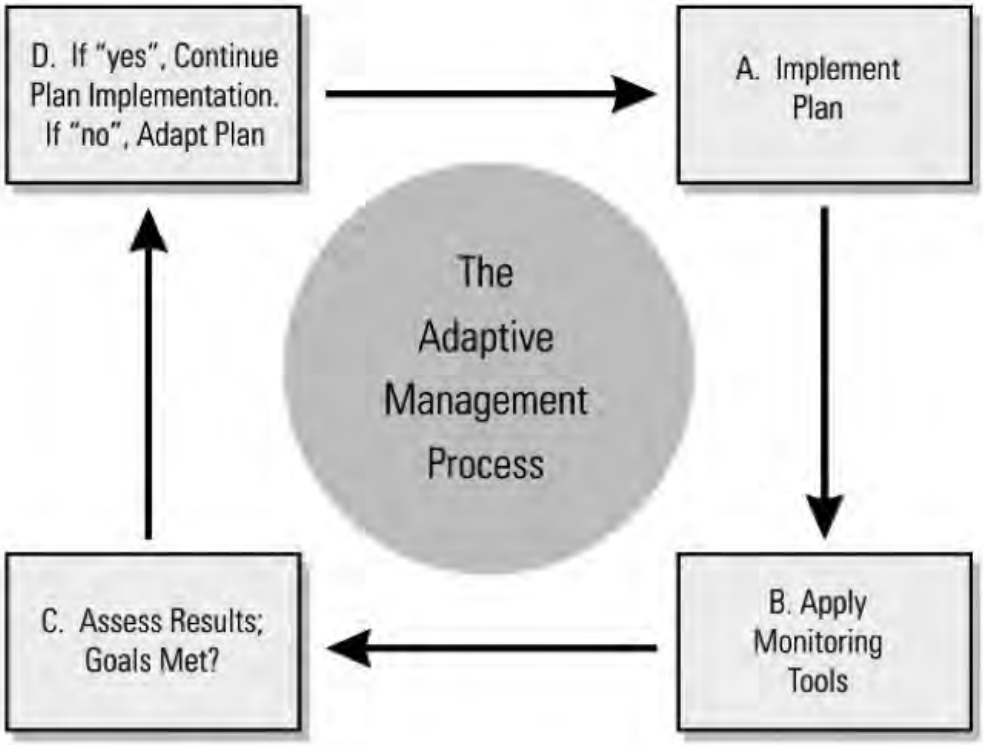

Figure 15. The adaptive resource management process.

Glossary

accessible—Pertaining to physical access to areas and activities for people of different abilities, especially those with physical impairments.

adaptive resource management—The rigorous application of management, research, and monitoring programs to gain information and experience necessary to assess and change management activities; a process that uses feedback from research, monitoring programs, and evaluation of management actions to support or change objectives and strategies at all planning levels; a process in which policy decisions are carried out within a framework of scientifically driven experiments to test predictions and assumptions inherent in management plan. Analysis of results helps managers decide whether current management should continue as is or whether it should be modified to achieve desired conditions.

Administration Act—National Wildlife Refuge System Administration Act of 1966.

alternative—A reasonable way to solve an identified problem or satisfy the stated need (40 CFR 1500.2); one of several different means of accomplishing refuge purposes and goals and contributing to the Refuge System mission (Draft Service Manual 602 FW 1.5).

amphibian—A class of cold-blooded vertebrates including frogs, toads or salamanders.

annual—A plant that flowers and dies within 1 year of germination.

baseline—A set of essential observations, data, or information used for comparison or a control.

biological control—The use of organisms or viruses to control invasive plants or other pests.

biological diversity, also biodiversity—The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1.12B). The National Wildlife Refuge System's focus is on indigenous species, biotic communities, and ecological processes.

biotic—Pertaining to life or living organisms; caused, produced by, or comprising living organisms.

candidate species, Federal—A plant or animal species proposed for addition to the Federal endangered and threatened species list. These species have formerly been referred to as category 1 candidate species. From the February 28, 1996, Federal Register, page 7597: "those species for which the Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list but issuance of the proposed rule is precluded."

canopy—A layer of foliage, generally the uppermost layer, in a vegetative stand; mid-level or understory vegetation in multilayered stands. Canopy closure (also canopy cover) is an estimate of the amount of overhead vegetative cover.

carrion—Dead animal body.

CCP—See comprehensive conservation plan.

CFR—See Code of Federal Regulations.

channel—The linear route along which surface water and ground water flow is concentrated.

channel morphology—the form and structure (such as width and depth) of a channel.

Code of Federal Regulations (CFR)—The codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government. Each volume of the CFR is updated once each calendar year.

compatibility determination—See compatible use.

compatible use—A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director of the U.S. Fish and Wildlife Service, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge (Draft Service Manual 603 FW 3.6). A compatibility determination supports the choice of compatible uses and identified stipulations or limits necessary to make sure that there is compatibility.

comprehensive conservation plan (CCP)—A document that describes the desired future conditions of the refuge and provides long-range guidance and management direction for the refuge manager to accomplish the purposes of the refuge, contribute to the mission of the Refuge System, and to meet other relevant mandates (Draft Service Manual 602 FW 1.5).

concern—See issue.

cover, also cover type, canopy cover—Present vegetation of an area.

cultural resources—The remains of sites, structures, or objects used by people in the past.

cygnet—A young swan.

EA—See environmental assessment.

ecosystem—A dynamic and interrelating complex of plant and animal communities and their associated nonliving environment; a biological community, with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and their sizes and ecological complexity vary.

emergent—A plant rooted in shallow water and having most of the vegetative growth above water such as cattail and hardstem bulrush.

endangered species, Federal—A plant or animal species listed under the Endangered Species Act of 1973, as amended, that is in danger of extinction throughout all or a substantial part of its range.

endangered species, State—A plant or animal species in danger of becoming extinct or extirpated in a particular state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a substantial degree.

endemic species—Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

environmental assessment (EA)—A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action and alternatives to such action, and provides sufficient evidence and analysis of effects to decide whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

extinction—The complete disappearance of a species from the earth; no longer existing.

extirpation—The extinction of a population; complete eradication of a species within a specified area.

Federal trust resource—A trust is something managed by one entity for another who holds the ownership. The Service holds in trust many natural resources for the people of the United States of America as a result of Federal acts and treaties. Examples are species listed under the Endangered Species Act, migratory birds protected by international treaties, and native plant or wildlife species found on a national wildlife refuge.

Federal trust species—All species where the Federal Government has primary jurisdiction including federally endangered or threatened species, migratory birds, anadromous fish, and certain marine mammals.

forb—A broad-leaved, herbaceous plant; a seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue but dies down at the end of the growing season.

fragmentation—The alteration of a large block of habitat that creates isolated patches of the original habitat that are interspersed with a variety of other habitat types; the process of reducing the size and connectivity of habitat patches, making movement of individuals or genetic information between parcels difficult or impossible.

Friends group—Any formal organization whose mission is to support the goals and purposes of its associated refuge and the National Wildlife Refuge Association overall; Friends organizations and cooperative and interpretive associations.

FWS—See U.S. Fish and Wildlife Service.

geographic information system (GIS)—A computer system capable of storing and manipulating spatial data; a set of computer hardware and software for analyzing and displaying spatially referenced features (such as points, lines and polygons) with nongeographic attributes such as species and age.

GIS—See geographic information system.

GL—General Schedule classification and pay system for law enforcement officers.

goal—Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Draft Service Manual 620 FW 1.5).

GS—General Schedule classification and pay system.

habitat—Suite of existing environmental conditions required by an organism for survival and reproduction; the place where an organism typically lives and grows.

habitat disturbance—Substantial alteration of habitat structure or composition; may be natural (for example, wildland fire) or human-caused events (for example, timber harvest and disking).

habitat type, also vegetation type, cover type—A land classification system based on the concept of distinct plant associations.

hydrologic regime—The system of a water cycle and its changes with time.

impoundment—A body of water created by collection and confinement within a series of levees or dikes, creating separate management units although not always independent of one another.

Improvement Act—National Wildlife Refuge System Improvement Act of 1997.

indigenous—Originating or occurring naturally in a particular place.

integrated pest management (IPM)—Methods of managing undesirable species such as invasive plants; education, prevention, physical or mechanical

methods of control, biological control, responsible chemical use, and cultural methods.

introduced species—A species present in an area because of intentional or unintentional escape, release, dissemination, or placement into an ecosystem as a result of human activity.

invasive plant, also noxious weed—A species that is nonnative to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

issue—Any unsettled matter that requires a management decision; for example, a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition (Draft Service Manual 602 FW 1.5).

listed species—A species, subspecies, or distinct vertebrate population segment that has been added to the Federal lists of Endangered and Threatened Wildlife and Plants as they appear in sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations (50 CFR 17.11 and 17.12).

management alternative—See alternative.

migration—Regular extensive, seasonal movements of birds between their breeding regions and their wintering regions; to pass usually periodically from one region or climate to another for feeding or breeding.

migratory birds—Birds that follow a seasonal movement from their breeding grounds to their wintering grounds. Waterfowl, shorebirds, raptors, and songbirds are all migratory birds.

mission—Succinct statement of purpose or reason for being.

mitigation—Measure designed to counteract an environmental effect or to make an effect less severe.

monitoring—The process of collecting information to track changes of selected parameters over time.

national wildlife refuge—A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System, but does not include coordination areas; a complete listing of all units of the Refuge System is in the current "Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service."

National Wildlife Refuge System (Refuge System)—Various categories of areas administered by the Secretary of the Department of the Interior for the conservation of fish and wildlife including species threatened with extinction, all lands, waters, and interests therein administered by the Secretary as wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas.

National Wildlife Refuge System Improvement Act of 1997 (Improvement Act)—Sets the mission and the administrative policy for all refuges in the National Wildlife Refuge System; defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation); establishes a formal process for determining appropriateness and compatibility; establishes the responsibilities of the Secretary of the Department of the Interior for managing and protecting the Refuge System. This Act amended parts of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

native species—A species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

neotropical migrant—A bird species that breeds north of the United States and Mexican border and winters primarily south of this border.

nest success—The percentage of nests that successfully hatch one or more eggs of the total number of nests started in an area.

nongovernmental organization—Any group that is not comprised of Federal, State, tribal, county, city, town, local, or other governmental entities.

noxious weed, also invasive plant—Any living stage (including seeds and reproductive parts) of a parasitic or other plant of a kind that is of foreign origin (new to or not widely prevalent in the United States) and can directly or indirectly injure crops, other useful plants, livestock, poultry, other interests of agriculture, including irrigation, navigation, fish and wildlife resources, or public health. According to the Federal Noxious Weed Act (PL 93–639), a noxious weed (such as invasive plant) is one that causes disease or has adverse effects on humans or the human environment and, therefore, is detrimental to the agriculture and commerce of the United States and to public health.

objective—A concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work; derived from goals and provide the basis for determining management strategies. Objectives should be achievable and time specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (Draft Service Manual 602 FW 1.5).

patch—An area distinct from that around it; an area distinguished from its surroundings by environmental conditions.

perennial—Lasting or active through the year or through many years; a plant species that has a lifespan of more than 2 years.

plant community—An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soil, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community, such as ponderosa pine or bunchgrass.

prescribed fire—The skillful application of fire to natural fuels under conditions such as weather, fuel moisture, and soil moisture that allow confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

priority public use—One of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with a refuge's purposes. This includes hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

proposed action—The alternative proposed to best achieve the purpose, vision, and goals of a refuge (contributes to the Refuge System mission, addresses the significant issues, and is consistent with principles of sound fish and wildlife management).

public—Individuals, organizations, and groups; officials of Federal, State, and local government agencies; American Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have shown an interest in Service issues and those who do or do not realize that Service decisions may affect them.

public involvement—A process that offers affected and interested individuals and organizations an opportunity to become informed about, and to express their opinions on, Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

purpose of the refuge—The purpose of a refuge is specified in or derived from the law, proclamation, Executive order, agreement, public land order, donation document, or administrative memorandum establishing authorization or expanding a refuge, refuge unit, or refuge subunit (Draft Service Manual 602 FW 1.5).

raptor—A carnivorous bird such as a hawk, a falcon, or a vulture that feeds wholly or chiefly on meat taken by hunting or on carrion (dead carcasses).

refuge purpose—See purpose of the refuge.

Refuge System—See National Wildlife Refuge System.

refuge use—Any activity on a refuge, except administrative or law enforcement activity, carried out by or under the direction of an authorized Service employee.

resident species—A species inhabiting a given locality throughout the year; nonmigratory species.

restoration—Management emphasis designed to move ecosystems to desired conditions and processes, such as healthy upland habitats and aquatic systems.

revetment—A structure to support a streambank.

riffle—The shallow zone between pools in a stream.

riparian area or riparian zone—An area or habitat that is transitional from terrestrial to aquatic ecosystems including streams, lakes, wet areas, and adjacent plant communities and their associated soils that have free water at or near the surface; an area whose parts are directly or indirectly attributed to the influence of water; of or relating to a river; specifically applied to ecology, "riparian" describes the land immediately adjoining and directly influenced by streams. For example, riparian vegetation includes all plant life growing on the land adjoining a stream and directly influenced by the stream.

riprap—A loose foundation of irregular rock fragments used under water for streambed protection or in soft materials to prevent streamside erosion.

scoping—The process of obtaining information from the public for input into the planning process.

section 7—The section of the Endangered Species Act that requires all Federal agencies, in consultation with the U.S. Fish and Wildlife Service, to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

sediment—Material deposited by water, wind, and glaciers.

Service—See U.S. Fish and Wildlife Service.

shelterbelt—Single to multiple rows of trees and shrubs planted around cropland or buildings to block or slow down the wind.

shorebird—Any of a suborder (*Charadrii*) of birds such as a plover or a snipe that frequent the seashore or mudflat areas.

spatial—Relating to, occupying, or having the character of space.

special use permit—A permit for special authorization from the refuge manager required for any

refuge service, facility, privilege, or product of the soil provided at refuge expense and not usually available to the public through authorizations in Title 50 CFR or other public regulations (Refuge Manual 5 RM 17.6).

species of concern—Those plant and animal species, while not falling under the definition of special status species, that are of management interest by virtue of being Federal trust species such as migratory birds, important game species, or significant keystone species; species that have documented or apparent populations declines, small or restricted populations, or dependence on restricted or vulnerable habitats.

stepdown management plan—A plan that provides the details necessary to carry out management strategies identified in the comprehensive conservation plan (Draft Service Manual 602 FW 1.5).

strategy—A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Draft Service Manual 602 FW 1.5).

suppression—All the work of extinguishing a fire or confining fire spread.

threatened species, Federal—Species listed under the Endangered Species Act of 1973, as amended, that are likely to become endangered in the future throughout all, or a substantial part, of their range.

threatened species, State—A plant or animal species likely to become endangered in a particular state within the near future if factors contributing to population decline or habitat degradation or loss continue.

travel corridor—A landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions. Such corridors may facilitate several kinds of traffic including frequent foraging movement, seasonal migration, or the once in a lifetime dispersal of juvenile animals. These are transition habitats and need not contain all the habitat elements required for long-term survival or reproduction of its migrants.

trust resource—See Federal trust resource.

trust species—See Federal trust species.

USDA—U.S. Department of Agriculture.

U.S. Fish and Wildlife Service (Service, FWS)—The principal Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the 93-million-acre National Wildlife Refuge System comprised of more than 530 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological service field stations, the agency enforces Federal wildlife laws, manages migratory bird populations, restores national significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to State wildlife agencies.

U.S. Geological Survey (USGS)—A Federal agency whose mission is to provide reliable scientific information to describe and understand the earth; decrease loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

USGS—See U.S. Geological Survey.

vision statement—A concise statement of the desired future condition of the planning unit, based primarily on the Refuge System mission, specific refuge purposes, and other relevant mandates (Draft Service Manual 602 FW 1.5).

wading birds—Birds having long legs that enable them to wade in shallow water including egrets, great blue herons, black-crowned night-herons, and bitterns.

waterfowl—A category of birds that includes ducks, geese, and swans.

waterfowl production area—Land that the National Wildlife Refuge System acquires with Federal Duck Stamp money for restoration and management, primarily as prairie wetland habitat critical to waterfowl and other wetland birds.

watershed—The region draining into a river, a river system, or a body of water.

wetland management district (WMD)—Land that the Refuge System acquires with Federal Duck Stamp money for restoration and management primarily as prairie wetland habitat critical to waterfowl and other wetland birds.

WG—Wage Grade classification and pay system.

WGFD—Wyoming Game and Fish Department.

wildfire—A wildland fire originating from an unplanned ignition caused by lightning, volcanoes, unauthorized and accidental human-caused fires, and escaped prescribed burns.

wildland fire—A general term describing any nonstructure fire that occurs in the wildland.

wildlife-dependent recreational use—Use of a refuge involving hunting, fishing, wildlife observation, photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority public uses of the Refuge System.

woodlands—Open stands of trees with crowns not usually touching, generally forming 25- to 60-percent cover.

Appendix A
Key Legislation and Policy

This appendix briefly describes the guidance for the National Wildlife Refuge System and other policies and key legislation that guide the management of the National Elk Refuge.

A.1 National Wildlife Refuge System

> The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the 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)

Goals

- Fulfill our statutory duty to achieve refuge purposes and further the Refuge System mission.
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations.
- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including the ecological processes characteristic of those ecosystems.
- Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Guiding Principles

There are four guiding principles for management and general public use of the Refuge System established by Executive Order 12996 (1996):

- *Public Use*—The Refuge System provides important opportunities for compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation, photography, environmental education, and interpretation.
- *Habitat*—Fish and wildlife will not prosper without quality habitat and without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.
- *Partnerships*—America's sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other Federal agencies, State agencies, tribes, organizations, industry, and the general public can make significant contributions to the growth and management of the Refuge System.
- *Public Involvement*—The public should be given a full and open opportunity to participate in decisions regarding acquisition and management of our national wildlife refuges.

Management actions on national wildlife refuges are circumscribed by many mandates including laws and Executive orders.

American Indian Religious Freedom Act (1978)—Directs agencies to consult with native traditional religious leaders to figure out proper policy changes necessary to protect and preserve Native American religious cultural rights and practices.

Americans with Disabilities Act (1992)—Prohibits discrimination in public accommodations and services.

Antiquities Act (1906)—Authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Archaeological and Historic Preservation Act (1974)—Directs the preservation of historic and archaeological data in Federal construction projects.

Archaeological Resources Protection Act (1979), as amended—Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.

Architectural Barriers Act (1968)—Requires federally owned, leased, or financed buildings and facilities to be accessible to persons with disabilities.

Clean Water Act (1977)—Requires consultation with the U.S. Army Corps of Engineers (404 permits) for major wetland modifications.

Dingell–Johnson Act (1950)—Authorized the Secretary of the Department of the Interior to provide financial help for State fish restoration and management plans and projects. Financed by excise taxes paid by manufacturers of rods, reels, and other fishing tackle. Known as the Federal Aid in Sport Fish Restoration Act.

Endangered Species Act (1973)—Requires all Federal agencies to carry out programs for the conservation of endangered and threatened species.

Executive Order 11988 (1977)—Requires Federal agencies to provide leadership and take action to reduce the risk of flood loss, decrease the effect of floods on human safety, and preserve the natural and beneficial values served by the floodplains.

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 Refuge System.

Executive Order 13007, Indian Sacred Sites (1996)—Directs Federal land management agencies to accommodate access to and ceremonial uses of American Indian sacred sites by American Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where proper, keep the confidentiality of sacred sites.

Federal Noxious Weed Act (1990)—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.

Federal Records Act (1950)—Requires 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 Coordination Act (1958)—Allows the U.S. Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

Migratory Bird Conservation Act (1929)—Establishes procedures for acquisition by purchase, rental, or gifts of areas approved by the Migratory Bird Conservation Commission.

Migratory Bird Hunting and Conservation Stamp Act (1934)—Authorizes the opening of part of a refuge to waterfowl hunting.

Migratory Bird Treaty Act (1918)—Designates the protection of migratory birds as a Federal responsibility; and enables the setting of seasons and other regulations, including the closing of areas, Federal or non-Federal, to the hunting of migratory birds.

National Environmental Policy Act (1969)—Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate this Act with other planning requirements, and prepare

proper documents to facilitate better environmental decisionmaking. [From the Code of Federal Regulations (CFR), 40 CFR 1500]

National Historic Preservation Act (1966), as amended—Establishes as policy that the Federal Government is to provide leadership in the preservation of the Nation's prehistoric and historic resources.

National Wildlife Refuge System Administration Act (1966)—Defines the National Wildlife Refuge System and authorizes the Secretary of the Department of the Interior to allow any use of a refuge, provided such use is compatible with the major purposes for which the refuge was established.

National Wildlife Refuge System Improvement Act of 1997—Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System; mandates comprehensive conservation planning for all units of the Refuge System.

Native American Graves Protection and Repatriation Act (1990)—Requires Federal agencies and museums to inventory, find ownership of, and repatriate cultural items under their control or possession.

Refuge Recreation Act (1962)—Allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient money is available to manage the uses.

Rehabilitation Act (1973)—Requires programmatic accessibility and physical accessibility for all facilities and programs paid for by the Federal Government to make sure that any person can take part in any program.

Rivers and Harbors Act (1899)—Section 10 of this Act requires the authorization of U.S. Army Corps of Engineers before any work in, on, over, or under navigable waters of the United States.

Volunteer and Community Partnership Enhancement Act (1998)—Encourages the use of volunteers to help in the management of refuges within the Refuge System; facilitates partnerships between the Refuge System and non-Federal entities to promote public awareness of the resources of the Refuge System and public participation in the conservation of the resources; and encourages donations and other contributions.

Appendix B

List of Preparers and Contributors

This draft CCP and EA is the result of extensive, collaborative, and enthusiastic effort by the members of the planning team shown below. In addition, many others have contributed time as subject matter experts and reviewers.

B.1 Planning Team

Team member	*Position*	*Work unit*
Patti Bennett-Taylor	Budget analyst, former	National Elk Refuge, Jackson, Wyoming
Eric Cole	Wildlife biologist	National Elk Refuge, Jackson, Wyoming
Carol Cunningham	Technical writer and editor	Grand Teton National Park, Moose, Wyoming
Cris Dippel	Deputy refuge manager	National Elk Refuge, Jackson, Wyoming
Mark Ely	GIS specialist (former)	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Tim Fuchs	Wildlife supervisor	WGFD, Jackson Regional Office, Jackson, Wyoming
Toni Griffin	Planning team leader	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Kirk HaYenga	Heavy mobile equipment mechanic (former)	National Elk Refuge, Jackson, Wyoming
Lori Iverson	Outdoor recreation planner	National Elk Refuge, Jackson, Wyoming
Steve Kallin	Refuge manager	National Elk Refuge, Jackson, Wyoming
Amanda Losch	Staff biologist	WGFD, Headquarters, Cheyenne, Wyoming
Marty Meyer	Law enforcement officer (former)	National Elk Refuge, Jackson, Wyoming
Alex Norton	Senior planner	Teton County Planning Department, Jackson, Wyoming
Deb Parker	Writer-editor	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Paul Santavy	Deputy refuge manager (former)	National Elk Refuge, Jackson, Wyoming
Daniel Sharps	Rangeland management specialist	National Elk Refuge, Jackson, Wyoming
Amanda Soliday	Engineering equipment operator	National Elk Refuge, Jackson, Wyoming
Bryan Yetter	Law enforcement officer	National Elk Refuge, Jackson, Wyoming
Mitch Werner	Writer-editor	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado

B.2 Contributors

Many organizations, agencies, and individuals helped prepare this CCP. We acknowledge the efforts of the following individuals and groups toward the completion of this plan. The diversity, talent, and knowledge contributed dramatically improved the vision and completeness of this document.

Contributor	*Position*	*Work unit*
Lara Gertsch	Aquatic habitat biologist	WGFD, Jackson Regional Office, Jackson, Wyoming
Shannon Heath	Outdoor recreation planner	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Wayne King	National Wildlife Refuge System biologist	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Lynne Koontz	Economist	U.S. Geological Survey, Fort Collins, Colorado
David Lucas	Chief, Division of Refuge Planning	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Dean Rundle	Refuge supervisor	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Richard Sterry	Regional fire planner	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado
Meg Van Ness	Regional archaeologist	U.S. Fish and Wildlife Service, Region 6, Lakewood, Colorado

Appendix C
Public Involvement

C.1 Public Involvement

On October 22, 2010, we published a notice of intent in the Federal Register to prepare a comprehensive conservation plan for the National Elk Refuge (75 Federal Register 65370). The notice provided information about the refuge and the CCP process along with details on how the public could provide comments about issues to consider in the environmental document and in development of the CCP. We specified that written comments were due by November 22, 2010. The notice indicated that more opportunities for providing comments would be announced in local news media throughout the planning process.

During preplanning, our planning team assembled a mailing list of private citizens; local, regional, and State government representatives and legislators; other Federal agencies; tribes; and interested organizations.

We sent the first planning update to the mailing list addressees in January 2011. The planning update provided information on the history of the National Elk Refuge and the CCP process, along with an invitation to an upcoming public open house on January 11. We invited the public to meet with our staff, learn more about the planning process, and provide input to the planning process. The planning update told people how to submit written comments by letter, fax, or email, which were due February 10, 2011.

At the January 2011 open house, the planning team used informational posters, maps, and handouts to display a history of the Refuge System, an orientation to the National Elk Refuge, and an overview of the processes for comprehensive conservation planning and implementing the National Environmental Policy Act. Staff answered questions on a variety of topics about refuge management and the CCP process. We encouraged the 40 attendees to ask questions and offer comments; planning team members recorded verbal comments and gave each attendee a comment form to submit more thoughts or questions, which were due by February 10, 2011.

We sent out a second planning update in March 2011. The update had a summary of the public scoping efforts and the more than 200 comments that the planning team got during scoping. The update listed the key issues that we identified: landscape-scale conservation, wildlife, habitat, scenic quality, and visitor services. We considered input from the public open house, letters, emails, and comment forms in developing the draft CCP and EA.

Although the public identified elk and bison management as an issue during scoping for the CCP, the issue is outside the scope of this planning process. We and the National Park Service previously addressed this issue in an interagency, environment analysis process that had extensive public involvement. In 2007, we completed the resulting Bison and Elk Management Plan, which has goals, objectives, and strategies for managing elk and bison at the National Elk Refuge and at Grand Teton National Park for the next 15 years.

Our response to public comments on this draft CCP and EA will be completed before final approval of the CCP. The mailing list for the CCP follows.

C.2 Federal Officials

U.S. Congressman Cynthia Lummis, Washington, DC
U.S. Senator John Barrasso, Washington, DC
U.S. Senator Michael Enzi, Washington, DC

C.3 Federal Agencies

Bureau of Reclamation, Pacific Northwest Regional Office, Boise, Idaho
National Park Service, Grand Teton National Park, Moose, Wyoming
National Park Service, Intermountain Regional Office, Denver, Colorado
USDA Forest Service, Bridger-Teton National Forest, Jackson, Wyoming

Assiniboine and Sioux Tribes of Fort Peck, Popular, Montana
Cheyenne and Arapaho Tribes, Concho, Oklahoma
Cheyenne River Sioux Tribe, Eagle Butte, South Dakota
Crow Creek Sioux Tribal Council, Fort Thompson, South Dakota
Eastern Shoshone Tribal Council, Fort Washakie, Wyoming
Lower Brule Sioux Tribe, Lower Brule, South Dakota
Northern Arapaho Business Council, Fort Washakie, Wyoming
Northern Cheyenne Tribal Council, Lame Deer, Montana
Oglala Sioux Tribe, Pine Ridge, South Dakota
Rosebud Sioux Tribal Council, Rosebud, South Dakota
Santee Sioux Tribal Council, Niobrara, Nebraska
Shoshone-Bannock Tribes, Fort Hall, Idaho
Shoshone Business Council, Fort Washakie, Wyoming
Shoshone Cultural Center, Fort Washakie, Wyoming
Standing Rock Sioux Tribal Council, Fort Yates, North Dakota

Governor Matt Mead, Cheyenne, Wyoming
Senator Leland G. Christensen, Alta, Wyoming
Senator Dan Dockstader, Afton, Wyoming
Representative Keith Gingery, Jackson, Wyoming
Representative Ruth A. Petroff, Jackson, Wyoming
Representative Jim Roscoe, Wilson, Wyoming

WGFD, Cheyenne, Wyoming
WGFD, Jackson, Wyoming
WGFD, Lander, Wyoming

Teton Conservation District, Jackson, Wyoming
Teton County Board of Commissioners, Jackson, Wyoming
Teton County Building Department, Jackson, Wyoming
Teton County Sheriff's Office, Jackson, Wyoming
Town of Jackson, Wyoming

Alta Planning and Design, Saratoga Springs, New York
Atkins, PBS&J, Missoula, Montana
Bear Creek Incorporated, Jackson, Wyoming
Biota Research and Consulting, Jackson, Wyoming
Brush Buck Guide Services, Jackson, Wyoming
Burton Design Incorporated, Jackson, Wyoming
Four Seasons Resort, Teton Village, Wyoming
Grizzly Country Wildlife Adventures, Jackson, Wyoming
The Hole Hiking Experience, Jackson, Wyoming
Jackson Hole Eco Tour Adventures, Jackson, Wyoming
Jackson Hole Photo Tours, Jackson, Wyoming
Jackson Hole Wildlife Safaris, Jackson, Wyoming
Nelson Engineering, Jackson, Wyoming
Snake River Brewing Company, Jackson, Wyoming
Snowmobiletours.net, Jackson, Wyoming
Spring Creek Ranch, Jackson, Wyoming
Steady Jake Mobile DJ, Jackson, Wyoming
Upstream Anglers and Outdoor Adventures, Jackson, Wyoming
Wyoming Photo Experience, Jackson, Wyoming

Concerned Citizens for the Elk, Jackson, Wyoming
Craighead Beringia South, Kelly, Wyoming
Defenders of Wildlife, Washington, DC
Ducks Unlimited, Conservation Program, Bismarck, North Dakota

Ducks Unlimited, National Headquarters, Memphis, Tennessee
Friends of Pathways, Jackson, Wyoming
Greater Yellowstone Coalition, Jackson, Wyoming
Jackson Hole and Greater Yellowstone Visitor Center, Jackson, Wyoming
Jackson Hole Art Initiative, Jackson, Wyoming
Jackson Hole Chamber of Commerce, Jackson, Wyoming
Jackson Hole Conservation Alliance, Jackson, Wyoming
Jackson Hole Historical Society and Museum, Jackson, Wyoming
Jackson Hole Land Trust, Jackson, Wyoming
Jackson Hole One Fly, Wyoming
Jackson Hole Trout Unlimited, Wyoming
Jackson Hole Wildlife Foundation, Jackson, Wyoming
The Murie Center, Moose, Wyoming
Northern Rockies Conservation Cooperative, Jackson, Wyoming
Rocky Mountain Elk Foundation, Missoula, Montana
Safe Wildlife Crossings for Jackson Hole, Jackson, Wyoming
Snake River Fund, Wyoming
Sportsmen for Fish and Wildlife, Jackson, Wyoming
Teton County Weed and Pest District, Jackson, Wyoming
Teton Raptor Center, Wilson, Wyoming
Teton Science Schools, Jackson, Wyoming
Wildlife Conservation Society, Bronx, New York
The Wildlife Society, Bethesda, Maryland
The Wildlife Society, Wyoming Chapter, Lander, Wyoming
Wyoming Wetlands Society, Jackson, Wyoming
Wyoming Wildlife Federation, Lander, Wyoming

Northwestern University, Evanston, Illinois

Sinte Gleska University, Sicangu Heritage Center, Mission, South Dakota

C.11 Media

Associated Press, Cheyenne, Wyoming
Casper Star Tribune, Casper, Wyoming
Dubois Frontier, Dubois, Wyoming
Herald Journal, Logan, Utah
Idaho State Journal, Pocatello, Wyoming
Jackson Hole Magazine, Jackson, Wyoming
Jackson Hole News and Guide, Jackson, Wyoming
Jackson Hole Underground, Jackson, Wyoming
JH Weekly, Jackson, Wyoming
K2TV, Casper, Wyoming
KCWY13, Mills, Wyoming
KHOL, Jackson Hole Community Radio, Jackson, Wyoming
KID FM, Idaho Falls, Idaho
KIFI TV, Idaho Falls, Idaho
KPIN, Pinedale Radio, Pinedale, Wyoming
KPVI TV, Pocatello, Idaho
KTWO, Casper, Wyoming
KZ95, Jackson Hole Radio, Jackson, Wyoming
The Mountain Pulse, Jackson, Wyoming
New York Times, New York
Pinedale Online, Pinedale, Wyoming
Pinedale Roundup, Pinedale, Wyoming
Post Register, Idaho Falls, Idaho
Star Valley Independent, Afton, Wyoming
Sublette Examiner, Pinedale, Wyoming
Teton Valley News, Driggs, Idaho
The Valley Citizen, Driggs, Idaho
Wyoming Lifestyle Magazine, Laramie, Wyoming
Wyoming Public Radio, Laramie, Wyoming

C.12 Individuals

121 individuals

Appendix D
Species Lists

What follows are the names of animals and plants found on the National Elk Refuge.

D.1 Lists of Federally Listed and State-Listed Plants and Animals

Plant species of concern listed in Wyoming are shown below.

Scientific name	*Common name*
Aster borealis	Rush aster
Astragalus terminalis	Railhead milkvetch
Carex buxbaumii	Buxbaum's sedge
Carex parryana	Parry sedge
Carex scirpoidea scripiformis	Canadian single-spike sedge
Eriophorum viridicarinatum	Green-keeled cotton-grass
Heterotheca villosa var. depressa	Teton golden aster
Lesquerella carinata	Keeled bladderpod
Muhlenbergia glomerata	Marsh muhly
Salix candida	Hoary willow
Scirpus rollandii	Pygmy bulrush
Utricularia intermedia	Flat-leaf bladderwort

Animal species listed under the Federal Endangered Species Act and by the State of Wyoming (species of greatest conservation need), with documented occurrence on the National Elk Refuge in Wyoming follow: Federally threatened—a plant or animal species listed under the Endangered Species Act of 1973, as amended, that is likely to become endangered within the foreseeable future throughout all or a significant part of its range; Federal candidate—a plant or animal species proposed for addition to the Federal endangered and threatened species list; Wyoming tier 1—highest priority species of greatest conservation need: Wyoming tier 2—moderate priority species of greatest conservation need.

Scientific name	*Common Name*	*Documented refuge use*
	Federally threatened	
Ursos arctos	Grizzly bear	Incidental
	Federal candidate	
Centrocercus urophasianus	Greater sage-grouse (also WY tier 1)	Year-round, breeding documented
	Wyoming tier 1	
Anaxyrus boreas boreas	Boreal toad	Year-round, breeding documented
Athene cunicularia	Burrowing owl	Incidental
Buteo regalis	Ferruginous hawk	Seasonal
Gavia immer	Common loon	Incidental
Haliaeetus leucocephalus	Bald eagle	Year-round, breeding documented
Strix nebulosa	Great gray owl	Incidental

Scientific name	*Common Name*	*Documented refuge use*
	Wyoming tier 2	
Rana luteiventris	Columbia spotted frog	Year-round, breeding documented
Charina bottae	Northern rubber boa	Incidental
Thamnophis sirtalis fitchi	Valley gartersnake	Incidental
Anas acuta	Northern pintail	Seasonal
Asio flammeus	Short-eared owl	Seasonal
Aythya affinis	Lesser scaup	Seasonal, breeding documented
Aythya americana	Redhead	Seasonal, breeding documented
Botaurus lentiginosus	American bittern	Seasonal
Bucephala islandica	Barrow's goldeneye	Seasonal
Buteo swainsoni	Swainson's hawk	Seasonal
Calamospiza melanocorys	Lark bunting	Incidental
Cygnus buccinator	Trumpeter swan	Year-round, breeding documented
Dolichonyx oryzivorus	Bobolink	Seasonal, breeding documented
Falco peregrinus	Peregrine falcon	Seasonal
Hydroprogne caspia	Caspian tern	Incidental
Larus pipixcan	Franklin's gull	Seasonal
Melanerpes lewis	Lewis's woodpecker	Seasonal
Numenius americanus	Long-billed curlew	Seasonal, breeding documented
Nycticorax nycticorax	Black-crowned night-heron	Incidental
Rallus limicola	Virginia rail	Incidental
Spizella breweri	Brewer's sparrow	Seasonal, breeding documented
Tympanuchus phasianellus columbianus	Columbian sharp-tailed grouse	Incidental
Alces alces	Moose	Year-round, breeding documented
Lontra canadensis	Northern river otter	Year-round, breeding documented
Myotis lucifugus	Little brown myotis	Seasonal
Ovis canadensis	Bighorn sheep	Year-round, breeding documented
	Wyoming tier 3	
Empidonax traillii	Willow flycatcher	Seasonal
Falco columbarius	Merlin	Seasonal
Grus canadensis	Sandhill crane	Seasonal, breeding documented

D.2 Plant Species

The following lists show the scientific and common names of the plant species that have been found on the National Elk Refuge in Wyoming. An asterisk (*) indicates a nonnative species.

Scientific name	*Common name*
Achillea millefolium var. alpicola	Common yarrow
Achnatherum hymenoides	Indian ricegrass
Achnatherum nelsonii ssp. nelsonii	Nelson's needlegrass
Agoseris glauca var. glauca	Short-beaked agoseris

Scientific name	*Common name*
Agoseris glauca var. laciniata	Short-beaked agoseris
Agropyron cristatum	Crested wheatgrass*
Agrostis stolonifera	Redtop*
Allium cernuum	Nodding onion
Allium schoenoprasum var. schoenoprasum	Wild chives*
Alopecurus aequalis	Shortawn foxtail
Alopecurus pratensis	Meadow foxtail*
Alyssum alyssoides	Pale alyssum*
Alyssum desertorum var. desertorum	Desert alyssum*
Amaranthus albus	White pigweed
Amelanchier alnifolia var. alnifolia	Western serviceberry
Anemone multifida	Cliff anemone
Angelica arguta	Sharptooth angelica
Angelica pinnata	Pinnate-leaved angelica
Antennaria dimorpha	Low pussytoes
Antennaria microphylla	Small-leaf pussytoes
Antennaria pulcherrima	Showy pussytoes
Antennaria rosea	Rosy pussytoes
Antennaria umbrinella	Umber pussytoes
Arabis drummondii	Drummond's rockcress
Arabis glabra	Towermustard
Arabis holboellii	Holboell's rockcress
Arenaria congesta	Ballhead sandwort
Argentina anserina	Silverweed
Arnica sororia	Twin arnica
Artemisia biennis var. biennis	Biennial wormwood*
Artemisia frigida	Fringed sagewort
Artemisia ludoviciana ssp. ludoviciana	Louisiana sagebrush
Artemisia tridentata ssp. tridentata	Basin big sagebrush
Artemisia tridentata ssp. vaseyana	Mountain big sagebrush
Artemisia tripartita ssp. tripartita	Threetip sagebrush
Astragalus agrestis	Field milkvetch
Astragalus argophyllus var. argophyllus	Silver-leaved milkvetch
Astragalus canadensis var. brevidens	Canada milkvetch
Astragalus diversifolius var. campestris	Lesser rushy milkvetch
Astragalus eucosmus	Elegant milkvetch
Astragalus miser var. decumbens	Sagebrush weedy milkvetch
Astragalus miser var. tenuifolius	Weedy milkvetch
Astragalus purshii var. purshii	Wooly milkvetch
Astragalus terminalis	Railhead milkvetch
Atriplex rosea	Red orache*
Atriplex truncata	Wedgescale orache
Balsamorhiza sagittata	Arrowleaf balsamroot
Besseya wyomingensis	Wyoming kittentails
Betula glandulosa	Bog birch

Scientific name	*Common name*
Betula occidentalis	Water birch
Bidens cernua	Nodding beggarticks
Bromus carinatus	California brome
Bromus ciliatus	Fringed brome
Bromus inermis ssp. inermis	Smooth brome*
Bromus tectorum	Cheatgrass*
Calamagrostis canadensis	Bluejoint wheatgrass
Calamagrostis rubescens	Pinegrass
Calamagrostis stricta	Slimstem reedgrass
Callitriche palustris	Spring water starwort
Calochortus nuttallii	Sego-lily
Camelina microcarpa	Littlepod falseflax*
Campanula rotundifolia	Harebell
Capsella bursa-pastoris	Shepherd's purse*
Caragana arborescens	Peatree*
Cardaria chalapensis	Chalapa hoarycress, whitetop*
Carduus acanthoides	Plumeless thistle*
Carduus nutans	Musk thistle*
Carex aquatilis	Water sedge
Carex aurea	Golden sedge
Carex buxbaumii	Buxbaum's sedge
Carex capillaris	Hair sedge
Carex duriuscula	Narrow-leaved sedge
Carex filifolia	Thread-leaved sedge
Carex interior	Inland sedge
Carex microptera	Small-wing sedge
Carex nebrascensis	Nebraska sedge
Carex parryana var. parryana	Parry sedge
Carex pellita	Woolly sedge
Carex praegracilis	Clustered field sedge
Carex rossii	Ross sedge
Carex rostrata	Beaked sedge
Carex sartwellii	Sartwell's sedge
Carex scirpoidea ssp. scirpoidea	Canadian single-spike sedge
Carex simulata	Analogue sedge
Carex viridula	Green sedge
Castilleja angustifolia var. angustifolia	Narrowleaf paintbrush
Castilleja angustifolia var. dubia	Desert paintbrush
Castilleja flava	Yellow paintbrush
Castilleja miniata	Scarlet paintbrush
Catabrosa aquatica	Brookgrass
Cerastium beeringianum ssp. earlei	Alpine chickweed
Cercocarpus ledifolius var. ledifolius	Curl-leaf mountain mahogany
Chaenactis douglasii var. douglasii	Hoary dustymaiden
Chamerion angustifolium	Fireweed

Scientific name	*Common name*
Chenopodium berlandieri var. zschackii	Pitseed goosefoot
Chenopodium foliosum	Smallhead goosefoot*
Chenopodium pratericola	Mountain goosefoot
Chrysothamnus viscidiflorus ssp. lanceolatus	Green rabbitbrush
Chrysothamnus viscidiflorus ssp. viscidiflorus	Green rabbitbrush
Cirsium arvense	Canada thistle*
Cirsium scariosum	Elk thistle
Cirsium subniveum	Snowy thistle
Cirsium vulgare	Bull thistle*
Clematis hirsutissima	Leatherflower
Clematis occidentalis var. grosseserrata	Rock virgin's bower
Collomia linearis	Narrowleaf collomia
Comandra umbellata ssp. pallida	Bastard toad-flax
Convolvulus arvensis	Field bindweed*
Cordylanthus ramosus	Bushy birdbeak
Cornus sericea	Redosier dogwood
Corydalis aurea	Golden-smoke
Crataegus douglasii	Black hawthorn
Crepis acuminata	Tapertip hawksbeard
Crepis modocensis	Siskiyou hawksbeard
Crepis runcinata ssp. glauca	Meadow hawksbeard
Crepis runcinata ssp. hispidulosa	Broad-leaved meadow hawksbeard
Dactylis glomerata	Orchardgrass*
Dasiphora fruticosa ssp. floribunda	Shrubby cinquefoil
Delphinium bicolor	Little larkspur
Deschampsia cespitosa	Tufted hairgrass
Descurainia incana ssp. procera	Mountain tansymustard
Descurainia sophia	Flixweed*
Dodecatheon pulchellum	Dark-throat shooting star
Elaeagnus commutata	Silverberry
Eleocharis acicularis	Slender spikerush
Eleocharis palustris	Common spikerush
Elymus albicans	Griffith's wheatgrass
Elymus elymoides	Bottlebrush squirreltail
Elymus lanceolatus	Thickspike wheatgrass
Elymus lanceolatus ssp. lanceolatus	Riparian thickspike wheatgrass
Elymus repens	Common quackgrass*
Elymus trachycaulus ssp. trachycaulus	Slender wheatgrass
Epilobium brachycarpum	Panicled willow-herb
Epilobium ciliatum ssp. ciliatum	American willow-herb
Epilobium hornemannii	Hornemann's willow-herb
Epilobium leptophyllum	Swamp willow-herb
Equisetum hyemale var. affine	Common scouring-rush
Equisetum laevigatum	Smooth scouring-rush
Equisetum variegatum	Northern scouring-rush

Scientific name	*Common name*
Ericameria nauseosa ssp. nauseosa var. nauseosa	Rubber rabbitbrush
Erigeron compositus	Cut-leaved fleabane
Erigeron corymbosus	Foothill daisy
Erigeron glabellus var. glabellus	Smooth daisy
Erigeron lonchophyllus	Spear-leaf fleabane
Erigeron pumilus	Shaggy fleabane
Eriogonum brevicaule var. laxifolium	Shortstem buckwheat
Eriogonum caespitosum	Mat buckwheat
Eriogonum ovalifolium var. purpureum	Cushion buckwheat
Eriogonum umbellatum var. majus	Sulfur buckwheat
Eriophorum angustifolium ssp. subarcticum	Many-spiked cottongrass
Eriophorum viridicarinatum	Green-keeled cottongrass
Erysimum capitatum var. capitatum	Sanddune wallflower
Erysimum cheiranthoides	Treacle wallflower*
Eucephalus elegans	Elegant aster
Festuca idahoensis	Idaho fescue
Festuca ovina	Sheep fescue
Fragaria virginiana	Virginia strawberry
Frasera speciosa	Monument plant
Frasera speciosa	Green gentian
Fritillaria atropurpurea	Checker lily
Galium boreale	Northern bedstraw
Galium trifidum	Small bedstraw
Gentiana affinis	Prairie gentian
Gentiana fremontii	Water gentian
Geranium viscosissimum var. incisum	Sticky geranium
Geranium viscosissimum var. viscosissimum	Sticky geranium
Geum macrophyllum var. perincisum	Large-leaved avens
Geum triflorum	Prairie-smoke
Glaux maritima	Sea-milkwort
Glyceria grandis	American mannagrass
Glyceria striata	Fowl mannagrass
Glycyrrhiza lepidota	Licorice-root
Gnaphalium palustre	Lowland cudweed
Grindelia squarrosa	Curly-cup gumweed
Gutierrezia sarothrae	Broom snakeweed
Hackelia floribunda	Many-flowered stickseed
Hedysarum boreale	Northern sweet-vetch
Helianthella uniflora	Rocky Mountain helianthella
Heracleum maximum	Cow parsnip
Hesperostipa comata ssp. intermedia	Needle and thread
Heterotheca villosa var. depressa	Teton golden aster
Heuchera parvifolia	Littleleaf alumroot
Hierochloe odorata	Common sweetgrass
Hippuris vulgaris	Common mare's-tail

Scientific name	*Common name*
Hordeum brachyantherum	Meadow barley
Hordeum jubatum	Foxtail barley
Hypericum scouleri ssp. scouleri	Western St. John's-wort
Ipomopsis aggregata	Scarlet gilia
Ipomopsis spicata ssp. orchidacea	Mountain spicate-gilia
Juncus arcticus ssp. littoralis	Baltic rush
Juncus longistylis	Long-styled rush
Juncus nodosus	Tuberous rush
Juncus saximontanus	Rocky Mountain rush
Juncus tenuis var. dudleyi	Slender rush
Juniperus communis var. depressa	Common juniper
Juniperus scopulorum	Rocky Mountain juniper
Koeleria macrantha	Junegrass
Krascheninnikovia lanata	Winterfat
Lactuca serriola	Prickly lettuce*
Lappula occidentalis var. occidentalis	Western stickseed
Lappula squarrosa	European stickseed*
Lemna minor	Lesser duckweed
Lepidium densiflorum	Common peppergrass
Lepidium perfoliatum	Clasping peppergrass*
Leptosiphon septentrionalis	Northern linanthus
Lesquerella carinata var. carinata	Keeled bladderpod
Leucopoa kingii	Spikefescue
Leymus cinereus	Great Basin wildrye
Linanthus pungens	Common prickly-phlox
Linum lewisii	Blue flax
Lithospermum ruderale	Western gromwell
Lomatium foeniculaceum	Fennel-leaved biscuitroot
Lomatium simplex var. simplex	Nineleaf biscuitroot
Lonicera involucrata	Bearberry honeysuckle
Lupinus argenteus ssp. argenteus	Silvery lupine
Lupinus argenteus var. rubricaulis	Silvery lupine
Lupinus sericeus	Silky lupine
Machaeranthera canescens ssp. canescens	Hoary aster
Mahonia repens	Oregon-grape
Maianthemum stellatum	Starry false Solomon's-seal
Malcolmia africana	Malcolmia*
Matricaria discoidea	Pineapple-weed*
Medicago lupulina	Black medic*
Medicago sativa ssp. sativa	Alfalfa*
Melilotus officinalis	White sweetclover*
Melilotus officinalis	Yellow sweetclover*
Mentha arvensis	Field mint
Mertensia ciliata	Ciliate bluebells
Mertensia oblongifolia	Leafy bluebells

Scientific name	*Common name*
Mimulus guttatus	Yellow monkeyflower
Minuartia nuttallii ssp. nuttallii	Nutall's sandwort
Monolepis nuttalliana	Povertyweed
Muhlenbergia filiformis	Pullup muhly
Muhlenbergia glomerata	Marsh muhly
Muhlenbergia richardsonis	Mat muhly
Myosotis scorpioides	Common forget-me-not*
Myriophyllum sibiricum	Common watermilfoil
Nassella viridula	Green needlegrass
Nasturtium officinale	Watercress
Oenothera caespitosa ssp. caespitosa	Tufted evening-primrose
Oenothera pallida ssp. trichocalyx	Pale evening-primrose
Opuntia polyacantha var. polyacantha	Plains prickly-pear
Orthocarpus luteus	Yellow owl-clover
Oxytropis deflexa var. sericea	Nodding locoweed
Packera cana	Woolly groundsel
Packera debilis	Weak groundsel
Packera paupercula	Balsam groundsel
Packera streptanthifolia	Alpine meadow groundsel
Packera streptanthifolia	Cleft-leaved groundsel
Parnassia palustris var. montanensis	Northern grass-of-Parnassus
Pedicularis crenulata	Meadow lousewort
Pedicularis groenlandica	Elephanthead lousewort
Penstemon humilis	Lowly beardtongue
Penstemon procerus var. procerus	Small-flower beardtongue
Penstemon radicosus	Matroot beardtongue
Penstemon subglaber	Subglabrous beardtongue
Petrophyton caespitosum	Rocky Mountain rockmat
Phacelia franklinii	Franklin's phacelia
Phalaris arundinacea	Reed canarygrass
Phleum alpinum	Alpine timothy
Phleum pratense	Timothy*
Phlox hoodii	Hood's phlox
Phlox kelseyi ssp. kelseyi	Kelsey's phlox
Phlox longifolia	Long-leaf phlox
Phlox multiflora	Many-flowered phlox
Picea engelmannii	Engelmann spruce
Picea pungens	Blue spruce
Pinus contorta	Lodgepole pine
Pinus flexilis	Limber pine
Plantago eriopoda	Alkali plantain
Plantago major	Common plantain
Platanthera aquilonis	Northern green bog-orchid
Poa annua	Annual bluegrass*
Poa bulbosa	Bulbous bluegrass*

Scientific name	*Common name*
Poa cusickii ssp. epilis	Cusick's bluegrass
Poa palustris	Fowl bluegrass
Poa pratensis	Kentucky bluegrass
Poa secunda	Sandberg bluegrass
Polemonium occidentale	Western Jacob's-ladder
Polygonum achoreum	Erect knotweed
Polygonum amphibium var. stipulaceum	Water smartweed
Polygonum aviculare	Common knotweed*
Polygonum douglasii ssp. douglasii	Douglas' knotweed
Polygonum viviparum	Alpine bistort
Populus angustifolia	Narrowleaf cottonwood
Populus tremuloides	Quaking aspen
Potentilla arguta	Glandular cinquefoil
Potentilla gracilis var. fastigiata	Slender cinquefoil
Potentilla gracilis var. pulcherrima	Soft cinquefoil
Potentilla norvegica	Norwegian cinquefoil
Potentilla ovina var. ovina	Sheep cinquefoil
Potentilla pensylvanica	Prairie cinquefoil
Primula incana	Mealy primrose
Prunella vulgaris ssp. lanceolata	Self-heal
Prunus virginiana var. melanocarpa	Chokecherry
Psathyrostachys juncea	Russian wildrye*
Pseudoroegneria spicata ssp. spicata	Bluebunch wheatgrass
Pseudotsuga menziesii	Douglas-fir
Pulsatilla patens ssp. multifida	Pasqueflower
Purshia tridentata	Bitterbrush
Pyrrocoma uniflora var. uniflora	One-flowered goldenweed
Ranunculus aquatilis var. diffusus new name	White water buttercup
Ranunculus cymbalaria	Shore buttercup
Ranunculus glaberrimus var. ellipticus	Sagebrush buttercup
Ranunculus hyperboreus	Floating water buttercup
Ranunculus inamoenus var. inamoenus	Unlovely buttercup
Ranunculus macounii	Macoun's buttercup
Ranunculus sceleratus var. multifidus	Blister buttercup
Ribes aureum var. aureum	Golden currant
Ribes cereum var. cereum	Wax currant
Ribes oxyacanthoides ssp. setosum	Missouri gooseberry
Rorippa curvipes var. truncata	Wasatch yellowcress
Rosa acicularis ssp. sayi	Prickly rose
Rosa woodsii var. woodsii	Woods' rose
Rumex aquaticus var. fenestratus	Western dock
Rumex maritimus var. fueginus	Golden dock
Rumex salicifolius var. mexicanus	Willow dock
Salix bebbiana	Bebb willow
Salix boothii	Booth's willow

Scientific name	*Common name*
Salix brachycarpa	Smallfruit willow
Salix candida	Hoary willow
Salix drummondiana	Drummond's willow
Salix exigua	Narrowleaf willow
Salix geyeriana	Geyer willow
Salix lucida ssp. caudata	Greenleaf willow
Salix lutea	Yellow willow
Salix melanopsis	Dusky willow
Salix planifolia	Planeleaf willow
Salsola tragus	Russian thistle*
Schoenocrambe linifolia	Flax-leaved plainsmustard
Schoenoplectus acutus var. acutus	Hardstem bulrush
Schoenoplectus tabernaemontani	Soft-stem bulrush
Scutellaria galericulata	Marsh skullcap
Sedum lanceolatum	Lance-leaved stonecrop
Selaginella densa	Compact spike-moss
Senecio hydrophilus	Water groundsel
Senecio integerrimus var. exaltatus	Western groundsel
Senecio serra	Butterweed groundsel
Shepherdia canadensis	Canada buffaloberry
Silene latifolia	White campion*
Sisymbrium altissimum	Tumblemustard*
Sisyrinchium idahoense var. occidentale	Western blue-eyed grass
Sium suave	Hemlock waterparsnip
Solidago canadensis var. salebrosa	Canada goldenrod
Solidago missouriensis var. missouriensis	Missouri goldenrod
Solidago nana	Low goldenrod
Sonchus arvensis ssp. uliginosus	Marsh sow-thistle*
Spiranthes romanzoffiana	Hooded lady's tresses
Stellaria crassifolia	Thickleaved starwort
Stellaria longipes	Longstalk starwort
Stenotus acaulis	Stemless goldenweed
Stuckenia filiformis ssp. filiformis	Slender-leaved pondweed
Stuckenia pectinata	Fennel-leaved pondweed
Swertia perennis	Swertia
Symphoricarpos oreophilus var. utahensis	Mountain snowberry
Symphyotrichum ascendens	Long-leaved aster
Symphyotrichum boreale	Boreal aster
Symphyotrichum eatonii	Eaton's aster
Symphyotrichum foliaceum var. apricum	Leafybract aster
Symphyotrichum spathulatum var. spathulatum	Western mountain aster
Taraxacum laevigatum	Red-seeded dandelion*
Taraxacum officinale	Common dandelion
Tetradymia canescens	Gray horsebrush
Thalictrum alpinum	Alpine meadowrue

Scientific name	*Common name*
Thalictrum venulosum	Veiny meadowrue
Thelypodium paniculatum	Panicled thelypody
Thinopyrum intermedium	Intermediate wheatgrass*
Thlaspi arvense	Field pennycress*
Townsendia nuttallii	Nuttall's Easter-daisy
Tragopogon dubius	Yellow salsify*
Trichophorum pumilum	Pygmy bulrush
Trifolium hybridum	Alsike clover*
Trifolium pratense	Red clover*
Trifolium repens	White clover*
Triglochin maritima	Seaside arrowgrass
Triglochin palustris	Marsh arrowgrass
Typha latifolia	Common cattail
Urtica dioica	Stinging nettle
Utricularia intermedia	Flat-leaf bladderwort
Utricularia macrorhiza	Greater bladderwort
Valeriana edulis	Tobacco-root
Valeriana occidentalis	Western valerian
Verbascum thapsus	Common mullein*
Verbena bracteata	Bracted vervain
Veronica americana	American brooklime
Veronica anagallis-aquatica	Water speedwell
Vicia americana ssp. minor	American vetch
Vicia cracca	Bird vetch*
Viola adunca	Early blue violet
Viola palustris	Marsh violet
Viola praemorsa ssp. linguifolia	Upland yellow violet
Zannichellia palustris	Horned pondweed
Zigadenus paniculatus	Panicled death-camas
Zizia aptera	Heart-leaved Alexanders

D.3 Mammal Species

The following lists show the scientific and common names of the mammal species that have been found on the National Elk Refuge in Wyoming.

Scientific name	*Common name*
Insectivora	Insectivores
Sorex cinereus	Masked shrew
Sorex merriami	Merriam's shrew
Sorex monticolus	Dusky or montane shrew
Sorex palustris	Water shrew

Scientific name	*Common name*
Chiroptera	Bats
Verspertilionidae	
Eptesicus fuscus	Big brown bat
Lasionycteris noctivagans	Silver-haired bat
Lasiurus cinereus	Hoary bat
Myotis ciliolabrum	Small-footed myotis
Myotis evotis	Long-eared myotis
Myotis lucifugus	Little brown myotis
Myotis volans	Long-legged myotis
Plecotus townsendii	Townsend's big-eared bat
Lagomorpha	Rabbits and Hares
Leporidae	
Lepus americanus	Snowshoe hare
Lepus townsendii	White-tailed jackrabbit
Rodentia	Rodents
Sciuridae (Squirrels)	
Glaucomys sabrinus	Northern flying squirrel
Marmota flaviventris	Yellow-bellied marmot
Spermophilus armatus	Uinta ground squirrel
Tamias amoenus	Yellow-pine chipmunk
Tamias minimus	Least chipmunk
Tamiasciurus hudsonicus	Red squirrel (pine squirrel, chickaree)
Geomyidae (Pocket gophers)	
Thomomys talpoides	Northern pocket gopher
Castoridae (Beavers)	
Castor canadensis	Beaver
Cricetidae	
Neotoma cinerea	Bushy tailed woodrat
Peromyscus maniculatus	Deer mouse
Arvicolinae (subfamily)	
Clethrionomys gapperi	Southern red-backed vole
Lemmiscus curtatus	Sagebrush vole
Microtus longicaudus	Long-tailed vole
Microtus montanus	Montane vole
Microtus pennsylvanicus	Meadow vole
Microtus richardsoni	Water vole
Microtus richardsoni	Richardson's vole
Ondatra zibethicus	Muskrat
Murinae (subfamily)	
Mus musculus	House mouse
Dipodidae	
Zapus princeps	Western jumping mouse
Erethizontidae (Porcupines)	
Erethizon dorsatum	Porcupine

Scientific name	*Common name*
Carnivora	Carnivores
Canidae (Canids)	
Canis latrans	Coyote
Canis lupus	Gray wolf
Vulpes vulpes	Red fox
Ursidae (Bears)	
Ursus americanus	Black bear
Ursus arctos	Grizzly bear
Procyonidae (Raccoons)	
Procyon lotor	Raccoon
Mustelidae (Mustelids)	
Lutra canadensis	Northern river otter
Mephitis mephitis	Striped skunk
Mustela erminea	Ermine (short-tailed weasel)
Mustela frenata	Long-tailed weasel
Mustela vison	Mink
Taxidea taxus	Badger
Felidae (Felids)	
Lynx rufus	Bobcat
Puma concolor	Mountain lion
Artiodactyla	Hoofed mammals
Cervidae	
Alces alces	Moose
Antilocarpa americana	Pronghorn
Cervus elaphus	Elk (wapiti)
Odocoileus hemionus	Mule deer
Odocoileus virgianus	White-tailed deer
Bovidae	
Bison bison	Bison (American buffalo)
Ovis canadensis	Mountain sheep (bighorn sheep)

D.4 Bird Species

The following lists show the scientific and common names of the mammal species that have been found on the National Elk Refuge in Wyoming. An asterisk (*) indicates a nonnative species.

Scientific name	*Common name*
Hummingbirds	
Selasphorus platycercus	Broad-tailed hummingbird
Selasphorus rufus	Rufous hummingbird
Stellula calliope	Calliope hummingbird

Scientific name	*Common name*
Perching birds	
Agelaius phoeniceus	Red-winged blackbird
Thus rubescens	American pipit
Bombycilla cedrorum	Cedar waxwing
Bombycilla garrulus	Bohemian waxwing
Carduelis pinus	Pine siskin
Carduelis tristis	American goldfinch
Carpodacus cassinii	Cassin's finch
Carpodacus mexicanus	House finch
Catharus fuscescens	Veery
Catharus guttatu	Hermit thrush
Catharus ustulatus	Swainson's thrush
Certhia americana	Brown creeper
Cinclus mexicanus	American dipper
Cistothorus palustris	Marsh wren
Contopus sordidulus	Western wood-pewee
Corvus brachyrhynchos	Common crow
Corvus corax	Common raven
Dendroica petechia	Yellow warbler
Dolichonyx oryzivorus	Bobolink
Dumetella carolinensis	Gray catbird
Empidonax minimus	Least flycatcher
Empidonax oberholseri	Dusky flycatcher
Empidonax occidentalis	Cordilleran flycatcher
Empidonax trailii	Willow flycatcher
Eremophila alpestris	Horned lark
Euphagus cyanocephalus	Brewer's blackbird
Geothlypis trichas	Common yellowthroat
Hirundo rustica	Barn swallow
Icteria virens	Yellow-breasted chat
Icterus bullockii	Bullock's oriole
Junco hyemalis	Dark-eyed junco
Lanius excubitor	Northern shrike
Lanius ludovicianus	Loggerhead shrike
Leucosticte tephrocotis	Gray-crowned rosy finch
Loxia curvirostra	Red crossbill
Loxia leucoptera	White-winged crossbill
Melospiza melodia	Song sparrow
Melospiza lincolnii	Lincoln's sparrow
Molothrus ater	Brown-headed cowbird
Myadestes townsendi	Townsend's solitaire
Nucifraga columbiana	Clark's nutcracker
Oporornis tolmiei	MacGillivray's warbler
Passer domesticus	House sparrow
Passerculus sandwichensis	Savannah sparrow

Scientific name	*Common name*
Passerella iliaca	Fox sparrow
Passerina amoena	Lazuli bunting
Perisoreus canadensis	Gray jay
Petrochelidon pyrrhonota	Cliff swallow
Pheucticus melanocephalus	Black-headed grosbeak
Pica hudsonia	Black-billed magpie
Pipilo chlorurus	Green-tailed towhee
Piranga ludoviciana	Western tanager
Plectrophenax nivalis	Snow bunting
Poecile atricapilla	Black-capped chickadee
Poecile gambile	Mountain chickadee
Pooecetes gramineus	Vesper sparrow
Regulus satrapa	Golden-crowned kinglet
Regulus calendula	Ruby-crowned kinglet
Riparia riparia	Bank swallow
Salpinctes obsoletus	Rock wren
Sayornis saya	Say's phoebe
Seiurus noveboracensis	Northern waterthrush
Setophaga ruticilla	American redstart
Sialia currucoides	Mountain bluebird
Sitta canadensis	Red-breasted nuthatch
Sitta carolinensis	White-breasted nuthatch
Spizella breweri	Brewer's sparrow
Spizella passerina	Chipping sparrow
Stelgidopteryx serripennis	Northern rough-winged swallow
Sturnella neglecta	Western meadowlark
Sturnus vulgaris	European starling*
Tachycineta bicolor	Tree swallow
Tachycineta thalassina	Violet-green swallow
Troglodytes aedon	House wren
Turdus migratorius	American robin
Tyrannus tyrannus	Eastern kingbird
Tyrannus verticalis	Western kingbird
Vermivora celat	Orange-crowned warbler
Vireo gilvus	Warbling vireo
Wilsonia pusilla	Wilson's warbler
Xanthocephalus xanthocephalus	Yellow-headed blackbird
Zonotrichia leucophrys	White-crowned sparrow
Woodpeckers	
Colaptes auratus	Northern flicker
Melanerpes lewis	Lewis' woodpecker
Picoides pubescens	Downy woodpecker
Picoides villosus	Hairy woodpecker
Sphyrapicus nuchalis	Red-naped sapsucker
Sphyrapicus thyroideus	Williamson's sapsucker

Scientific name	*Common name*
Gallinaceous birds	
Alectoris chukar	Chukar*
Perdix perdix	Gray partridge*
Tympanuchus phasianellus columbianus	Columbian sharp-tailed grouse
Bonasa umbellus	Ruffed grouse
Centrocercus urophasianus	Greater sage-grouse
Dendragapus obscurus	Blue grouse
Waterfowl	
Anas acuta	Northern pintail
Anas americana	American wigeon
Anas clypeata	Northern shoveler
Anas crecca	Green-winged teal
Anas cyanoptera	Cinnamon teal
Anas platyrhynchos	Mallard
Anas strepera	Gadwall
Aythya affinis	Lesser scaup
Aythya americana	Redhead
Aythya collaris	Ringed-neck duck
Branta canadensis	Canada goose
Bucephala albeola	Bufflehead
Bucephala clangula	Common goldeneye
Bucephala islandica	Barrow's goldeneye
Chen caerulescens	Snow goose
Cygnus buccinator	Trumpeter swan
Cygnus columbianus	Tundra swan
Lophodytes cucullatus	Hooded merganser
Mergus merganser	Common merganser
Oxyura jamaicensis	Ruddy duck
Shorebirds	
Actitis macularia	Spotted sandpiper
Capella gallinago	Common snipe
Catoptrophorus semipalmatus	Willet
Charadrius vociferus	Killdeer
Ereubetes mauri	Western sandpiper
Eupoda montana	Mountain plover
Himantopus mexicanus	Black-necked stilt
Limnodromus scolopaceus	Long-billed dowitcher
Limosa fedoa	Marbled godwit
Numenius americanus	Long-billed curlew
Phalaropus tricolor	Wilson's phalarope
Recurvirostra americana	American avocet
Tringa flavipes	Lesser yellowlegs
Tringa melanoleuca	Greater yellowlegs
Rails and coots	
Coturnicops noveboracensis	Yellow rail

Scientific name	*Common name*
Fulica americana	American coot
Porzana carolina	Sora
Cranes	
Grus canadensis	Sandhill crane
Bitterns, herons, and ibis	
Plegadis chihi	White-faced ibis
Ardea herodias	Great blue heron
Botaurus lentiginosus	American bittern
Bubulcus ibis	Cattle egret
Leucophoyx thula	Snowy egret
Nycticorax nycticorax	Black-crowned night-heron
Raptors	
Accipiter cooperii	Cooper's hawk
Accipiter striatus	Sharp-shinned hawk
Aquila chrysaetos	Golden eagle
Buteo jamaicensis	Red-tailed hawk
Buteo lagopus	Rough-legged hawk
Buteo swainsoni	Swainson's hawk
Cathartes aura	Turkey vulture
Circus cyaneus	Northern harrier
Falco columbarius	Merlin
Falco mexicanus	Prairie falcon
Falco peregrinus	Peregrine falcon
Falco sparverius	American kestrel
Haliaeetus leucocephalus	Bald eagle
Pandion haliaetus	Osprey
Owls	
Aegolius acadicus	Northern saw-whet owl
Asio flammeus	Short-eared owl
Asio otus	Long-eared owl
Athene cunicularia	Burrowing owl
Bubo virginianus	Great-horned owl
Strix nebulosa	Great grey owl
Seabirds	
Aechmophorus occidentalis	Western grebe
Pelecanus erythrorhynchos	White pelican
Phalacrocorax auritus	Double-crested cormorant
Podiceps caspicus	Eared grebe
Podilymbus podiceps	Pied-billed grebe
Gulls and terns	
Chlidonias niger	Black tern
Larus californicus	California gull
Larus philadelphia	Bonaparte's gull
Larus pipixcan	Franklin's gull
Sterna caspia	Caspian tern

Scientific name	*Common name*
Sterna forsteri	Forster's turn
Other birds	
Gavia immer	Common loon
Ceryle alcyon	Belted kingfisher
Chordeiles minor	Common nighthawk
Columba livia	Rock dove*
Streptopelia decaocto	Eurasian collared dove*
Zenaida macroura	Mourning dove

D.5 Amphibian and Reptile Species

The following lists show the scientific and common names of the amphibian and reptile species that have been found on the National Elk Refuge in Wyoming.

Scientific name	*Common name*
Ambystoma tigrinum	Tiger salamander
Bufo boreas boreas	Boreal toad
Charina bottae bottae	Rubber boa
Pseudacris maculate	Boreal chorus frog
Rana luteiventris	Columbia spotted frog
Thannophis elegans vagrans	Intermountain wandering garter snake
Thamnophis sirtalis fitchi	Valley garter snake

D.6 Fish Species

The following lists show the scientific and common names of the fish species that have been found on the National Elk Refuge in Wyoming. An asterisk (*) indicates a nonnative species.

Scientific name	*Common name*
Catostomus discobolus	Bluehead sucker
Catostomus ardens	Utah sucker
Catostomus platyrhynchus	Mountain sucker
Cottus bairdi	Mottled sculpin
Cottus beldingi	Paiute sculpin
Oncorhynchus clarkii	Snake River cutthroat trout
Oncorhynchus clarkia ssp. x O. mykiss	Snake River cutthroat trout x rainbow trout hybrid
Oncorhynchus mykiss	Rainbow trout*
Pimephales promelas	Fathead minnow*
Prosopium williamsoni	Mountain whitefish
Richardsonius balteatus	Redside shiner

Scientific name	*Common name*
Rhinichthys cataractae	Longnose dace
Rhinichthys osculus	Speckled dace
Salmo trutta	Brown trout*
Salvelinus fontinalis	Eastern brook trout*

Appendix E
Compatibility Determinations

E.1 Refuge Name and Date Established

- National Elk Refuge
- Established August 10, 1912

E.2 Refuge Purposes

The following excerpts describe the various purposes of the refuge as set in legal orders, laws, and regulations:

- as "a winter game (elk) reserve" (16 U.S.C. § 673, 37 Stat.293)
- as "a winter elk refuge" (37 Stat. 847)
- for "refuge and breeding grounds for birds" (Executive Orders 3596 and 3741)
- for "the grazing of, and as a refuge for, American elk and other big game animals" (16 U.S.C. § 673a, 44 Stat. 1246)
- for "the conservation of fish and wildlife" (16 U.S.C. § 742[a–j], Fish and Wildlife Act of 1956)
- for "opportunities for wildlife-oriented recreational development oriented to fish and wildlife, the protection of natural resources, and the conservation of threatened or endangered species" (16 U.S.C., § 460[k–l], Refuge Recreation Act)

E.3 National Wildlife Refuge System Mission

The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

E.4 Description of Uses

The following uses are evaluated for their compatibility on the refuge:

- Hunting
- Fishing
- Wildlife Observation and Noncommercial Photography
- Environmental Education and Interpretation
- Research and Monitoring
- Commercial Filming, Audio Recording, and Still Photography
- Commercial Guiding, Outfitting, Game Retrieval, and Wildlife-Viewing Tours

Hunting

The CCP proposes to continue to provide elk and bison hunting consistent with the Bison and Elk Management Plan, including adaptively modifying hunting regulations to achieve herd size objectives and extending accommodations for hunters with disabilities. The refuge would continue to allow elk and bison retrieval from the Bridger-Teton National Forest to Elk Refuge Road south and west of Twin Creek subdivision, allow a ceremonial tribal bison hunt with annual harvest of up to five bison, prohibit the hunting of any other wildlife species other than elk and bison, and promote voluntary use of lead-free ammunition.

In addition, the refuge would expand hunting opportunities for young people. We would work with partners to develop a hunter mentoring program. By scheduling the existing youth hunt to later in the season, young hunters would have a better chance of observing and harvesting elk. Options would include designating a weekend midseason (of the adult hunter season) for youth only or adding a weekend after the end of the regular elk season.

The refuge would provide more outreach for other refuge users to promote education and awareness of the refuge hunting program. Staff would develop bear attractant regulations for hunting on the refuge, encourage the carry of bear spray while hunting, and consider requiring hunters to carry bear spray. Staff might develop hunter-use management tools such as hunter checkpoints, hunter success surveys, and mandatory reporting of tag use to better manage hunt program opportunities.

The refuge would consider and create more hunting opportunities for species other than elk and bison as the need arose. Staff would coordinate with WGFD to develop specific refuge hunting opportunities by making available limited-quota type 6 tags in Hunt Area 77 on the refuge to increase cow elk harvest. We would also work with WGFD to develop a limited-quota antlered elk hunt on the refuge to provide more quality opportunities using limited-quota, type 1 tags in Hunt Area 77. The refuge would open currently closed areas on the southern and western boundaries of the refuge to archery hunters to create more harvest opportunities.

We would analyze and consider more hunter access areas and designated parking lots. The staff would look at more access for bison hunters on the northern end of the refuge though the Teton Valley Highlands subdivision, either on the western end of the subdivision to hunt retrieval road 6 or on the eastern end to hunt retrieval road 7. We would consider access for archery hunters on the western boundary of the refuge next to the Jackson National Fish Hatchery.

Availability of Resources

The refuge updates with available resources the current directional signs and brochures. Maintenance of access roads, parking, hunting and information kiosks, and public use signs is closely tied to Maintenance Management System funding. The refuge's base money would pay for the update and printing of brochures.

The refuge would need more law enforcement staff and resources (1) to manage significant changes in the hunting program to reduce disturbance to wildlife and habitat, (2) to carry out and encourage preventative law enforcement efforts, and (3) to check compliance with public use and hunting regulations.

Anticipated Impacts of Use

The hunting program would continue to provide hunters ample opportunity for quality hunting experiences without materially detracting from the mission of the Refuge System or the establishing purposes of the refuge. We would keep the public use brochures and the refuge's Web site up-to-date and readily available to hunters. Staff would continue to monitor hunter success and satisfaction through random contacts with hunters in the field and in the refuge office.

Elk and bison hunting programs on the National Elk Refuge are essential to achieve the population objectives outlined in the Bison and Elk Management Plan. Although hunting directly affects the hunted species and might indirectly disturb other species, limits on harvest and access for recreational hunting would make sure that populations do not fall to unsustainable levels. By its nature, hunting creates a disturbance to wildlife and directly affects the individual animals being hunted. We would design and monitor hunting to offer a safe and quality program and to keep adverse effects within acceptable limits.

Other effects from hunting activity include conflicts with individuals participating in wildlife-dependent, priority public uses such as wildlife observation and photography. This could decrease the visitor satisfaction during the hunting season.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Hunting would be a compatible use on the National Elk Refuge.

Stipulations Necessary for Compatibility

Hunters would be required to follow refuge-specific regulations for acquisition of hunting permits; access, parking, and travel restrictions; and weapons and ammunition limitations. Limiting access and monitoring the use could help limit any adverse effects.

Justification

The National Wildlife Refuge System Act of 1966, other laws, and the Service's policy allow hunting on a national wildlife refuge when it is compatible with the purposes for which the refuge was established and acquired. Hunting is a form of wildlife-dependent recreation and is identified as a priority public use in the Improvement Act. Based on anticipated biological effects described above and in the EA, we find that hunting on the refuge in accordance with State regulations would not interfere with the purposes for which the refuge was established and would support management objectives. Special refuge regulations are in place to reduce negative effects on habitat and wildlife.

Mandatory 15-year Reevaluation Date: 2028

Fishing

This use would be a continuation of the historical activity of noncommercial fishing. Public use areas such as parking and fishing areas, as well as interpretive panels, signs, kiosks, and other structures might be installed and supported to facilitate the fishing program. Areas on the refuge that are seasonally sensitive to migratory birds would remain closed to public entry and use. The refuge would open only selected areas to fishing. Special refuge regulations governing fishing would be available in refuge brochures.

The CCP proposes to allow fishing on the refuge in accordance with State regulations. The refuge would provide fishing opportunities during daylight hours. We would maintain fishing access along Highway 89, along with the parking turnouts along upper Flat Creek. The Gros Ventre River, upper Flat Creek, lower Flat Creek, lower Nowlin Creek and Sleeping Indian Pond are open to fishing according to season dates and regulations set by WGFD. All other refuge ponds, Flat Creek downstream from the old Crawford Bridge site, and Nowlin Creek upstream from the posted fishing boundary would remain closed to fishing.

Besides sponsoring Kids' Fishing Day with Jackson National Fish Hatchery and WGFD, the refuge would start programs that attract more young people to fish at the refuge. Future programs could include casting instruction, fishing skills clinics, and a mentoring program for young anglers.

The Flat Creek fishery is managed for a native, wild, and trophy-sized population of Snake River cutthroat trout. Long-time devotees of Flat Creek report a decline in the opportunity to fish for large cutthroats. Recent fish surveys show that nonnative trout (brook, brown, and rainbow) account for almost half of the trout population in Flat Creek. There is a need for management of this fishery to support the quality of the fishing experience.

Availability of Resources

The refuge has adequate administrative and management staff to support the fishing program.

Anticipated Impacts of Use

Temporary disturbance of wildlife might occur near fishing activity. Fishing would temporarily decrease the fish population until natural reproduction or stocking replenished the population. Frequency of use would be directly dependent on fish populations and their feeding activity. When fish populations were high and active, public use would increase. Minimal disturbance to ground-nesting birds might occur from anglers walking along rivers and streams. Littering could also become a problem. We anticipate no long-term negative effects on resources.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Fishing would be a compatible use on the National Elk Refuge in accordance with State regulations.

Stipulations Necessary for Compatibility

Refuge regulations allow access to fishing areas during daylight hours only. A scheduled gate opening at daylight on the August 1 season opening would be consistent with refuge regulations. We would post access gates with opening time information and conduct public outreach.

The typical Flat Creek anglers are avid flycasters that have adopted catch-and-release principles as their conservation ethic. The refuge needs to create an educational component that would convince our anglers to harvest nonnative trout. Special refuge regulations might be necessary to require anglers to remove nonnative trout caught in Flat Creek to meet management objectives.

Justification

Fishing is a form of wildlife-dependent recreations and is identified as a priority public use in the Improvement Act. Based on the biological effects addressed above and in the EA, we find that fishing would not interfere with the purposes for establishment of the refuge. Current staff levels and money are adequate. Special refuge regulations are in place to reduce negative effects on refuge habitat and wildlife.

Mandatory 15-year Reevaluation Date: 2028

Wildlife Observation and Noncommercial Photography

A variety of habitats and many species of wildlife on the refuge provide observation and photography opportunities year-round. The refuge would continue to provide wildlife observation and photography opportunities such as (1) observation blinds, (2) an up-to-date species list for the refuge, and (3) allowing the use of portable viewing and photography blinds through the issuance of special use permits. These activities may take place on foot, bicycle, automobile, horse, cross-country skis, and snowshoes.

Refuge facilities bring visitors closer to wildlife. New facilities for observing and photographing wildlife (such as observation platforms, trails, auto tour routes, photography blinds, and webcams) might be developed. In addition, the CCP proposes maintaining access to existing turnouts, trails, and other observation sites. The primary viewing turnouts and designated observation sites follow:

- upper viewing platform on the second story of the visitor center
- Burt Raynes Boardwalk and remote-viewing platform on the eastern side of the visitor center lawn
- turnout north of the visitor center and the Flat Creek Bridge, which has a viewing platform and National Elk Refuge sign (turnout would continue to be plowed in winter, thus providing year-round access to the turnout)
- turnout along Highway 89 north of Jackson, which has a kiosk and interpretive panel about the purpose of the fence and the elk "jumps" (refer to "Fencing" in chapter 4, section 4.3) (turnout would continue to be plowed in winter by the Wyoming Department of Transportation, giving travelers on Highway 89 a safe place to pull over and view wildlife; however, plowed snow would pile up on the northern end of the turnout, blocking access to the kiosk and interpretive panel)
- with added turnouts, about 10 turnouts would be available on Elk Refuge Road. They would be plowed during winter months to encourage vehicles to move off the road to view wildlife

Elk Refuge Road and Flat Creek Road would be open to the public for wildlife observation and access to national forest lands from May 1 through November 30. During winter, 3.5 miles of Elk Refuge Road (from the refuge entrance to the Twin Creek subdivision) would be open to provide access to national forest lands and wildlife-viewing opportunities. Access to the refuge beyond the Twin Creek subdivision would continue to be restricted as part of an area closure to protect wintering wildlife and is coordinated with the Bridger-Teton National Forest.

In addition the refuge would use the Jackson Hole Community Pathways to develop a more prominent access route across visitor center lawn to the existing remote-viewing platform and develop a boardwalk through wetland areas near the visitor center. We might build a photo blind along the boardwalk for noncommercial photography. The refuge might use webcams to provide remote wildlife-viewing opportunities.

Availability of Resources

Sufficient resources are available to administer, manage, and check this use of wildlife observation and noncommercial photography. Existing refuge infrastructure would support these activities. The construction and maintenance of roadways, kiosks, observation platforms, and trails, as well as law enforcement activities to make sure that visitors comply with refuge regulations while conducting these activities, are the principle expenses associated with wildlife observation and photography. An extra park ranger, law enforcement officer, and maintenance worker, as proposed in the CCP, would enhance public opportunities for these uses and improve the quality and quantity of opportunities.

Anticipated Impacts of the Use

The proposed wildlife observation and photography uses, including development of facilities to support those uses, would foster public appreciation and understanding of the Greater Yellowstone Ecosystem and the importance of refuge habitats for wildlife conservation.

Short-term effects might include the temporary displacement of bison, elk, birds, and other wildlife to adjacent habitats during the initial positioning and removal of portable blinds, cameras, and other equipment. Observation areas are in locations that provide consistent wildlife-viewing opportunity with minimal disturbance to wildlife.

Hiking during the breeding season, when confined to open trails and roads would have little or no effect on wildlife. Bicycling would be restricted to roadways open to vehicular traffic to reduce disturbance to wildlife. Some animals and birds would be flushed from foraging or resting habitats by the approach of people on trails.

Winter disturbance to resident wildlife would be temporary and minor. The destruction of ground bird nests by horses (allowed only during hunting) and the disturbance to other wildlife would be minimal because of the seasonal restrictions inherent to the hunting season.

The area affected by these disturbances would be small compared to the overall habitat available. Furthermore, all areas are available to wildlife for undisturbed use during closed hours, and we do not anticipate that disturbance caused by observation and photography would cause wildlife to leave the refuge. We find that disturbance from wildlife observation and noncommercial photography programs would be biologically insignificant. We would expect no long-term effects if recommended stipulations were followed.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Wildlife observation and noncommercial photography would be compatible uses on the National Elk Refuge.

Stipulations Necessary for Compatibility

The refuge would issue special use permits to all individuals using blinds for observation and photography on the refuge. Staff would issue five special use permits for designated areas in any given year. The use of small observation blinds would be available on a first-come, first-serve basis. If the number of requests for blinds exceeded five, the permitting process would be reviewed and modified as necessary. Refuge staff would give information to visitors using permanent or portable observation and photography blinds on proper use and etiquette of these structures to reduce disturbance to wildlife and their natural environments and other refuge visitors:

- Visitors need to notify refuge staff before arrival at the refuge for observation and photography.
- Refuge staff decides locations of blinds, which might be limited to areas next to public access roads.
- Refuge staff decides if, when, where, and for how long access may be allowed to photograph at individual areas.
- Visitors need to erect and remove portable blinds daily.

The refuge would support seasonal closures to protect sensitive wildlife areas and reduce disturbance to fish and wildlife. We would restrict non-Service vehicles to county and public access roads in the refuge.

We would design viewing areas to reduce disturbance effects on wildlife and all refuge resources while providing a good opportunity to view wildlife in natural environments.

The refuge would allow foot traffic (hiking, cross-country skiing, and snowshoeing) only on designated trails, roads open to motorized vehicles, and in the refuge hunt area during the refuge hunting season.

We would restrict use of horses to the hunting program or to roadways open to motorized vehicles year-round. The refuge would restrict bicycling to designated trails and roadways open to motorized vehicles.

Justification

Wildlife observation and photography are forms of wildlife-dependent recreation and are identified as priority public uses in the Improvement Act. These uses, both existing and future enhanced programs as prescribed in the CCP, would be compatible with the purposes of the refuge and the mission of the Refuge System. These uses are not only justified but are encouraged by the Improvement Act. Wildlife observation and photography can instill, in citizens of all ages, a greater appreciation for wildlife and its habitat. This appreciation could extend to the Refuge System and other conservation agencies.

Disturbance from wildlife observation and photography is not expected to adversely affect wildlife populations. Most wildlife observation is confined within a set distance from existing roadways. In some locations, the infrastructure helps to concentrate visitors in areas that can allow wildlife observation and photography opportunities at safe distances that reduce disturbance to wildlife.

Based on anticipated biological effects described above and in the EA, we find that wildlife observation and noncommercial photography on the refuge would not interfere with the purposes for which the refuge was established. Limiting access and monitoring the uses could help limit any adverse effects.

Mandatory 15-year Reevaluation Date: 2028

Environmental Education and Interpretation

The refuge would provide opportunity for student field trips on an "as-arranged" basis. Temporary and impromptu outdoor classrooms could be established or used in wetland and riparian habitats; however, seasonal closures might occur to avoid effects on threatened and endangered species or sensitive habitats.

Interpretive panels and auto tour brochures would give visitors information about habitat, wildlife, management actions.

The CCP proposes to continue environmental education and interpretation and add the following to improve these programs to foster appreciation and understanding of the Refuge System and the resources of the refuge:

- The refuge would develop a self-guided interpretive tour route on Elk Refuge Road and Flat Creek Road on the eastern side of the refuge, including interpretive turnouts, signage, and brochures. We would need to address safety mitigation during critical times of year (hunting and bison hazing). The refuge would need to update and replace interpretive signs as needed, with panels related to the tour route theme.
  - First phase (winter route)—Develop the route from Elk Refuge Road entrance to Twin Creek subdivision for approximately 3.5 miles.
  - Second phase (summer route)—Develop the route from Twin Creek subdivision to the McBride area; open May 1–December 1 with an interpretive kiosk at the McBride parking area.
  - Third phase—Increase traffic control signing from the McBride area to the eastern parking lot and include the traffic information in the brochure. (If we encouraged or promoted traffic to the east parking lot, we would need to make a major change to the road for safety. Currently, this is a one-lane road around McBride Ridge.)
- We might develop short multimedia presentations that would be available on demand. This would respond to visitors' needs and preferences as well as allow refuge staff to update segments with minimal cost and staff time.
- We would emphasize the role of national wildlife refuges versus national parks and national forests.
- The refuge would use the North Highway 89 Pathway during open season to interpret wetland values or other messages. Refuge staff would cooperate with Teton County to evaluate pathway effects on wildlife and habitat and adjust use as appropriate.
- Refuge staff would develop a more prominent access route across visitor center lawn to the existing remote-viewing platform and develop a boardwalk through wetland areas

near the visitor center. A photo blind might be developed along the boardwalk for non-commercial photography.

- We would develop more accessible observation sites on the refuge.
- Refuge staff might take part in special events and activities offsite to bring the refuge message to large numbers of people as time and staff allow.
- The refuge would update interpretive panels, brochures, Web sites, and maps.

Availability of Resources

The refuge would use annual operations money, grants, regional project proposals, and challenge cost-share agreements to enhance environmental education and interpretation activities, directional signs, and brochures.

The visitor services staff relies on a large residential volunteer workforce as the means to offer formal and informal interpretation during the summer months when visitor center visitation peaks. Volunteers also provide formal and informal interpretation during the winter months. The refuge would seek money for permanent or seasonal interpreters to improve programming at the visitor center, Miller House, and offsite programs.

To meet the demand for environmental education during the school year, we use money from nongovernmental partnerships to hire seasonal winter naturalists. Refuge volunteers offer environmental education programs in the spring.

Anticipated Impacts of the Use

We would continue to promote a greater public understanding and appreciation of the refuge resources, programs, and issues through interpretive, outreach, and environmental education programs. The refuge staff would continue to provide environmental education and interpretation both on and off refuge lands. Presentations, both on and off Service lands, would be provided to refuge visitors, school groups, and organizations, helping us reach a broader audience.

Updated brochures, interpretive panels, and other educational materials would help visitors understand refuge resources, ecosystem processes, and land management. Features such as the proposed auto tour route and accessible observation sites would provide access to the many sights and sounds of the refuge.

We would manage onsite presentations to reduce disturbance to wildlife, habitat, and cultural resources.

We would manage onsite presentations to reduce disturbance to wildlife, habitat, and cultural resources; however, there might be a short-term, low-level effect on the immediate and surrounding area. Effects could include trampling of vegetation and temporary disturbance to nearby wildlife species during the activities. Development and implementation of interpretive and education programs would have minimal and biologically insignificant effects on refuge resources.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Environmental education and interpretation would be compatible uses on the National Elk Refuge.

Stipulations Necessary for Compatibility

The refuge would hold onsite activities where minimal effect on wildlife and habitats would occur.

All motor vehicles associated with environmental education and interpretation would remain on designated roads open to vehicular traffic.

Staff would check use patterns and would make adjustments in timing, location, and duration of activities as needed to limit disturbance to wildlife and habitat.

We would review new environmental education and interpretation activities to make sure these activities met program objectives and were compatible.

Justification

Environmental education and interpretation are forms of wildlife-dependent recreation and are priority public uses of the Refuge System. Environmental education and interpretation would increase public awareness and appreciation of the significant wildlife and habitat values of the refuge and the Refuge System. We anticipate that such appreciation and understanding would foster increased public support for

the Refuge System and conservation of America's wildlife resources.

Based on the anticipated biological effects described above and in the EA, we find that environmental education and interpretation on the refuge would not interfere with the purposes for which the refuge was established. Limiting access and monitoring the uses could help limit any adverse effects.

Mandatory 15-year Reevaluation Date: 2028

Research and Monitoring

The refuge would allow research and monitoring on a variety of biological, physical, and social issues and concerns to address management information needs or other issues. Studies would be conducted by Federal, State, and private entities, including the U.S. Geological Survey, State and private universities, and independent researchers and contractors.

Each year, the refuge issues special use permits for biological and physical research studies; normally, we get fewer than 10 requests each year. The refuge would give priority to studies that contribute to the enhancement, protection, preservation, and management of the refuge's native plant, fish, and wildlife populations and their habitats. Research applicants must submit proposals that describe the following:

- objectives of the study
- justification for the study
- detailed study methods and a schedule
- potential effects on wildlife and habitat including short- and long-term disturbance, injury, or mortality
- measures the researcher would take to reduce disturbances or other effects
- personnel involved and their qualifications and experience
- status of necessary permits (such as scientific collecting permits and endangered species permits)
- costs to the refuge and refuge staff time requested, if any
- anticipated progress reports and end products, such as reports or publications

Refuge staff would review research permit applications and issue special use permits if approved. Evaluation criteria for the issuance of special use permits would include, but not be limited to, the following:

- We would give higher priority over other requests to research that would contribute to specific management issues, the purposes of the refuge, or the mission of the Refuge System.
- We would not approve research that would conflict with other ongoing research, monitoring, or management programs.
- We would be less likely to approve research projects that could be conducted off refuge lands.
- We would likely not approve research that would cause undue disturbance or would be intrusive. The refuge would carefully weigh the degree and type of disturbance when evaluating a research request.
- We would decide if the research evaluation made any effort to reduce disturbance through study design including adjusting location, timing, number of permittees, study methods, and number of study sites.
- We would likely deny the request if staff levels or logistics make it impossible for refuge staff to check researcher activity in a sensitive area.
- We would consider and agree on the length of the project before approval.
- To reduce disturbance to wildlife, we would not permit researchers in closed areas, unless specifically authorized. The refuge would permit vehicular access only on roads and trails normally open to the public.

Availability of Resources

Current staff would be adequate to manage research and monitoring projects at anticipated levels. Reviewing a permit application, drafting and issuing the special use permit, and making compliance assessments would take an average of 15 hours of staff time per permit.

Access points, vehicles, miscellaneous equipment, and limited logistical support might be available at

the refuge manager's discretion. Temporary housing on the refuge might be available for use by researchers while studying refuge resources, at the refuge manager's discretion.

Anticipated Impacts of Use

We would expect some degree of disturbance with all research activities, because researchers might use Service roads or enter areas that are closed to the public. Research activities might disturb fish and wildlife and their habitats. For example, the presence of researchers could cause waterfowl to flush from resting and feeding areas, cause disruption of birds and other wildlife on nests or breeding areas, or increase predation on individual nests and animals as predators follow human scent or trails. To wildlife, the energy cost of disturbance could be appreciable in terms of disruption of feeding, displacement from preferred habitat, and the added energy expenditure to avoid disturbance. Some research might require collection of samples or handling of wildlife. Efforts to capture animals could cause disturbance, injury, or death to groups of wildlife or to individuals.

Sampling activities could cause compaction of soils and the trampling of vegetation, the establishment of temporary foot trails through vegetation, and disruption of bottom sediments in wetlands. The removal of vegetation or sediments by core sampling methods could increase localized turbidity and disrupt nontarget plants and animals. Installation of posts, equipment platforms, collection devices, and other research equipment might present a hazard to heavy equipment operators if these items were not adequately marked and removed at the right times or on completion of the project.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Research and monitoring would be compatible uses on the National Elk Refuge.

Stipulations Necessary for Compatibility

Refuge staff would use the above criteria for evaluating and determining whether to approve a proposed study. Before conducting investigations, researchers would obtain a special use permit from the refuge that contained specific stipulations for when, where, and how the research would be conducted. If research methods were found to have potential effects on habitat or wildlife, it must be shown that the research was necessary for conservation management of resources on the refuge. The researchers would develop measures to reduce potential effects to be included as part of the study design; these measures would be conditions in the special use permit. The refuge manager would have the discretion to prohibit research that causes undo harm or disturbance or that would not contribute to the purposes of the refuge or the mission of the Refuge System.

Researchers would follow all refuge rules and regulations unless otherwise exempted by refuge management. Extremely sensitive wildlife habitats and species would be sufficiently protected from disturbance by limiting research activities in these areas. The refuge would review projects annually, and researcher would submit annual progress reports. Refuge staff would check research activities for compliance with conditions of the special use permit. At any time, refuge staff might accompany the researchers to determine potential effects. Staff could decide that approved research and special use permits be terminated because of observed effects. The refuge manager could also cancel a special use permit if the researcher was out of compliance or to make sure there is wildlife and habitat protection.

Specific stipulations in the special use permit would vary by research project, but would be designed to reduce impacts to wildlife and their habitats and to make sure visitors, researchers, and refuge staff were safe. To reduce potential safety hazards, researchers must clearly mark posts, equipment platforms, fencing materials, and other equipment left unattended. Such items must be promptly removed on completion of the research.

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 any other regulated activities.

Research involving collections would be extremely restricted. Collections would be limited to type or voucher specimens only, require preapproval by the refuge manager, and include verification of compliance with all State and Federal collection permits and requirements.

Researchers would promptly submit findings, such as annual status reports and a final report, to the refuge manager for inclusion in the decisionmaking and management process.

Justification

Research and monitoring would be activities that provide essential information necessary for the

appropriate and effective management of refuge resources:

- • Research can help provide answers to complex questions, when those answers are not readily apparent and are vital to determining effective management strategies.

- • Monitoring would be necessary to quantify or qualify the results of management actions. This is a basic step in the adaptive resource management process and necessary to guide modifications to management actions for improved results.

We would issue research and monitoring permits only when the information they provided was so valuable that it outweighed the temporary disturbance and minor effects on wildlife and their habitats. We would expect minimal effects on refuge wildlife and habitats with research studies, because special use permits would include conditions to make sure that these effects were kept to a minimum.

Mandatory 10-year reevaluation date: 2023

Commercial Filming, Audio Recording, and Still Photography

Commercial motion pictures and audio recordings are defined as the digital or film recording of a visual image or sound recording by a person, business, or other entity for a market audience, such as for a documentary, television, feature film, advertisement, or similar project. It does not include news coverage or amateur and visitor use.

Commercial photography is defined as a visual recording (motion or still) by firms or individuals other than news media representatives who intend to distribute their photographic content for money or other consideration. This includes the creation of educational, entertainment, or commercial enterprises as well as advertising audiovisuals for the purpose of paid product or services, publicity, and commercially oriented photo contests.

The National Elk Refuge provides tremendous opportunities for commercial filming and photography of bison, elk, migratory birds, and other wildlife. Each year, the refuge staff receives 6–15 requests to conduct commercial filming or photography on refuge lands. Refuge staff review requests for commercial photography, motion pictures, and audio recordings and issue special use permits for approved requests. We evaluate each request on an individual basis using several U.S. Department of the Interior, agency, and Refuge System policies (such as 43 CFR Part 5, 50 CFR 27.71, and 8 RM 16).

Evaluation criteria would include the following:

- Commercial photography, motion pictures, and audio recordings must (1) show a means to increase public appreciation and understanding of wildlife or natural habitats, (2) enhance public knowledge, appreciation, and understanding of the Refuge System, or (3) facilitate outreach and education goals of the refuge. The refuge would deny the use and not issue a special use permit if none of the previous criteria were met.

- We would not approve activities that caused undue disturbance to wildlife or habitat. Refuge staff would carefully weigh the degree and type of disturbance when evaluating a request.

- We would not approve requests that would conflict with other management programs or would impair existing wildlife-dependent recreational uses.

- If logistics or lack of staff made it impossible for the refuge staff to monitor the activity, we might deny the request, depending on the specific circumstances.

Availability of Resources

The commercial filming, audio recording, and still photography uses would be administered with current resources. Administrative costs for review of applications and issuance of special use permits and staff time to conduct compliance checks might be offset by a fee system designated for the agencies within the U.S. Department of the Interior.

Anticipated Impacts of Use

Wildlife filmmakers and photographers tend to create the greatest disturbance of all wildlife observers (Dobb 1998, Klein 1993, Morton 1995). While observers frequently stop to view wildlife, photographers are more likely to approach the animals; even a slow approach by photographers tends to have behavioral consequences to wildlife (Klein 1993). Photographers often remain close to wildlife for extended periods in an attempt to habituate the subject to their presence (Dobb 1998). Furthermore, photographers with low-power lenses tend to get much closer to their subjects (Morton 1995). This usually causes

more disturbance to wildlife as well as habitat, including the trampling of plants. Handling of animals and disturbing vegetation (such as cutting plants and removing flowers) or cultural artifacts is prohibited on refuge lands.

Issuance of special use permits with strict guidelines and followup by refuge staff for compliance would help to reduce or avoid these effects. Permittees who did not follow the stipulations of their special use permits could have their permits revoked, and further applications for filming or photographing on the refuge would be denied. The refuge could issue a notice of violation to permittees who operate outside the conditions of their permits and violate refuge regulations.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Commercial filming, audio recording, and still photography would be compatible uses on the National Elk Refuge.

Stipulations Necessary for Compatibility

We would use the evaluation criteria described earlier to decide if commercial filming, audio recording, or still photography was a compatible use.

All commercial filming would require a special use permit that would (1) describe conditions that protect the refuge's values, purposes, resources, and public health and safety, and (2) prevent unreasonable disruption of the public's use and enjoyment of the refuge. Such conditions may be, but are not limited to: specifying road conditions when access would not be allowed, establishing time limitations, and identifying routes of access. These conditions would be identified to prevent (1) excessive disturbance to wildlife, (2) damage to habitat or refuge infrastructure, or (3) conflicts with other visitor services or management activities. Staff and workloads would determine if special access to closed areas of the refuge would be allowed case-by-case.

The special use permit would stipulate that imagery produced on refuge lands would be made available for environmental education, interpretation, outreach, internal documents, or other suitable uses. In addition, any commercial products must include proper credits to the refuge, the Refuge System, and the Service.

Still photography would require a special use permit, with specific conditions as outlined above, if one or more of the following occurred:

- Photography takes place at locations where or when members of the public are not allowed.
- Photography uses models, sets, or props that are not part of the location's natural or cultural resources or administrative facilities.
- The refuge has higher administrative costs to provide management and oversight to avoid impairment of the resources and values of the site, limit resource damage, and decrease health and safety risks to the visiting public.
- The photographer intentionally manipulates vegetation to create a shot, for example, cutting vegetation to create a blind.

To reduce the effects on refuge lands and resources, the refuge staff would make sure that all commercial filmmakers and commercial still photographers (regardless of whether a special use permit were issued) comply with policies, rules, and regulations. The staff would monitor and assess the activities of all filmmakers, audio recorders, and still photographers.

Justification

Commercial filming, audio recording, and still photography are economic uses that, to be compatible, must contribute to the achievement of the refuge purposes, mission of the Refuge System, and the mission of the Service. Providing opportunities for these uses should result in an increased public awareness of the refuge's ecological importance as well as advancing the public's knowledge and support for the Refuge System and our agency. The stipulations outlined above and conditions imposed in the special use permits issued to commercial filmmakers, audio recorders, and still photographers would make sure that these wildlife-dependent activities occur with minimal adverse effects to resources or visitors.

Mandatory 10-year reevaluation date: 2023

Commercial Guiding, Outfitting, Game Retrieval, and Wildlife-Viewing Tours

Flat Creek is a popular fishing destination especially in August, and some time periods seem to be overcrowded. Private anglers have asked us why we issue guided fishing permits since they can add to the crowding. Law enforcement has identified several unpermitted guiding outfitters in the past two seasons and suspects that there is little respect for the refuge permitting requirements. Creating a limit for the total number of permits and setting quotas of two trips, two guides, and a maximum of two clients per day could have a desired result of dispersing anglers. Charging a permit fee could create a sustained funding mechanism for maintaining fishing access signing and the printing of fishing regulations.

The refuge has allowed guided elk and bison hunts by special use permit since 2008. This service has helped young, novice, and elderly hunters and hunters with limited equipment to enjoy a quality, well-equipped hunting experience. Guided hunting would continue to increase the potential for hunters unfamiliar with the refuge to successfully harvest an animal, contributing to meeting the refuge population objectives. Fees collected would help offset the costs of administering this program.

The refuge has allowed game retrieval services by special use permit for decades. Elk and bison are large, making it challenging for a young, inexperienced, physically challenged, or ill-equipped hunter to field-dress or transport a large carcass from an area closed to motor vehicles to the hunter's vehicle.

We would continue to allow wildlife-viewing tour companies to operate on the refuge through a special use permit that outlined special conditions for operation including required safety mitigation. Several of the tour companies have attended National Elk Refuge–sponsored training to enable them to provide accurate, interpretive wildlife information. The visitor services staff would continue communication throughout the year with wildlife tour companies to give them with current information about management practices, operations, and issues.

The refuge would continue to support a contracted interpretive sleigh ride program in winter and work closely with the contractor to provide quality education and interpretation through a unique wildlife-viewing opportunity.

Availability of Resources

The refuge would administer commercial guiding, outfitting, game retrieval, and wildlife-viewing tours with current resources. Administrative costs for review of applications, issuance of special use permits, and staff time to make compliance checks could be offset by a fee system designated for the agencies within the U.S. Department of the Interior.

Anticipated Impacts of the Use

Fishing and hunting guides assist visitors by providing local knowledge and equipment to enhance their client's chances for a successful outdoor experience. Limitations placed in the special use permits would restrict these guiding operations and prevent an exclusive right to an area or the exclusion of the public. Fishing guides can help clients catch and release fish in a manner that prevents injuries to the fish. Hunting guides likely improve the potential for their clients to harvest a bison or elk, which helps move the herds closer to the population objectives outlined in the Bison and Elk Management Plan; this would be a positive contribution to the refuge's management efforts.

Permittees for game retrieval services would be constrained by the same travel restrictions as hunters, operating only in areas and on routes that were open to hunters. Wildlife disturbance would be minimal in these areas, which are already subject to hunter activities. Game retrieval services would prevent carcass spoilage and provide a service to hunters who might be unable to process and retrieve a harvested elk or bison. These services would contribute to a quality hunting program and could help increase total harvest.

Wildlife-viewing tour companies provide wildlife observation and interpretation opportunities primarily to tourists visiting Jackson Hole, many of which arrive by aircraft and need ground transportation to wildlife-viewing areas. Tour company vehicles, along with tourists in personal vehicles, have parked along Elk Refuge Road in the winter to observe bighorn sheep and have caused traffic congestion. The proposed construction of additional parking areas along Elk Refuge Road near Miller Butte would help reduce this problem.

The sleigh ride program would continue to provide a unique and spectacular setting to present a wildlife interpretive message that was important to the mission of the National Elk Refuge and raised awareness of National Wildlife Refuge System. This program is anticipated to continue to reach between 20,000 and 25,000 people annually. Horse-drawn sleighs and wagons would cause insignificant disturbance to elk and other wildlife.

The above commercial activities would require special use permits, which would include strict guidelines and conditions to prevent the exclusion of the public or damage and disturbance to wildlife and

their habitats. Refuge staff monitoring these activities for compliance with restrictions would help prevent conflicts with wildlife or the public. Permittees who did not follow the conditions outlined in their special use permits could have their permits revoked and further applications denied.

Public Review and Comment

This compatibility determination is presented for public review and comment as part of the 30-day public comment period for the draft CCP and EA for the National Elk Refuge.

Determination

Commercial guiding, outfitting, game retrieval, and wildlife-viewing tours would be compatible uses on the National Elk Refuge.

Stipulations Necessary for Compatibility

Commercial guiding, outfitting, game retrieval, and wildlife-viewing tours must (1) show a means to extend public appreciation and understanding of wildlife or natural habitats, (2) enhance education, appreciation, and understanding of the Refuge System, or (3) facilitate outreach and education goals of the refuge. Failure to show any of these criteria would result in a special use permit being denied.

Special use permits for these uses would (1) describe conditions that protect the refuge's values, purposes, resources, and public health and safety, and (2) prevent unreasonable disruption of the public's use and enjoyment of the refuge. Such conditions may be, but would not be limited to, specifying road conditions when access would not be allowed, establishing time limitations, and identifying routes of access.

For game retrieval services, we would prohibit off-road vehicles and require companies to operate only in areas and on routes that are open to hunters.

The refuge would set these conditions to prevent excessive disturbance to wildlife, damage to habitat or refuge infrastructure, or conflicts with other visitor services or management activities. To reduce the effects on our lands and resources, the refuge staff would make sure that all commercial guides, outfitters, game retrieval services, and wildlife-viewing tour companies (regardless of whether a special use permit is issued) comply with policies, rules, and regulations.

Justification

Commercial guiding, outfitting, game retrieval, and wildlife-viewing tours are economic uses that would need to contribute to the achievement of the refuge purposes, mission of the Refuge System, or the mission of the Service. Providing opportunities for these uses should result in an increased public awareness of the refuge's ecological importance as well as advancing the public's knowledge and support for the Refuge System and the Service. The stipulations outlined above and conditions imposed in the special use permits issued to commercial guides, outfitters, game retrieval services, and wildlife-viewing tour companies would make sure that these wildlife-dependent activities occur with minimal adverse effects to resources or visitors.

Mandatory 10-year Reevaluation Date: 2023

E.5 Approval of Compatibility Determinations

Submitted by:

Steve Kallin, Project Leader — Date
National Elk Refuge
Jackson, Wyoming

Reviewed by:

Mike Blenden, Refuge Supervisor — Date
U.S. Fish and Wildlife Service, Region 6
National Wildlife Refuge System
Lakewood, Colorado

Approved by:

Will Meeks, Assistant Regional Director — Date
U.S. Fish and Wildlife Service, Region 6
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