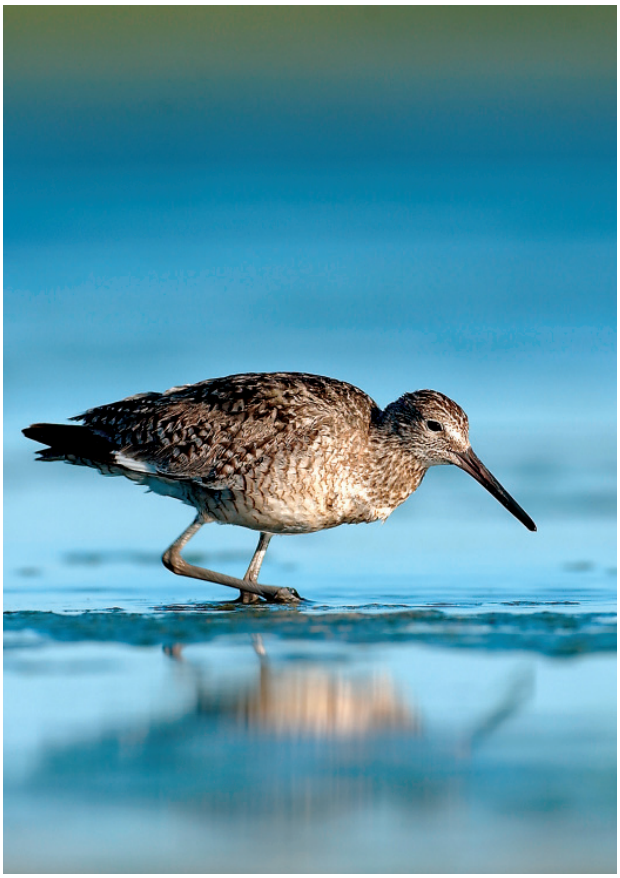
3 Alternatives



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The willet finds an important food source in district wetlands in North Dakota.

Alternatives are different approaches for management of the nine wetland management districts that are designed to resolve issues; achieve the districts' purposes, vision, and goals; and help fulfill the mission of the Refuge System while complying with current laws and regulations and policies. The NEPA requires an equal and full analysis of all alternatives considered for implementation.

This chapter describes three management alternatives for the districts: alternative A (current management, "no action"); alternative B (moderately enhanced management, proposed action); and alternative C (enhanced management).

This draft CCP and EA was completed at the programmatic level (overall guidance covering multiple units), rather than as a management plan for each district. This was the most logical approach given the following circumstances:

- Nine wetland management districts are addressed in the plan.
- There is a mixture of fee-title and conservation easement authorities.
- There is a similar purpose, vision, and goal for each district.
- All units are located throughout the state of North Dakota.

3.1 Alternatives Development

Alternatives were formulated to address the significant issues, concerns, and problems identified by the Service, the public, and the governmental partners during public scoping and throughout the development of the draft plan.

This chapter contains the following sections:

- elements common to all alternatives
- description of alternatives
- summary of alternatives and environmental consequences (table 2)

The three management alternatives represent different approaches to protect and restore fish, wildlife, plants, habitats, and other resources. Alternative A, no-action alternative, describes ongoing district management. The no-action alternative is a basis for comparison with alternatives B and C. Alternative B is the Service's proposed action and basis for the draft CCP in chapter 6.

The planning team assessed biological conditions and external relationships affecting the districts. This information contributed to the development of alternatives, each of which presents a unique approach for addressing long-term goals. Each alternative was evaluated based on expected progress in meeting the vision and goals of the districts and how it would address core habitat and wildlife issues and threats. Where data are available, trends in habitat and wildlife are evaluated, and the environmental consequences of each alternative are projected.

3.2 Elements Common to All Alternatives

A number of elements are common to all three alternatives. The need to maintain suitable habitat for a wide range of migratory bird species, especially

those species of management concern, is common throughout.

Management of upland habitats includes the potential use of an array of practices (fire, grazing, chemicals, and biological control) in all alternatives. Across all alternatives, management of disturbed uplands (lands that have been, or are currently being, cropped, farmed, broken, or seeded to a native or tame grass mixture) focuses on improved habitat quality for migratory birds.

The Service has developed criteria, applicable to all alternatives, to determine priorities for management of WPAs. Because each district is unique, specific thresholds will need to be developed for each criterion. These criteria are described in chapter 4 (4.2 Biological Resources, Wildlife, Strategic Planning for Waterfowl).

The Service recently completed a "decision tree" that outlines how the Service will set priorities for grassland and wetland acquisitions (see chapter 6, 6.3 Goals, Objectives, Strategies, and Rationale; Wetlands in Easements Objective 1; Uplands in Easements Objective 1). These priorities apply to all alternatives.

The alternatives include cultural resource evaluations in response to activities that are "undertakings" under section 106 of the National Historic Preservation Act (NHPA). The Service would comply with the NHPA and other pertinent cultural resource laws. In addition, the Service would protect where possible resources eligible to the National Register of Historic Places.

Visitor services, such as workshops and enhanced outreach, would be provided to area schools and the public to as full an extent as possible. Maintaining support for hunting, fishing, wildlife observation and photography, and environmental education and interpretation are common to all the alternatives.

The monitoring and research efforts in all alternatives focus on improving the Service's knowledge of how best to control invasive plants and increasing the intensity and extent of upland and wetland vegetation monitoring.

3.3 Description of Alternatives

Management actions to advance the mission of the Refuge System and the purpose and vision of the nine wetland management districts are described below. The alternatives reflect options to address significant threats, problems, and issues raised by public agencies, private citizens, and interested organizations.

Each alternative differs in its ability to achieve long-term habitat and wildlife goals. However, each is similar in its approach to managing the districts.

Each alternative

- would pursue the goals outlined in chapter 2;
- would protect and enhance a diverse assemblage of habitats;
- would be consistent with the purpose of the districts and mission and goals of the Refuge System.

Donna Dewhurst/USFWS

A green-winged teal rests on its travel north to nest during the spring.

Alternative A—Current Management (No Action)

Under alternative A, management activities being conducted by the Service throughout the nine districts would not change. It provides the baseline against which to compare other alternatives. It is also a requirement of the NEPA that a no-action alternative be addressed in the planning process.

The Service would not develop any new management, restoration, or visitor services programs for the districts. Staffs would not expand or change current habitat and wildlife management practices conducted for the benefit of waterfowl, migratory birds, and other wildlife. Staffs would conduct monitoring, inventory, and research activities at their current level (limited, issue-driven research and limited monitoring and inventory of birds and vegetation). Funding and staff levels would not change and

programs would follow the same direction, emphasis, and intensity as they do at present.

Habitat and Wildlife

The current management of wildlife habitat and associated species is based on high-, medium-, and low-priority areas at the WPAs. Currently, only high-priority WPAs receive consistent management. Service staffs monitor all conservation easements; however, only the high-priority easement violations are consistently enforced. Acquisition efforts by the division of realty focus on high-priority tracts, and those are mostly to secure easements from willing private landowners.

There is a concerted control effort for invasive plants recognized by the state and county. Habitat management at high-priority WPAs addresses invasive plants of ecological concern. District staffs use prescribed fire, farming and grazing (see appendix D), and invasive plant control to maintain and improve native prairie and tame grass units.

District staffs would continue to monitor energy development and evaluate road and pad development on a case-by-case basis. Staffs would monitor for contaminant spills and direct cleanup by the power company.

Under this alternative, the staffs would continue to monitor and document the presence and use of district lands by federally listed species such as piping plovers and whooping cranes. The staffs would continue to close areas to public use in order to protect federally listed species using district lands, especially during nesting season.

Monitoring and Research

Staffs would complete Service-mandated surveys on habitat and wildlife within specified timeframes and would continue to conduct baseline monitoring on high-priority tracts.

The current wildlife-monitoring efforts would continue: (1) annual surveys of various bird groups (for example, breeding waterfowl and migrant shorebirds); (2) periodic monitoring of waterfowl- and colonial waterbird-nesting effort and success; and (3) 4-square-mile waterfowl pair counts.

Monitoring and inventory of vegetation—through belt transect monitoring of management effects and "Refuge Lands Geographic Information System" (RLGIS) habitat mapping—would continue. Vegetation line transects would continue periodically on a limited number of district units to track trends in progress being made using management activities to improve native prairie habitat.

Cooperative research efforts with other agencies and organizations would continue. Staffs would continue to use available information and sound science to make informed management decisions.

Cultural Resources

The effect on cultural resources would be evaluated in response to activities that are "undertakings" under section 106 of the NHPA. The Service would comply with the NHPA and other pertinent cultural resource laws. In addition, the Service would protect where possible resources eligible to the National Register of Historic Places.

Visitor Services

The districts' hunting, trapping, and fishing programs would continue with season dates paralleling the regular statewide seasons. WPAs would continue to be open to all waterfowl, small game, and furbearer hunting, consistent with state regulations. Access would continue to be limited to foot traffic on all Service lands, with the exception of identified motorized vehicle trails at specific WPAs. Recreational trapping is available at all WPAs, in accordance with state trapping regulations (authorized by 50 CFR, part 31.16, recreational trapping is administered by the Service).

Currently, visitor services events and workshops with such groups as school districts, youth groups, and conservation groups are conducted on a multiyear rotation among districts.

District informational brochures and publications would continue to be updated periodically. Visitor service facilities including displays and signs, along with brochures, would be maintained at each district's headquarters and throughout each district.

Media outreach through newspaper articles and radio announcements would continue to be occasionally made.

Partnerships

The district staffs would work to preserve existing partnerships need to 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—for management, acquisition of grassland and wetland easements, weed initiatives, and outreach.

The districts also would continue their partnerships for biological and public outreach with government agencies such as U.S. Geological Survey (USGS) and NDGF and with nongovernmental organizations such as Ducks Unlimited.

Operations

The funding and staff resources would remain at current levels to meet the necessary legal and obligated mandates and to provide management at the high-priority WPAs. Operations for the districts would continue to include maintenance of vehicles and other equipment in good working condition to achieve management goals. An adequate law enforcement

presence would be provided for visitor safety and facility and wildlife protection.

Alternative B—Moderately Enhanced Management (Proposed Action)

Under alternative B, wildlife habitat management would provide for enhanced wetland and upland management, where warranted, on district lands. Management objectives for various habitat types would be based on habitat preferences of groups of target species such as waterfowl, migratory shorebirds, grassland bird species, and threatened and endangered species. District staffs would focus on high-priority properties, also known as tracts, and on medium-priority tracts. The district staffs would carry out compatible production enhancement techniques for targeted migratory bird populations.

The district staffs would expand existing environmental education and visitor services programs, with additional waterfowl emphases.

Habitat and Wildlife

Management of wetland and upland habitats would be driven by the habitat needs of a group of target species (for example, waterfowl, migratory shorebirds, grassland bird species, endangered species). The focus of the district staffs would be to maintain and enhance native prairie through enhanced management at high- and medium-priority WPAs to address invasive plants of ecological concern, in order to provide quality habitat.

Old croplands would be managed for the same target species. Management would be an ongoing process to convert unsuitable nesting habitat (such as cropland; degraded dense, nesting cover [DNC]; monotypic cool-season tame grass stands) to a diverse native plant mixture. Species included in the plant mix would be based on historical vegetative composition, soil structure, and requirements of the target species. Established native grass stands and the remainder of the disturbed uplands would be periodically managed to rejuvenate grass, reduce litter accumulations, and control invasive plants through (1) haying and grazing (see appendix D), (2) prescribed burning, and (3) chemical or biological treatments.

Invasive and planted woody vegetation would be managed in a way that provides the greatest overall benefit to a select group of targeted species. This alternative would allow for the removal of trees and shrubs if district staffs decided that it is the most appropriate management for the benefit of target species.

Under this alternative, the HAPET would help district staffs to identify high- and medium-high-priority habitats for target species. The Service's division of realty would focus acquisition efforts on high-priority conservation easements and some of the highest priority fee tracts, such as "roundouts" (odd shapes in boundaries that are "straightened" by the purchase of land), from willing selling landowners.

For targeted migratory bird populations, the district staffs would incorporate compatible production enhancement techniques such as island trapping for predators and artificial nesting structures.

As in alternative A, the district staffs would continue to monitor and document the presence and use of district lands by federally listed species such as piping plovers and whooping cranes. The staffs would continue to close areas to public use in order to protect federally listed species using district lands, especially during nesting season.

Monitoring and Research

Current monitoring and research would continue as described for alternative A. District staffs would also complete some baseline monitoring at high- and medium-priority tracts. The staffs would participate in landscape-level analysis to (1) guide acquisition, (2) promote management-level research to improve habitat management practices, and (3) monitor for improved success of seeded areas to native grasses (both in composition and structure), as well as monitoring control of nonnative grasses (such as Kentucky bluegrass and smooth brome) and other invasive plants.

Cultural Resources

As in alternative A, the effect on cultural resources would be evaluated in response to activities that are "undertakings" under section 106 of the NHPA. The Service would comply with the NHPA and other pertinent cultural resource laws. In addition, the Service would protect where possible resources eligible to the National Register of Historic Places.

Visitor Services

This alternative would expand the current level and quality of opportunities and facilities for environmental education and interpretation to meet the needs of a wide array of target audiences of all abilities. Hunting, fishing, wildlife observation, and photography uses would be similar to alternative A.

Visitor services events and workshops with such groups as school districts, youth groups, and conservation groups would be conducted on a 3-year rotation among districts (every 3 years, a different district would conduct these activities). Workshops would emphasize waterfowl and migratory bird identification with school groups and teachers.

Media outreach with local newspapers and radio stations would be conducted annually. District brochures and publications would be reviewed annually and updates completed as needed.

All visitor services facilities would be reviewed and, if necessary, upgraded to meet Service standards.

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Duck hunting is permitted at all WPAs within a district.

The Service proposes, at a future date, (1) one new administrative and visitor center facility each for Audubon and Kulm wetland management districts, and (2) one new visitor contact station each for Arrowwood, Devils Lake, Lostwood, and Valley City wetland management districts. An administrative and visitor center facility is a building with office space for district and refuge staffs, along with space that provides visitors with interpretive and brochure information. A visitor contact station is a small space that provides visitor information such as a free-standing kiosk, brochure rack, or small room attached to the main district office.

Partnerships

Under this alternative, existing partnerships would be expanded to address resource information needs for a broad group of wildlife species such as waterfowl, shorebirds, and songbirds. This alternative would encourage continued work with local, state, and federal agencies to explore new avenues to meet the goals. Neighboring, private landowners would be targeted for partnerships, which the Service would expand to enhance waterfowl habitats within the districts. This alternative would also promote developing and fostering partnerships with local communities, such as "friends groups," to inform the public of district programs and special events.

Operations

This alternative would necessitate an increase in district operations to address program needs for the "modified management" strategy. Increased funding for staff, equipment, and supplies would be needed to support management of priority resources. Law enforcement would be provided for visitor safety and facility and wildlife protection.

Alternative C—Enhanced Management

Under alternative C, district staffs would apply more intensive and widespread management of the native prairie and wetland complexes. District staffs would seek out restoration projects that expand and return native grasslands to quality native prairie. This alternative has the potential to provide management options that address habitat requirements and needs of specific groups of water-dependent birds (for example, waterfowl and shorebirds).

The staffs would develop new environmental education and visitor services programs.

Habitat and Wildlife

All WPAs would receive consistent management. The staffs would intensively manage the most intact ecosystems of native prairie and wetland, which are more likely to support a wide range of migratory bird species, especially those of management concern such as northern pintail and marbled godwit. Returning grasslands to quality native prairie would be a priority. Management would emphasize restoration of representative examples of native mixed- and tall-grass prairies, including healthy grasslands to benefit ground-nesting species of migratory birds.

Management of disturbed upland habitats would be driven by the needs of waterfowl and shorebirds. Under this alternative, old cropland sites and badly degraded native prairies would be lowest priority, but would be managed to attract high densities of waterfowl species that use DNC; efforts to increase nest and brood survival would focus on these tracts.

The Service would continue and expand acquisition of conservation easements, along with enforcement through mapping and strong enforcement. Acquisition efforts would be directed at high-priority conservation easements, fee-title WPAs, and "roundouts." The acquisition of easements on native prairie and wetlands would be of highest priority.

Legally identified, nonnative, invasive plants would be managed on priority tracts, allowing for management actions that benefit a specific wildlife group. This alternative would allow for the removal of existing nonnative trees and shrubs for the benefit of another wildlife group such as grassland-dependent songbirds, upland-nesting shorebirds, and waterfowl.

As in alternative A, the district staffs would continue to monitor and document the presence and use of district lands by federally listed species such as piping plovers and whooping cranes. The staffs would continue to close areas to public use in order to protect federally listed species using district lands, especially during nesting season.

Monitoring and Research

The districts' monitoring and research activities would parallel those in alternative B, with the addition of answering specific management questions. Research money would be available for graduate student work and self-directed research projects.

The following research would be conducted:

- Annually conduct vegetation transects on native prairie habitats.

- Conduct a research project on reseeding uplands to native mixes.
- Monitor water quality; specifically assess upstream threats (concentrated animal-feeding operations, air base).
- Conduct waterfowl population and density surveys.
- Conduct cooperative (with NDGF) upland bird and deer surveys.
- Conduct research on migratory bird response (especially of shorebirds, waterbirds, and waterfowl) to large-scale wind farms.
- Conduct a reptile and amphibian inventory.

Cultural Resources

As in alternatives A and B, the effect on cultural resources would be evaluated in response to activities that are "undertakings" under section 106 of the NHPA. The Service would comply with the NHPA and other pertinent cultural resource laws. In addition, the Service would protect where possible resources eligible to the National Register of Historic Places. In addition, the district staffs would develop educational programs and interpretive opportunities for the public.

Visitor Services

The current level and quality of environmental education and interpretation opportunities and facilities would be expanded to meet the needs of a wide array of target audiences of all abilities. The district staffs would develop programs to enhance public use, outdoor classroom activities, and interpretive exhibits and displays.

Visitor services events such as teacher workshops and waterfowl identification would be expanded over current levels and would be conducted annually by district staffs. Brochures and publications would be reviewed and renewed annually. New publications and educational materials would be developed to aid in the interpretation of the sights and sounds within WPAs.

Outreach would include the media and partner groups such as wildlife clubs and nonprofit conservation groups. Efforts to give presentations to the area public and schools would be a priority.

As in alternative A, the Service proposes, at a future date, (1) one new administrative and visitor center facility each for Audubon and Kulm wetland management districts, and (2) one new visitor contact station each for Arrowwood, Lostwood, and Valley City wetland management districts.

Partnerships

Partnership development and management would parallel that in alternative B. Additionally, existing partnerships with the local public and NDGF would be expanded. New partnerships would be developed to further partnerships with community members ("friends groups") who have an appreciation for and interest in the welfare of the districts.

Operations

As in alternative B, monitoring and enforcement would be expanded at all conservation easements. Conservation easement enforcement would be increased through projects such as landowner notification letters.

3.4 Comparison of Alternatives

Table 2 summarizes the actions and predicted consequences of each alternative.

Table 2. Comparison of Alternatives for the Nine Districts, North Dakota.

Alternative A	*Alternative B*	*Alternative C*
Current Management (No Action): Current funding, staff, and programs. Only the highest priority actions are addressed.	*Moderately Enhanced Management (Proposed Action): Management of high- and medium-priority habitats. Production enhancement for targeted migratory bird populations.*	*Enhanced Management: Widespread management of native prairies and wetland. Expanded restoration of grasslands. New visitor services programs.*
Habitat and Wildlife—Actions		
Prioritize WPA management, with only high-priority WPAs receiving consistent management. Monitor all conservation easements; only enforce high-priority violations. Focus acquisition on high-priority tracts; use mostly conservation easements. Manage legally identified invasive plants at high-priority WPAs. Use prescribed fire, grazing, farming, and invasive plant control to maintain and improve native prairie and tame grass units.	Manage only medium- and high-priority WPAs. Monitor and enforce all conservation easements. Monitor the effects of management and restoration on migratory birds. Focus acquisition on high-priority conservation easements and some of the highest priority fee tracts. Manage legally identified invasive plants at high- and medium-priority WPAs. Apply compatible production enhancement techniques for targeted migratory bird populations.	Manage all WPAs. Apply intensive management on native prairies and wetlands in the most intact ecosystems, which are more likely to support a wide range of migratory bird species. Emphasize restoration of representative examples of native mixed- and tall-grass prairies, to benefit ground-nesting species of migratory birds. Manage the low-priority old cropland and degraded prairies to increase nest and brood survival for high densities of waterfowl species that use DNC. Expand conservation easement acquisition and enforcement through proactive mapping and strong enforcement. Direct acquisition efforts at high-priority conservation easements (native prairie and wetlands), fee-title WPAs, and "roundouts." Manage legally identified invasive plants at all fee tracts.
Habitat and Wildlife—Environmental Consequences		
The current productivity of wetland and upland vegetation communities would be maintained at high-priority WPAs. The current support of waterfowl, shorebird, and upland species use would be maintained. There would be a gradual long-term deterioration of habitats at medium- and low-priority WPAs.	The productivity of vegetative wetland and upland communities would be improved at all WPAs for bird species migration, breeding, and recruitment. Waterfowl recruitment would be increased through improved habitat conditions and control of predators. Additional habitat at high-priority WPAs would be protected through acquisition. Native prairie grasses and forbs conditions for targeted species would improve.	The productivity of vegetative wetland and upland communities would be improved at all WPAs for bird species migration, breeding, and recruitment. Management of intact landscapes would provide a structural mosaic of native vegetative communities with less fragmentation, which would lead to less invasive plant species. *(continued)*

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Habitat and Wildlife—Environmental Consequences *(continued)*		
		Additional WPAs with high-priority habitat would be acquired using progressive HAPET mapping. The occurrence of all invasive plants on all district lands would be mapped.
Monitoring and Research—Actions		
Conduct mandated surveys and some baseline monitoring on high-priority tracts. Periodically complete vegetation line transects at a limited number of WPAs to track progress of management activities to improve native prairie. Complete 4-square-mile waterfowl pair counts.	Conduct mandated surveys and some baseline monitoring on high- and medium-priority tracts. Periodically complete vegetation line transects at a limited number of WPAs to track progress of management activities to improve native prairie. Complete 4-square-mile waterfowl pair counts. Support landscape-level analysis to guide acquisition. Promote management level research to improve habitat management practices.	Conduct mandated surveys and baseline monitoring. Conduct specific research to answer management questions (money is available for graduate student work and self-directed research). Increase monitoring of grasslands, wetlands, and wildlife: ■ Expand vegetation transects on native prairie to include more district units and do annually. ■ Conduct research on reseeding uplands to native mixes. ■ Monitor water quality to assess upstream threats. ■ Conduct waterfowl population and density, upland bird, and deer surveys. ■ Conduct research on migratory bird response to large-scale wind farms. ■ Conduct a reptile and amphibian inventory.
Monitoring and Research—Environmental Consequences		
Although limited, any information gathered would be beneficial to the staffs in analysis of management needs.	The additional monitoring and research would lead improved habitat conditions and health of migratory and resident species that use district lands.	*Same as alternative B.*

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Cultural Resources—Actions		
Conduct cultural resource evaluations in response to activities that are "undertakings" under section 106 of the NHPA. Comply with cultural resource laws including protection, when possible, of resources eligible for the National Register of Historic Places.	*Same as alternative A.*	*Same as alternatives A and B, plus the following.* Develop educational programs and interpretive opportunities for the public.
Cultural Resources—Environmental Consequences		
Cultural resources that would be potentially affected by an undertaking would be identified and, if significant, preserved when possible.	*Same as alternative A.*	*Same as alternatives A and B, plus the following.* More of the public would learn about cultural resources in the districts.
Visitor Services—Actions		
Conduct visitor services events such as teacher workshops on a multiyear rotation among districts. Occasionally update brochures and publications. Occasionally do media outreach.	Conduct visitor services events such as teacher workshops and waterfowl identification on a 3-year rotation among districts. Annually conduct media outreach. Annually review brochures and publications; complete updates as needed. Construct new administrative and visitor center facilities: ❑ Audubon WMD ❑ Kulm WMD Construct new visitor contact stations: ❑ Arrowwood WMD ❑ Devils Lake WMD ❑ Lostwood WMD ❑ Valley City WMD *(continued)*	Enhance visitor services. Develop outdoor classroom activities. Add interpretive exhibits and displays. Annually conduct visitor services events such as teacher workshops and waterfowl identification. Annually review and renew brochures and publications. Develop new publications and educational materials. Do outreach with the media and partner groups such as wildlife clubs and nonprofit conservation groups. Make presentations to the area public and schools. Construct visitor center and contact station facilities (*same as alternative B*).

Table 2. Comparison of Alternatives for the Nine Districts, North Dakota.

Alternative A *Current Management (No Action): Current funding, staff, and programs. Only the highest priority actions are addressed.*	*Alternative B* *Moderately Enhanced Management (Proposed Action): Management of high- and medium-priority habitats. Production enhancement for targeted migratory bird populations.*	*Alternative C* *Enhanced Management: Widespread management of native prairies and wetland. Expanded restoration of grasslands. New visitor services programs.*
Visitor Services—Actions *(continued)*		
	Redesign the visitor contact station at Crystal Springs WPA in the Chase Lake WMD. Construct a new interpretive sign for the auto tour route at Chase Lake WMD. Develop an interpretive display for Crosby WMD.	
Visitor Services—Environmental Consequences		
Opportunities would continue at or near existing levels.	Through the development of additional workshops, brochures, and exhibits, the public and school groups would better understand the species and habitat relationships and the general mission of the Refuge System. The establishment of visitor centers and contact stations would increase public visitation and knowledge of the districts. There may be irreversible damage to relatively small areas of vegetation due to facility construction. Construction equipment may cause short-term disturbance to wildlife.	*Same as alternative B.*
Partnerships—Actions		
Use partnerships with the public, primarily landowners adjacent to the WPAs, to cooperatively manage district habitats. Continue coordination with the NDGF to manage hunting at WPAs.	*Same as alternative A, plus the following.* Develop "friends" groups, expand partnerships with universities, and improve relations with neighbors.	*Same as alternative B, plus the following.* Expand and improve existing partnerships with the local public and NDGF. Develop new partnerships to benefit mutual programs.
Partnerships—Environmental Consequences		
Without new partnerships, the districts would be unable to meet future demands from the public for visitation and public education. Monitoring and research would remain at the current level without the ability to expand into needs analyses.	Expanded partnerships would enable the districts to meet the needs of visitors. Partners would assist staff in monitoring and research, which would expand knowledge about habitat management and restoration.	*Same as alternative B.*

Table 2. Comparison of Alternatives for the Nine Districts, North Dakota.

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Operations—Actions		
Maintain current staff, equipment, and other resources.	Increase resources necessary to (1) meet legal and obligated mandates, (2) provide management at high- and medium-priority WPAs, and (3) provide limited resources to other projects. Provide law enforcement for visitor safety and facility and wildlife protection.	Increase resources to accomplish all mandates and other projects to enhance the mission of the Refuge System. Increase resources to be able to monitor and enforce all conservation easements. Enhance enforcement of conservation easements through projects such as landowner notification letters.
Operations—Environmental Consequences		
Current levels of operation would be maintained. Property and equipment would be safe and workable, but districts would lack state-of-the-art equipment for habitat improvement.	The district staffs would have the resources necessary to improve habitats and management for migratory species. New improvements and accessibility would increase the value and usability of the districts to visitors.	*Same as alternative B.*

4 Affected Environment

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Sunrise over a Wells County wetland.

The nine wetland management districts manage thousands of noncontiguous tracts of federal land totaling 1,125,084 acres. These lands include 1,208 WPAs, 37 WDAs, and tens of thousands of conservation easements.

This chapter describes the physical environment and biological resources of these district lands. In addition, the affected environment includes the fire and grazing history, cultural resources, visitor services, socioeconomic environment, and operations of the districts.

4.1 Physical Environment

The districts are primarily east and north of the Missouri River, from the Canadian border south to the state line of South Dakota. Because districts cover such a large geographic area, the physical environment and biological resources are described in terms of physiographic region (or level 3 and level 4 ecoregions) (Bryce et al. 1996) in which each district is located. Five physiographic regions occur in the nine-district area: Red River Valley, Glaciated Plains, Turtle Mountains, Missouri Coteau, and Coteau Slope (see figure 6, map of physiographic regions). These physiographic regions correspond closely to the level 3 ecoregions described below with the exception of the Turtle Mountains, which is described as a level 4 ecoregion.

The prairies of North Dakota have become an ecological treasure of biological importance for waterfowl and other migratory birds. The prairie potholes of North Dakota and South Dakota support a wide diversity of wildlife, but they are most famous for their role in waterfowl production. Although the Prairie Pothole Region occupies only 10% of North America's waterfowl-breeding range, it produces approximately 50% of the continent's waterfowl population.

Complexes of wetlands scattered throughout the wetland management districts attract breeding duck pairs. While semipermanent and permanent wetlands provide brood-rearing habitat and migratory stopover habitat, respectively, it is the smaller temporary and seasonal wetlands that draw breeding duck pairs to the North Dakota prairies and other parts of the Prairie Pothole Region.

Global Warming

The DOI 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.

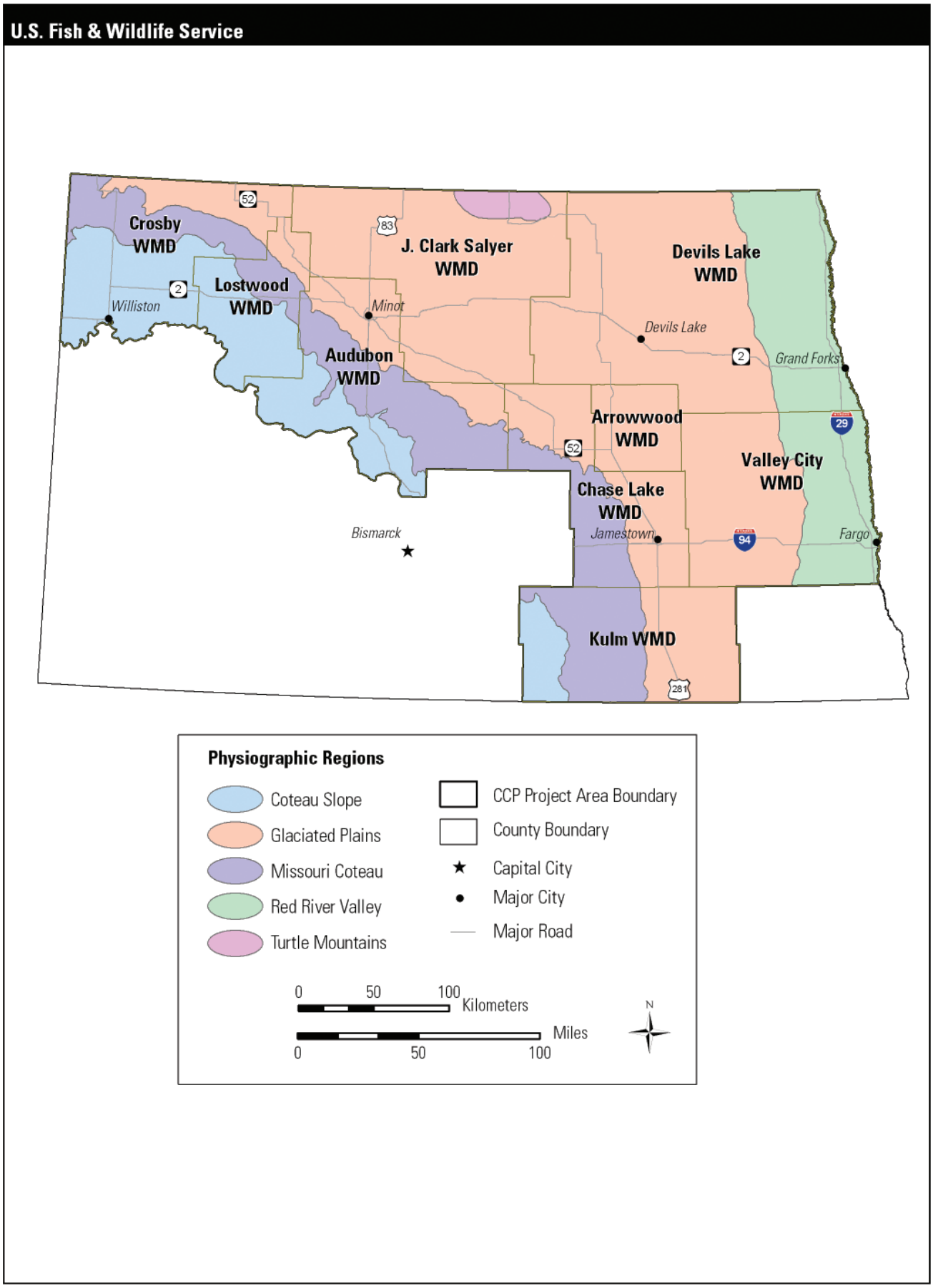

Figure 6. Map of the physiographic regions in the nine districts, North Dakota.

The U.S. Department of Energy's report, "Carbon Sequestration Research and Development," concluded that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently 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."

The increase of carbon dioxide (CO_2) within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as "global warming." In relation to comprehensive conservation planning for Refuge System units, carbon sequestration constitutes the primary climate-related effect considered during planning.

Vegetated land is a tremendous factor in carbon sequestration. Large, naturally occurring communities of plants and animals that occupy major habitats—grasslands, forests, wetlands, tundra, and desert—are effective both in preventing carbon emission and in acting as biological "scrubbers" of atmospheric CO_2.

One Service activity in particular—prescribed burning—releases CO_2 directly to the atmosphere from the biomass consumed during combustion yet results in no net loss of carbon because new vegetation quickly germinates and sprouts 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 other effects of climate change may need consideration in the future:

- Habitat available in lakes and streams for cold-water fish such as trout and salmon could be reduced.
- Forests may change, with some plant species shifting their range northward or dying out and other trees moving in to take their place.
- Ducks and other waterfowl could lose breeding habitat because of stronger and more frequent droughts.
- Changes in the timing of migration and nesting could put some birds out of synchronization with the life cycles of their prey.

Climate

The normal average annual temperature in North Dakota ranges from 37°F in the northeast to 43°F along the southern border. January is the coldest month with average temperatures ranging from 2°F in the northeast to 17°F in the southwest. July is the warmest month with temperatures averaging 67°F in the northeast to 73°F in parts of the south. The range of normal average monthly temperatures between the coldest and warmest months is 54°F in the southwest and 65°F in the northeast. These large annual ranges attest to the continental nature of North Dakota's climate (Jensen, no date).

The highest temperature ever recorded in North Dakota was 121°F at Steele on July 6, 1936, and the lowest temperature measured was –60°F at Parshall on February 15, 1936. Temperatures of 100°F or higher occur nearly every year somewhere in North Dakota. Chances of this occurring are greatest in the south-central area where, in about 85% of the years, maximum temperature will equal or exceed 100°F. These temperatures of 100°F or more last only for a day or two. In the northeast, temperatures reach 100°F or higher in only 3 years out of 10 (Jensen, no date).

Annual precipitation ranges from less than 13 inches in the northwest to more than 20 inches in parts of the Red River Valley and southeast. The lines of equal precipitation, although subject to some meandering, are oriented north–south; as a generalization, precipitation increases about 1 inch for every 50 miles of eastward movement.

There are two areas where the general increase of precipitation in an easterly direction does not apply:

- One area is located in the southwest where the annual precipitation of more than 16 inches is higher than the surrounding area. This area of higher precipitation is largely a result of topographic uplift.
- The other area is in the north-central section of the state, where the annual precipitation of less than 16 inches is lower than surrounding areas. This area is caused primarily by air moving downhill from all but a southerly direction, which works against the precipitation process (Jensen, no date).

Annual snowfall in North Dakota ranges from less than 26 inches in parts of Mountrail and McLean counties (west-central portion of the state) to about 38 inches in a belt extending diagonally across the state northeast–southwest (Jensen, no date).

Physiography, Geography, and Soils

This section describes the districts' ecoregions and soils.

Ecoregions

Four level 3 ecoregions cover the nine districts (see figure 7): Lake Agassiz Basin, Northern Glaciated Plains, Northwestern Glaciated Plains, and Northwestern Great Plains. The differences in ecosystem properties and functions in the level 3 ecoregions are distinguished by the patterns of biotic and abiotic phenomena: vegetation, climate, soils, land use, wildlife use, and hydrology. Local biotic and abiotic factors have further refined the ecoregions. Each level 3 ecoregion is subdivided into several level 4 ecoregions; level 4 ecoregions are the finest level in the hierarchy (Bryce et al. 1996). Table 3 displays the level 3 ecoregions in which each district occurs.

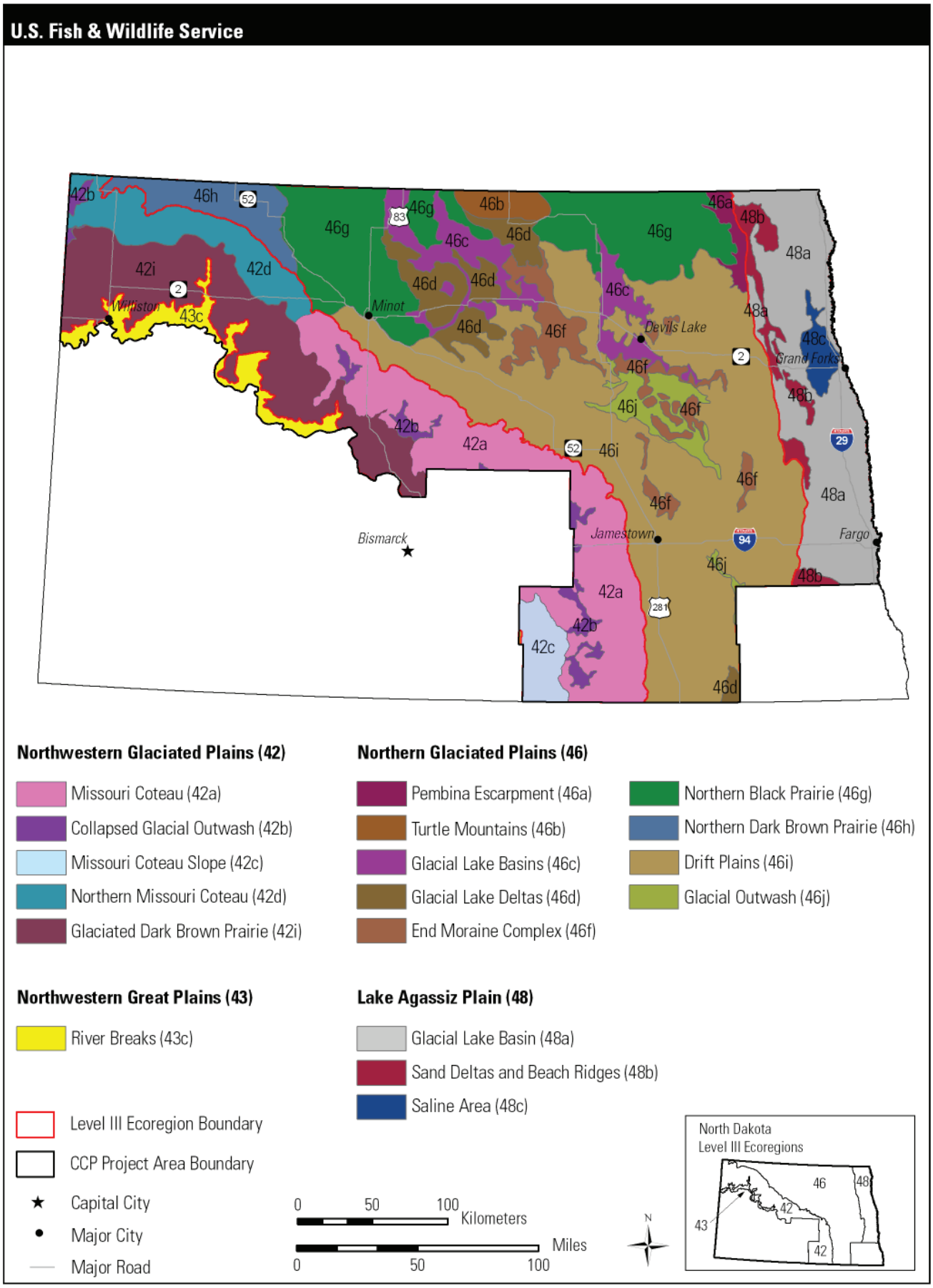

Figure 7. Map of the level 4 ecoregions in the nine districts, North Dakota.

Table 3. Ecoregions in the Nine Districts, North Dakota.

Wetland Management District	*Level 3 Ecoregion*
Arrowwood	Northern Glaciated Plains Ecoregion 46
Audubon	Northwestern Glaciated Plains Ecoregion 42
	Northwestern Great Plains Ecoregion 43
	Northern Glaciated Plains Ecoregion 46
Chase Lake	Northwestern Glaciated Plains Ecoregion 42
	Northern Glaciated Plains Ecoregion 46
Crosby	Northwestern Glaciated Plains Ecoregion 42
	Northwestern Great Plains Ecoregion 43
	Northern Glaciated Plains Ecoregion 46
Devils Lake	Northern Glaciated Plains Ecoregion 46
	Lake Agassiz Basin Ecoregion 48
J. Clark Salyer	Northern Glaciated Plains Ecoregion 46
Kulm	Northwestern Glaciated Plains Ecoregion 42
	Northern Glaciated Plains Ecoregion 46
Lostwood	Northwestern Glaciated Plains Ecoregion 42
	Northwestern Great Plains Ecoregion 43
	Northern Glaciated Plains Ecoregion 46
Valley City	Northern Glaciated Plains Ecoregion 46
	Lake Agassiz Basin Ecoregion 48

Descriptions of the four level 3 ecoregions and their level 4 ecoregions relevant to the districts follow (see figure 7). Most text and graphics in this section are from "Ecoregions of North Dakota and South Dakota" (USGS 2006).

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North Dakota's prairie is a haven of unique species.

Northwestern Glaciated Plains Ecoregion 42 (Level 3)

Portions of Audubon, Chase Lake, Crosby, Kulm, and Lostwood wetland management districts occur within this ecoregion.

The Northwestern Glaciated Plains ecoregion marks the westernmost extent of continental glaciation. The youthful morainal (ridges of rock debris at the margins of glaciers) landscape has significant surface irregularity and high concentrations of wetlands. The rise in elevation along the eastern boundary defines the beginning of the Great Plains. Land use is transitional between the intensive dryland farming in Drift Plains ecoregion 46i (below) to the east and the predominance of cattle ranching and farming to the west in Northwestern Great Plains ecoregion 43 (described below).

Missouri Coteau Ecoregion 42a (Level 4)

Like closely spaced ocean swells, the rolling mounds of the Missouri Coteau enclose countless wetland depressions or potholes. During its slow retreat, the Wisconsinan glacier stalled at the Missouri escarpment for thousands of years, melting slowly beneath a mantle of sediment to create the characteristic pothole topography of the coteau. The wetlands of the Missouri Coteau and the neighboring Prairie Pothole Region are the major WPAs in North America. Land use on the coteau is a mixture of tilled agriculture in flatter areas and grazing land on steeper slopes.

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The vastness of the North Dakota prairie is protected by grassland easements throughout the districts.

Collapsed Glacial Outwash Ecoregion 42b (Level 4)

Areas of Collapsed Glacial Outwash formed from gravel and sand that was deposited by glacial meltwater and precipitation runoff over stagnant ice. Many large, shallow lakes are found in these areas; these lakes and wetlands tend to be slightly to very alkaline depending upon the flow path of groundwater moving through the permeable outwash deposits. They attract birds preferring large areas of open water such as American white pelican, black tern, and Forster's tern, as well as those living in brackish water such as American avocet and tundra swan.

Missouri Coteau Slope Ecoregion 42c (Level 4)

The Missouri Coteau Slope ecoregion declines in elevation from Missouri Coteau ecoregion 42a to the Missouri River. Unlike Missouri Coteau ecoregion 42a, where there are few streams, the Missouri Coteau Slope has a simple drainage pattern and fewer wetland depressions. Due to the level to gently rolling topography, there is more cropland than in Missouri Coteau ecoregion 42a. Cattle graze on the steeper land that occurs along drainages.

Northern Missouri Coteau Ecoregion 42d (Level 4)

The Northern Missouri Coteau lies in a transition zone to a more boreal climate to the north and a more arid climate to the west. Willow and aspen, southern occurrences of aspen parkland to the north, may occur at wetland margins. Rough fescue, also a northern species, appears in grassland associations. Wetlands tend to dry out earlier in the summer than in Missouri Coteau ecoregion 42a to the south and east. Mixed dryland agriculture is the major land use.

Glaciated Dark Brown Prairie Ecoregion 42i (Level 4)

The boundary of the Glaciated Dark Brown Prairie marks a transition to drier conditions. Glaciated Dark Brown Prairie has a well-defined drainage system and fewer wetlands compared with the more recently glaciated Missouri Coteau Slope ecoregion 42c to the east. Land use is a mosaic of cropland and rangeland.

Northwestern Great Plains Ecoregion 43 (Level 3)

Small portions of the Audubon, Crosby, and Lostwood wetland management districts occur within this ecoregion.

The Northwestern Great Plains ecoregion encompasses the Missouri Plateau section of the Great Plains. It is a semiarid rolling plain of shale, siltstone, and sandstone punctuated by occasional buttes and badlands. Native grasslands persist in areas of steep or broken topography, but they have been largely replaced by spring wheat and alfalfa over most of the ecoregion. Agriculture is limited by erratic precipitation patterns and limited opportunities for irrigation.

River Breaks Ecoregion 43c (Level 4)

The River Breaks form broken terraces and uplands that descend to the Missouri River and its major tributaries. They have formed in soft, easily erodible strata, such as Pierre shale. The dissected topography,

wooded draws, and uncultivated areas provide a haven for wildlife. Riparian gallery forests of cottonwood and green ash persist along major tributaries such as the Moreau and Cheyenne rivers, but they have mostly been eliminated along the Missouri River by impoundments.

Northern Glaciated Plains Ecoregion 46 (Level 3)

All nine districts have portions of their management area within this ecoregion. Also commonly referred to as the Drift Plains or Drift Prairie, this area was subject to scouring and deposition due to prolonged glacier activity between 70,000 and 10,000 years ago.

A flat to gently rolling landscape of glacial drift characterizes the Northern Glaciated Plains ecoregion. The subhumid conditions foster a grassland transition between the tall- and short-grass prairies. High concentrations of temporary and seasonal wetlands create favorable conditions for duck nesting and migration. Although the tilled soil is very fertile, agricultural success is subject to annual climatic fluctuations.

Pembina Escarpment Ecoregion 46a (Level 4)

The Pembina Escarpment is a rugged, forested slope that marks the boundary between Northern Black Prairie ecoregion 46g (below) and the Lake Agassiz Plain. Though small, the Pembina Escarpment is a distinctive level 4 ecoregion. Originally formed by the undercutting of Cretaceous sandstones by the ancestral Red River, glacial scouring later steepened the escarpment. The vista today, of wooded hills with small farms tucked into valleys, is reminiscent of pastoral sections of New England. Streams flowing off the escarpment have high gradients and a cobble substrate.

Turtle Mountains Ecoregion 46b (Level 4)

The undulating landscape and abundant wetlands of the Turtle Mountains are similar to Missouri Coteau ecoregion 42a (previous). However, the Turtle Mountains contain larger, deeper, and more numerous lakes. Additionally, this ecoregion receives about 10 inches more precipitation than the surrounding drift plains; thus, it supports a forest cover of aspen, birch, bur oak, elm, and ash. The forest soils are erodible and poorly suited for cropland, although there is some clearing for pastureland.

Glacial Lake Basins Ecoregion 46c (Level 4)

Lake Souris, Devils Lake, and Lake Dakota once occupied the Glacial Lake Basins. These proglacial (adjacent to a glacier) lakes were formed when major stream or river drainages were blocked by glacial ice during the Pleistocene. The smooth topography of the Glacial Lake Basins—even flatter than the surrounding drift plains (ecoregions 46g, 46i, and 46n)—resulted from the slow buildup of water-laid sediments. The level, deep soils in the lake plains are intensively cultivated. In the north, the primary crops are spring wheat, other small grains, and sunflowers; in the Lake Dakota basin of South Dakota, corn and soybeans are more prevalent.

Glacial Lake Deltas Ecoregion 46d (Level 4)

The Glacial Lake Deltas were deposited by rivers entering glacial lake basins (for example, Glacial Lake Souris, Devils Lake, and Lake Dakota). The heaviest sediments, mostly sand and fine gravel, formed delta fans at the river inlets. As the lake floors were exposed during withdrawal of the glacial ice, wind reworked the sand in some areas into dunes. In contrast to the highly productive, intensively tilled glacial lake plains, the dunes in the delta areas have a thin vegetative cover and a high risk for wind erosion. These areas are used mainly for grazing or irrigated agriculture.

End Moraine Complex Ecoregion 46f (Level 4)

The End Moraine Complex is a concentration of glacial features in east-central North Dakota. Blue Mountain and Devils Lake Mountain are comprised of blocks of surface material scraped off and thrust up by the continental glacier at the south end of the Devils Lake basin. In the western part of the ecoregion, patches of stagnation moraine similar to Missouri Coteau ecoregion 42a (previous) have high densities of wetlands. Favorable precipitation, aspect, and slightly higher elevations result in wooded lake margins and morainal (stone debris carried by glaciers) ridges for the moraines south of Devils Lake basin.

Northern Black Prairie Ecoregion 46g (Level 4)

The Northern Black Prairie represents a broad range of biological events (such as flowering, seeding, and propagation) within this transition zone that is influenced by the boreal climate. Aspen and birch appear in wooded areas, willows grow on wetland perimeters, and rough fescue, common to the Rocky Mountain foothills, becomes evident in grassland associations. This ecoregion has the shortest growing season and the lowest January temperatures of any level 4 ecoregion in North Dakota and South Dakota. Most of the area is used for growing small grains, with durum wheat being a major crop.

Northern Dark Brown Prairie Ecoregion 46h (Level 4)

The Souris and Des Lacs rivers generally divide the Northern Dark Brown Prairie from Northern Black Prairie ecoregion 46g. These ecoregions differ in precipitation, soil, and vegetation characteristics. The Souris River is within the broad transitional zone between subhumid and semiarid climatic conditions. Soils west of the Souris River developed under drier conditions than those soils further east; they have less organic material, which gives them a lighter color. In addition, crop and native grass production is generally lower than in ecoregions further east.

Drift Plains Ecoregion 46i (Level 4)

On the Drift Plains, the retreating Wisconsinan glaciers left a subtle, rolling topography and a thick mantle of glacial till (mixture of clay, sand, and rocks). A greater proportion of temporary and seasonal wetlands are

found in the Drift Plains than in the coteau areas, where semipermanent wetlands are numerous. Because of the productive soil and level topography, this ecoregion is almost entirely cultivated, with many wetlands drained or simply tilled and planted. However, valuable waterfowl habitat still remains, concentrated in state- and federally sponsored duck production areas. The historical grassland in the Drift Plains was a transitional mix of tall-grass and short-grass prairie. The prairie grasses have been largely replaced by fields of spring wheat, barley, sunflowers, and alfalfa.

Glacial Outwash Ecoregion 46j (Level 4)

The separated areas of Glacial Outwash differ from outwash areas in Missouri Coteau ecoregion 42a (previous) in that they generally have a smoother topography. The soils are highly permeable with low water-holding capacity. Areas of excessive soil permeability have a poor to fair potential for dryland crop production. Some areas are used for irrigated agriculture. The risk for blowing soil in droughty areas is reduced by retaining native range grasses like little bluestem, needle and thread, and green needlegrass.

Lake Agassiz Basin Ecoregion 48 (Level 3)

Devils Lake and Valley City wetland management districts occur in this ecoregion.

Glacial Lake Agassiz was the last in a series of proglacial lakes to fill the Red River Valley since the beginning of the Pleistocene era. The Lake Agassiz Plain is comprised of thick lacustrine (formed in lakes) sediments underlain by glacial till. It is extremely flat and has fewer lakes and pothole wetlands than neighboring ecoregions. The historical tall-grass prairie has been replaced by intensive agriculture. The preferred crops in the northern half of the region are potatoes, beans and wheat; soybeans and corn dominate in the south. Sugar beets are grown throughout the ecoregion.

Glacial Lake Agassiz Basin Ecoregion 48a (Level 4)

From the Pembina escarpment, the view of the Glacial Lake Agassiz Basin is an extremely flat patchwork of cultivated farmland. Because the Red River of the North has a poorly defined floodplain and very low gradient, flooding can be a problem. Outside of channelized areas in the floodplain, muddy valley streams meander within narrow buffer strips of cottonwood, elm, ash, and willow. Soils range from silty to clayey in texture. Most have high water tables and are extremely productive.

Sand Deltas and Beach Ridges Ecoregion 48b (Level 4)

The varying relief of the Sand Deltas and Beach Ridges interrupts the extremely flat and intensively farmed land of the Lake Agassiz Plain. The beach ridges appear as parallel lines of sand and gravel formed by wave action on the varying shoreline levels of glacial Lake Agassiz. Three sand deltas—

Jennifer Anderson/USDA–NRCS PLANTS Database

Big bluestem.

the largest being the Sheyenne River delta in the south—occur where major rivers entered glacial Lake Agassiz and dropped their sediment load. A high erosion risk exists in the sand dune areas.

Saline Area of the Lake Agassiz Basin Ecoregion 48c (Level 4)

In the Saline Area of the Lake Agassiz Basin, salty artesian groundwater flows to the surface through glacial till and lacustrine sediments from the underlying beds of Cretaceous sandstone. The regional boundary of the Saline Area of the Lake Agassiz Basin delineates an area where salt effects are most evident. Other saline areas occur along the tributaries of the Park, Forest, and Turtle rivers in northeastern North Dakota. Salt-affected soils in the saline area reduce crop productivity. Many areas are not suitable for farming, but are used for range or wildlife habitat.

Soils

Data for soil temperature and frost penetration in North Dakota are scarce. Dr. Guy Wilkinson of the department of soils at North Dakota State University did the most complete study of soil temperatures. Wilkinson measured soil temperature at Fargo, North Dakota, continuously over a 4-year period (Jensen, no date).

At Fargo, the average date of soil surface freezing was November 26. Freezing progressed to greater depths throughout the winter until the average maximum frost penetration depth of 4.5 feet was reached April 1. Surface thawing in the spring began on March 26, a few days earlier than the occurrence of maximum frost penetration. After April 1, soil thawing proceeded both downward from the surface and upward toward the surface from the deeper unfrozen soil until May 1, when the last of the frozen soil at about the 3-foot level was thawed (Jensen, no date).

The lowest average soil temperature of 8.2°F was found at a depth of 0.25 inch on January 17. The time of minimum soil temperature for deeper soil depths was progressively later, with minimum soil temperatures at the 4.5-foot depth occurring on April 1. Highest average soil temperature at the 0.25-inch depth reached the low 80s during the third week in July. As in winter, soil temperatures at greater depths reached their highest levels later in the season. For instance, soil temperatures at the 2-foot depth did not reach their highest levels until about August 6, while 3-foot-deep maximum temperatures were reached August 15 (Jensen, no date).

Water Resources

The districts cover the prairie basins of the Red River Valley basin to the east, to the Missouri basin to the west. Prairie basin wetlands of North Dakota and South Dakota are part of a series of community profiles on ecologically important wetlands of national significance. The shallow wetlands of North Dakota and South Dakota form the bulk of the portion of the Prairie Pothole Region lying within the United States. This region is famous as the producer of at least half of North America's waterfowl and an unknown, but large, proportion of other prairie-dwelling marsh and aquatic birds.

Hydrology

The wetlands described here lie in relatively small, shallow basins that vary greatly in their ability to maintain surface water, and in their water chemistry, which varies from fresh to hypersaline. These wetlands occur in a wide variety of hydrological settings, in an area where annual and seasonal precipitation varies greatly in form and amount. Thus, the presence of surface water in these wetlands is largely unpredictable. Superimposed on these phenomena are the effects of a variety of land uses including pasture, cultivation, mechanical forage removal, idle conditions, and burning. All these factors greatly affect the plant and animal communities found in these basins (Kantrud et al. 1989).

These wetlands described as lacustrine basins and palustrine basins (wetlands that lack flowing water including marshes, swamps, bogs, and floodplains) have water regimes that are temporarily flooded, seasonally flooded, and semipermanently flooded. Basins with these water regimes compose about 90% of the basins in the Prairie Pothole Region of North Dakota and South Dakota. This profile outlines the wetland subsystems, classes, and subclasses that occur in these basins and provides a useful reference to their geologic, climatic, hydrologic, and pedologic (natural composition, distribution, and formation of soils) setting (Kantrud et al. 1989).

Glacially created wetlands in the Prairie Pothole Region, in combination with the surrounding grasslands, provide breeding habitat that supports half of the continent's waterfowl production (Kantrud 1983). The original density of wetlands in the Prairie Pothole Region is thought to have been about 80 wetlands per square mile before historical settlement. Since European settlement, 49% of North Dakota's wetlands have been drained for agriculture or development (Dahl 1990). The Prairie Pothole Region is a major world supplier of cereal grains. Consequently, wetlands in the region are often drained for crop production or otherwise cropped when water conditions permit.

Wetlands exist because specific geologic settings and hydrologic processes favor pooling of water or soil saturation. A unique combination of glaciation and climatic conditions in the Prairie Pothole Region has produced a large number of dynamic aquatic ecosystems that have a tendency to not receive or contribute to channelized surface flow. These basins have the potential to impound large volumes of water and undergo long-term, extreme changes in water depth and biotic conditions in response to climatic trends. The water level fluctuates in typical, seasonal and semipermanent North Dakota wetlands. The low-grade shorelines of prairie wetlands combine with the semiarid climate to produce dynamic wetlands; for example, small increases in water level cause great increases in the proportion of a basin inundated and, conversely, hot, dry conditions often remove surface water from large areas of a basin in a relatively short time (Kantrud et al. 1989).

Water Quality

Some wetland basins function as groundwater recharge areas; such basins tend to be temporarily or seasonally flooded. These basins hold water for only a few months each year, and the water is generally low in dissolved solids. Some basins are through-flow systems with respect to groundwater; that is, groundwater flows in through parts of their bed while other parts recharge groundwater. Through-flow basins hold water over longer periods and the water tends to have higher concentrations of dissolved solids. Some basins serve only as discharge areas for groundwater. Lakes that receive discharge from both regional and local groundwater flow systems and do not lose water to seepage or surface outflow are highly saline (Kantrud et al. 1989).

Human-related disturbance such as drainage and cultivation are the most extreme disturbances seen in most prairie wetlands in North Dakota and South Dakota. In some instances, fill (earth or rocks) or use

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Wetlands are a natural filter for the nation's water resources.

for solid-waste disposal has also destroyed the basins (Kantrud et al. 1989).

Water Rights

During the 1930s, the U.S. Bureau of Biological Survey on behalf of the federal government submitted "declarations of filing" in North Dakota for many impoundments on national wildlife refuges. Such filing applies for and documents the claim of ownership of the right to use water for current purposes. In 1930, there was a fire at the state capitol that destroyed most of these early filings, and, subsequently, new legislation was introduced to alter the way in which water rights were applied for and processed. As a result, there are many old declarations of filing that have not been entered into the state's water rights database and have never been "perfected" (described in following paragraph) in the same manner as the newer water right permits. There is one documented filing on a conservation easement for Billings Lake WPA.

The state of North Dakota currently issues a "conditional water permit" when an application for a water right is made. This permit grants the claimant the right to develop the structure or structures necessary to put the water to beneficial use. After the claimant has developed the necessary structures and put the water to beneficial use, the North Dakota State Water Commission has to inspect the project and verify that the water as claimed is being put to beneficial use. The North Dakota State Engineer then issues a "perfected" water permit.

Early water rights usually included a storage amount as well as an amount for seasonal use. The seasonal use is the water needed to offset evaporation and is generally only seen in connection with a reservoir. The state instituted a one-time fill rule, eliminating the ability to offset evaporation. This rule was waived in some cases, but many of the later water rights only list a storage volume.

Some water rights—particularly groundwater rights, but also some surface water rights—have an associated flow rate. If there is a decreed flow rate, this is the maximum rate at which water can be pumped or diverted.

There are no water rights associated with Crosby, Kulm, and Lostwood wetland management districts. Tables 4–9 list the water rights for Arrowwood, Audubon, Chase Lake, Devils Lake, J. Clark Salyer, and Valley City wetland management districts, respectively.

Table 4. Water Rights for Arrowwood Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	—	—	Stutsman	Hawks Nest WDA	Dikes	Fish, wildlife	—	—	—

Table 5. Water Rights for Audubon Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	—	—	Dunn	Audubon WMD	Lake Ilo G-6	—	—	1.80	—
—	—	—	—	Slope	Audubon WMD	White Lake G-1 Dugout	—	—	0.30	—
—	—	—	—	Dunn	Audubon WMD	Lake Ilo G-5 Dam	—	—	0.90	—
—	—	—	—	Dunn	Audubon WMD	Lake Ilo Wl-3 Dam	—	—	0.80	—
—	—	—	—	Dunn	Audubon WMD	Lake Ilo G-6 Dam	—	—	1.40	—
—	—	—	—	Dunn	Audubon WMD	Lake Ilo A-6	—	—	0.20	—
—	—	—	—	Dunn	Audubon WMD	Lake Ilo G-5 Dugout	—	—	0.80	—
—	—	—	—	Dunn	Audubon WMD	Lake Ilo G-5 Channel Dam	—	—	1.50	—
—	—	—	—	Slope	Audubon WMD	White Lake G-2 Dugout	—	—	0.60	—
—	—	—	—	McLean	Coal Coulee WDA	—	Fish, wildlife	—	—	—
—	—	—	—	Sheridan	Goodrich WDA	Dikes	Fish, wildlife	—	—	—
—	—	—	—	McLean	Heckers Lake WDA	—	Fish, wildlife	—	—	—
—	—	—	—	Sheridan, Wells	Johnson Lake WDA	—	Fish, wildlife	—	2,591.00	—
—	—	—	—	McLean	Koenig WDA	Muskrat Wetland #2	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Cattail Wetland #207	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Gravel Pit Wetland #154	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Cattail Wetland #215	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Willow Wetland #519	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Laibs Marsh #49	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Seepage Wetlands #551, 562, 730	Fish, wildlife	—	—	—

Table 5. Water Rights for Audubon Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	—	—	McLean	Koenig WDA	Cattail Wetland #3	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Dave's Wetland	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Sump Wetland	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Hippie Slough	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Sectionline Slough	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Droplog Wetland	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Cattail Wetland #2	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Fisher Lake	Fish, wildlife	—	—	—
—	—	—	—	McLean	Koenig WDA	Gravel Pit Wetland #173	Fish, wildlife	—	—	—
—	—	—	—	McLean	Lake Holmes Outlet WDA	Pool 2	Fish, wildlife	—	42.40	—
—	—	—	—	McLean	Lake Holmes Outlet WDA	Pool 5	Fish, wildlife	—	86.20	—
—	—	—	—	McLean	Lake Holmes Outlet WDA	Pool 6	Fish, wildlife	—	57.40	—
—	—	—	—	McLean	Lake Holmes Outlet WDA	Pool 4	Fish, wildlife	—	90.80	—
—	—	—	—	McLean	Lake Holmes Outlet WDA	Pool 3	Fish, wildlife	—	10.80	—
—	—	—	—	McLean	Lake Holmes Outlet WDA	Pool 1	Fish, wildlife	—	29.40	—
—	—	—	—	McLean	Lake Williams North WDA	—	Fish, wildlife	—	—	—
—	—	—	—	McLean	Lake Williams South WDA	—	Fish, wildlife	—	—	—
—	—	—	—	Sheridan	Lincoln Valley South WDA	—	Fish, wildlife	—	—	—
—	—	—	—	McLean	Lost Lake West WDA	—	Fish, wildlife	—	—	—
—	—	—	—	Wells	Pony Gulch WDA	—	Fish, wildlife	—	—	—
—	—	04499	7/22/1991	Ward	Rovig WPA	Dam	Fish, wildlife	—	108.50	46.50
—	—	04500	7/22/1991	Ward	Rovig WPA	Dam	Fish, wildlife	—	47.00	16.90
—	—	—	—	McLean	Turtle Creek 2 WDA	—	Fish, wildlife	—	—	—

Table 5. Water Rights for Audubon Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	—	—	McLean	Turtle Creek 3 WDA	—	Fish, wildlife	—	—	—
—	—	—	—	McLean	Turtle Lake 1 WDA	Central Marsh	Fish, wildlife	—	—	—
—	—	—	—	McLean	Turtle Lake 2 WDA	Nygaard Slough	Fish, wildlife	—	—	—
—	—	—	—	McLean	Turtle Lake 2 WDA	Overflow Wetlands 1, 2, 3	Fish, wildlife	—	—	—
—	—	—	—	McLean	Turtle Lake 2 WDA	Hanson Hay Slough	Fish, wildlife	—	—	—
—	—	—	—	McLean	Turtle Lake 3 WDA	Turtle Lake	Fish, wildlife	—	—	—

Table 6. Water Rights for Chase Lake Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	01720	6/23/1970	Wells	Crystal Lake WPA	Dike	Fish, wildlife, recrea-tion	—	37.80	10.50
—	—	03986	6/21/1988	Sheridan, Wells	Indian Hills WDA	Dikes	Fish, wildlife	—	74.00	29.00
—	—	03985	6/21/1988	Sheridan, Wells	Indian Hills WDA	Dikes	Fish, wildlife	—	31.00	9.00
—	—	01481	9/14/1967	Stutsman	Mt. Moriah WPA	Dike	—	—	171.00	162.00
—	—	03962	3/3/1988	Wells	Pipestone WDA	Dike	Fish, wildlife	—	105.30	52.40
—	—	01361	4/19/1966	Stutsman	Thiesen Marsh WPA	Dike	Fish, wildlife, recrea-tion, stock	—	32.00	51.00
—	—	01339	11/17/1965	Stutsman	Vashti WPA	Dikes	Stock, wildlife	—	49.00	45.00
—	—	05229	3/2/1998	Stutsman	Woodworth Station WPA	Dike, water control structure	Fish, wildlife	—	18.10	10.00

Table 7. Water Rights for Devils Lake Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	03924	6/9/1987	Ramsey	Avocet Island WDA	Dam	Fish, wildlife	—	290.00	104.00
—	—	—	—	Towner	Big Coulee WDA	Dikes	Fish, wildlife	—	—	—
Yes	—	—	9/1/1934	Cavalier	Billings Lake WPA	Dam, dikes	Fish	—	216.00	216.00
—	—	03543	3/19/1982	Cavalier	Billings Lake WPA (center)	Stop log	Fish, wildlife	—	60.00	54.00
—	05256	—	4/20/1998	Cavalier	Billings Lake WPA (north)	Dam	Fish, wildlife	—	39.00	24.00
—	—	04981	2/12/1996	Cavalier	Edwards WPA (Dike 1)	Dam	Fish, wildlife	—	34.37	31.92
—	—	04982	2/12/1996	Cavalier	Edwards WPA (Dikes 2, 3)	Dam	Fish, wildlife	—	154.45	74.56
—	—	04468	5/8/1991	Walsh	Forest River WPA	Dike	Fish, wildlife	—	311.00	91.30
—	—	—	—	Nelson	Goose River WDA	17 dikes	Fish, wildlife	—	—	—
—	—	03905	1/26/1987	Grand Forks	Hofer WPA	Dam	Fish, wildlife	—	66.00	20.30
—	—	03049	2/27/1978	Benson	Hofstrand Lake WPA	Dam	Fish, wildlife	—	1,425.00	1,425.00
—	05425	—	4/14/2000	Towner	Kitsch WPA	Dam	Fish, wildlife		69.20	61.00
—	05439	—	5/22/2000	Towner	Kitsch WPA, McLaughlin Lake	Pump	Fish, wildlife	10,000 gpm*	69.20	—
—	—	—	—	Ramsey	Kneeling Moose WDA	Dikes, water control structure	Fish, wildlife	—	—	—
—	—	—	—	Ramsey	Lake Alice WDA	—	Fish, wildlife	—	—	—
—	—	—	—	Cavalier	Mulberry Creek WDA	Dikes	Fish, wildlife	—	—	—
—	—	04814	10/20/1994	Towner	Nikolaisen WPA	Dam	Fish, wildlife	—	13.00	13.00
—	—	04813	10/20/1994	Towner	Nikolaisen WPA	Dam	Fish, wildlife	—	48.40	48.40
—	—	—	—	Benson	Rolling Rock WDA	—	Fish, wildlife	—	—	—
—	—	—	—	Nelson	Rugh Lake WDA	Dikes	Fish, wildlife	—	—	—
—	—	—	—	Cavalier	Storlie WDA	—	Fish, wildlife	—	—	—

Table 7. Water Rights for Devils Lake Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	04469	5/9/1991	Grand Forks	Turtle River WPA	Dike	Fish, wildlife	—	122.00	75.90
—	—	04730	11/8/1993	Cavalier	Weaver WPA	Dam	Fish, wildlife	—	63.10	43.50
—	pending	—	—	Cavalier	Wengeler South WPA	Dam	Fish, wildlife	—	34.30	14.80
—	—	03482	4/12/1982	Cavalier	Wengeler WPA, Phase 1	—	Fish, wildlife	10,000 gpm	55.37	—
—	—	04608	6/5/1992	Cavalier	Wengeler WPA, Phase 1	Dam	Fish, wildlife	10,000 gpm	14.63	30.40
—	—	04804	8/19/1994	Cavalier	Wengeler WPA, Phase 2	Dam	Fish, wildlife	—	47.60	42.80
—	—	04902	5/5/1995	Cavalier	Wengeler WPA, Phase 3	Dam	Fish, wildlife	10,000 gpm	174.00	60.00

**gpm=gallons per minute.*

Table 8. Water Rights for J. Clark Salyer Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	05021	—	5/31/1996	Renville	Brudvik WPA	Dam	Fish, wildlife	—	200.00	280.00
—	—	03806	6/28/1985	Bottineau	Holsten Slough WPA	Slough	Fish, wildlife	50 cfs*	180.00	334.00

**cfs=cubic feet per second.*

Table 9. Water Rights for Valley City Wetland Management District, North Dakota.

Declaration of Filing	*Conditional Permit Number*	*Perfect Water Permit Number*	*Priority Date*	*County*	*Area*	*Structure Type*	*Use*	*Flow Rate*	*Storage Acre-feet*	*Seasonal Acre-feet*
—	—	01362	4/25/1966	Steele	Fullers Lake WPA	Dam, stop logs	Fish, wildlife, recreation, flood control	—	1,044.00	1,218.00

Air Quality

Air quality receives protection under several provisions of the Clean Air Act, including the national ambient air quality standards (NAAQS) and the prevention of significant deterioration program. The NAAQS include maximum allowable pollution levels for particulate matter, ozone, sulfur dioxide, nitrogen dioxide, lead, and carbon dioxide.

North Dakota is one of only a handful of states that meets all the NAAQS, given the title of "Attainment." Attainment status is based on data collected through an ambient air-monitoring network, which has various sites throughout the state. North Dakota is rural, with monitoring data stations throughout the state. Although the data is not on a county-by-county basis, data collected in one county is representative of other areas. North Dakota has energy facilities operating in the central part of the state and oil and gas activity in the western portion of the state. Even with the influence of the energy production activity, North Dakota still has some of the cleanest air in the nation. Some of the monitoring locations are in North Dakota's class 1 areas, which include the three units of Theodore Roosevelt National Park and the Service's Lostwood Wilderness (Terry O'Clair, director, division of air quality, North Dakota Department of Health; personal communication; August 10, 2007).

Prescribed burning is the management activity that has the greatest effect on air quality (find more information in the descriptions of the fire management programs in appendixes E and F). Planning for use of prescribed fire incorporates the management of smoke. To the extent possible, suppression of wildfires also addresses smoke management. The Service identifies sensitive areas and takes precautions to safeguard visitors and local residents. Smoke dispersal is a consideration in determining whether a prescribed burn is within prescription. Generally, the fine-grass fuels and small burn size (80–600 acres) generate low volumes of smoke for short durations (4–5 hours).

4.2 Biological Resources

This section contains descriptions of the vegetative communities and wildlife at the districts. The vegetation section includes discussions about invasive plants, fire, and grazing, each of which has a major influence on native vegetative communities.

Vegetative Communities

Prairies, or grasslands, in North Dakota and throughout the Great Plains have been gaining public interest over the last few years as more people become aware of their decline (see table 10). Before the 1870s, prairies covered more than a third of the United States and almost all of North Dakota. What once was a mosaic of grasses and forbs (flowering plants) where bison roamed is now predominantly agricultural land. With the arrival of increasing numbers of settlers in the late 1800s, the landscape started to change and continued to change at such a great extent that now only one-half of a percent of those areas in the United States remain.

Table 10. Prairie Decline in North Dakota.

Prairie Type	*Historical Acreage*	*Present Acreage*	*% Decline*
Mixed grass	35,088,200	11,119,500	68.3
Tall grass	321,230	297	99.9

Source: National Wildlife Federation (2001).

A combination of factors is to blame for this loss. Large-scale agriculture and intensive grazing are often criticized but fire suppression, introduction of invasive plants, altered hydrology, and modified animal communities have contributed. The loss of diversity and distribution of prairie grass and forbs are of great concern, but it is not just plants that have suffered. Grasslands not only provide primary nesting habitat for a variety of bird species, but also are very important staging and feeding areas for waterfowl and shorebirds during long migratory flights. In addition, prairies provide an important food source for small mammals and insects that, in turn, support larger wildlife species. From a human standpoint, prairies can help to maintain clean air and water, control erosion, provide rich soil, are rich in history and folklore, and provide community income from wildlife-related recreation and tourism. All this combined makes it easy to see why prairies are considered the most endangered ecosystems.

Historically, North Dakota was predominantly mixed-grass prairie in the southwest and tall-grass prairie in the northeast. As the total annual precipitation increases eastward across the state, conditions allow for taller, more robust grasses. Today, some of the best places to find prairie plants in North Dakota are federal grassland refuges, state-owned land, railway rights-of-way, ditches, old cemeteries, pastures, and private property throughout the Missouri Coteau in the central and western parts of the state (Grondahl and Evelsizer 2002).

Many prairie birds currently show population declines. The western prairie fringed orchid is now a rare flower of the tall-grass prairie; its habitat occurs at Devils Lake and Valley City wetland management districts. The Dakota skipper butterfly is another prairie inhabitant whose numbers are decreasing. Each of these declines is directly related to the loss of prairie.

Prairie provides important values to people. It contains dozens of wildlife species, hundreds of different plants, and thousands of insects. These species provide genetic diversity important to agriculture and medicine. Planted grasslands do not begin to match the diversity found in native prairie.

In addition to its importance to wildlife, prairie is also crucial for soil and water conservation. Prairie provides a reminder of the nation's rural and pioneer heritage; it provides recreational activities such as hunting, hiking, and bird watching; and it offers living laboratories for scientific research. Prairie also provides economic benefits through cattle grazing, haying, and native seed harvesting. When prairie is lost, the nation's natural heritage is lost, along with a valuable resource (North Dakota Parks and Recreation Department, no date).

Mixed-grass Prairie

The mixed-grass prairie is one of the largest ecosystems in North America, with significant areas preserved for natural values in national wildlife refuges, WPAs, state game management areas, and nature preserves (Johnson 2006a). The predominant grassland vegetation within the mixed-grass prairie is prairie Junegrass, little bluestem, needle and thread, blue grama, green needlegrass, porcupine grass, prairie cordgrass, northern reedgrass, plains muhly, western wheatgrass, and Kentucky bluegrass (NDGF 2005).

One can envision the short-grass and tall-grass prairies intergrading just east of an irregular line that runs from northern Texas through Oklahoma, Kansas, and Nebraska, and then northwestward into west-central North Dakota and South Dakota. The perimeter is not well defined because of the array of short-stature, intermediate, and tall-grass species that make up an ecotone between the short-grass and tall-grass prairies (Bragg and Steuter 1996). In general, the mixed-grass prairie is characterized by the warm-season grasses of the short-grass prairie to the west and the cool- and warm-season grasses (which grow much taller) to the east. Because of this ecotonal mixing, the number of plant species found in mixed-grass prairies exceeds that in other prairie types. Estimated declines in area of native mixed-grass prairie, although less than those of the tall-grass prairie, range from 30.5% in Texas to more than 99.9% in Manitoba (Austin 1988).

The landscape component across the districts includes the mixed-grass prairie of the Missouri Coteau and associated wetlands. This area marks the boundary of the western limits of glaciation in North Dakota. The hummocky, rolling hills of the Missouri Coteau dramatically rise 150–500 feet above the Drift Prairie. A high concentration of wetlands are present, roughly 800,000 basin acres. Alkaline lakes are also more prevalent here. Streams and rivers are nearly absent as are upland deciduous forests, but tracts of aspen parkland occur in the north. A considerable amount of native prairie remains, and this area provides primarily for cattle grazing. Areas of reduced slope, particularly the western edge, have been converted to cropland for small grains, sunflowers, corn, and alfalfa hay land. The coteau is known for supporting some of the highest numbers of breeding ducks in North America. Due to the large amount of grassland and wetland that remains

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North Dakota's unbroken prairie.

or has been restored, this area is especially crucial to many other species and constitutes the focus area, Missouri Coteau Breaks. Much of the coteau is classified as "good" to "outstanding" for wind energy potential, which could pose the threat of habitat fragmentation. Irrigation and new advances in cropland could allow farming of native prairie. There is established oil and gas activity in the extreme northwest.

Tall-grass Prairie

Tall-grass prairie is the wettest of the grassland types and predominantly contains sod-forming bunchgrasses. Like other grasslands, the tall-grass prairie has species originally from different geographical sources (Sims 1988). Grassland groupings of the tall-grass prairie are (1) the bluestem prairie from southern Manitoba through eastern North Dakota and western Minnesota south to eastern Oklahoma, and (2) the wheatgrass, bluestem, and needlegrass area from south-central Canada through east-central North Dakota and South Dakota to southern Nebraska. The predominant grass vegetation within this area is big bluestem, little bluestem, switchgrass, Indiangrass, prairie dropseed, slender wheatgrass, porcupine grass, mat muhly, fescue sedge, and meadow sedge.

Since 1830, there have been estimated declines of 82.6%–99% in tall-grass prairie within specific states and provinces. These declines exceed those reported for any other major ecological community in North America (Samson et al. 1998).

Less than one-tenth of 1% of all tall-grass prairie in North Dakota lies intact. Nationwide, just 1% remains. No other major ecosystem on the North American continent—not Pacific Northwest old-growth forest, not tundra, not southwestern desert, not eastern deciduous forest—has been so fully altered by people (Domek 1998).

Located in southeastern North Dakota (Richland and Ransom counties), the 70,000-acre Sheyenne grassland straddles the ancient Sheyenne River Delta, where prehistoric meanderings of the river flowed into the

glacial Lake Agassiz-forerunner to the Red River Valley. Just a century ago, this area hosted native grasses, some as high as a human: big bluestem, switchgrass, Indiangrass, and prairie cordgrass (Domek 1998).

Prairie landscapes are shaped by disturbance regimes such as drought, fire, and grazing. That meant wildland fire and bison 130 years ago. On the tall-grass prairie, fire probably played a larger role than did bison in shaping the vegetative mosaic. Fire would sweep through the area every 3–5 years, burning plant material, and thus recycling nutrients into the soil and setting the stage for diverse, healthy plant growth (Domek 1998).

The tall-grass prairie and associated wetlands within the districts were historically found predominantly in the eastern one-fourth of North Dakota. The Red River of the North forms the state line between North Dakota and Minnesota. This area is referred to as the Red River Valley. Until just 10,000 years ago, a large glacial lake named Lake Agassiz covered this area. The flat topography and rich soil of the glacial Lake Agassiz basin provides for excellent but intensive agricultural production including potatoes, beans, sugar beets, corn, and wheat. By the 20th century, much of the tall-grass prairie had been converted to farmland. Few tracts of native vegetation remain; places where small natural areas remain intact are remnants of Lake Agassiz. The shoreline of Lake Agassiz created diagonal striations of sand and gravel a few feet high that are visible in aerial and satellite imagery. The Red River Valley has few wetlands compared with the mixed-grass prairie to the west, with roughly 150,000 total wetland basin acres. Farmland with woodlot and shelterbelt plantings is now prevalent, particularly in Grand Forks County (NDGF 2005).

Initially the Service focused on protection of wetlands in the Prairie Pothole Region. However, data also revealed the importance of upland grasslands to successful nesting of waterfowl. With the continued conversion of grassland to cropland and consistent declines in the populations of grassland-dependent birds, the need to protect adjacent grassland habitats became evident. Like a wetland easement, a grassland easement transfers limited perpetual rights to the Service for a one-time, lump-sum payment. The purpose of a grassland easement is to prevent the conversion of grassland to cropland while minimally restricting existing agricultural practices.

More specifically, the purposes of the grassland easement are

- to improve the water quality of wetlands by reducing soil erosion and the use of chemicals and fertilizers on surrounding uplands;
- to improve upland nesting habitat for all ground-nesting birds, especially waterfowl, and enhance nesting success on private lands;
- to perpetuate grassland cover established by other federal programs (for example, the Conservation Reserve Program);
- to provide an alternative to the purchase of uplands in fee title, thus maintaining lands in private ownership.

Bluestem.

Grassland easements restrict the landowner from altering the grass by digging, plowing, disking, or otherwise destroying the vegetative cover. Haying, mowing, and seed harvest is restricted until July 15 of each year. The landowner can graze without restriction.

Initially, the tracts in all districts that were considered for a grassland easement were on native prairie, at least 160 acres in size, and situated in an area supporting at least 40 waterfowl pairs per square mile. Most of the native grassland fitting these criteria lies within the Missouri Coteau. The first grassland easement within the nine-district area was in acquired in Chase Lake Wetland Management District (Stutsman County; tract 558G, 1; 520 acres) on November 7, 1990. To date, 556 grassland easements have been bought covering 243,130 acres in the districts.

Wetland Habitat

Wetlands once covered about 4.9 million acres of North Dakota—11% of the state. By the 1980s, the acreage had decreased to about 2.7 million acres, a loss of about 45%. Most of the losses have been caused by drainage for agricultural development. The rate of agricultural conversions in the future will likely depend on crop prices and other economic factors. Most of North Dakota's wetlands are prairie potholes, which provide nesting and feeding habitat for migratory waterfowl and wading birds. About one-half the nation's duck population originates in the Prairie Pothole Region of North Dakota and other prairie states.

Prairie potholes, or sloughs, are water-holding depressions of glacial origin that occur in 300,000 square miles of prairies in north-central United States and south-central Canada. These potholes provide the most productive wetland habitat for waterfowl in North America. Although comprising only 10% of the continental waterfowl breeding, the Prairie Pothole Region produces about 50% of the duck crop in an average year and much more in bumper years. Potholes also furnish water for other wildlife and livestock (USGS 2007).

Turtle Mountains

The Turtle Mountains are located in the extreme north-central extent of the Drift Prairie. This landform is known as an erosional outlier and covers nearly 1,000 square miles and rises 800 feet above the surrounding landscape (NDGF 2005).

Forested habitats are found in only a few locations in North Dakota, and they do not cover large contiguous areas. A majority of the forest habitat is in riparian zones. The Turtle Mountains and a forested section of northeastern North Dakota contain some of the largest stands of aspen and bur oak in the state (NDGF 2005).

Aspen and oak make up 42% of North Dakota's forested lands. Aspen is the dominant forest species, but bur oak, balsam poplar, boxelder, green ash, and paper birch are also present. Shrubs associated with this forest type are beaked hazel, highbush cranberry, juneberry, chokecherry, and raspberry. These stands are often associated with lakes, wetlands, and grassy meadows (NDGF 2005).

Invasive Plants

North Dakota has designated the invasive plants in table 11 as noxious weeds because they pose serious threats to agriculture and the environment. The North Dakota Weed and Pest Control Commission has designated certain weeds as noxious because of their difficulty to control and the costs associated with loss of agricultural production. All of the state-listed noxious weeds were introduced from other ecosystems and have flourished in the absence of natural controls.

Control of state-listed noxious weeds is a priority for the Service. However, many other invasive plants are threatening wildlife habitat and interfering with the Service's management objectives. District staffs deal with these species on a case-by-case basis, depending on available money, time, and resources.

The "North Dakota Department of Agriculture Cooperative Weed Management Plan–January 2004" identifies nine goals:

1. Prevent the introduction, reproduction, and spread of designated noxious and invasive nonnative plants into North Dakota.
2. Develop cooperative weed management partnerships with public and private partners to attack shared weed problems.
3. Carry out the most effective, economical, and environmentally appropriate weed control methods for the target weeds.

Table 11. State-listed Noxious Weeds Found at Waterfowl Production Areas in North Dakota.

Common Name	*Scientific Name*	*State-listed Noxious Weed*	*Invasive Characteristics*	*Present on Service Lands*
Canada thistle	*Cirsium arvense*	Yes	Yes	Yes
musk thistle	*Carduus nutans*	Yes	Yes	Yes
absinth wormwood	*Artemisia absinthium*	Yes	Yes	Yes
leafy spurge	*Euphorbia esula*	Yes	Yes	Yes
purple loosestrife	*Lythrum salicaria*	Yes	Yes	No
Dalmatian toadflax	*Linaria genistifolia* ssp. *dalmatica*	Yes	Yes	No
diffuse knapweed	*Centaurea diffusa*	Yes	Yes	No
Russian knapweed	*Acroptilon repens*	Yes	Yes	No
saltcedar	*Tamarix ramosissima*	Yes	Yes	Yes
spotted knapweed	*Centaurea maculosa*	Yes	Yes	Yes
yellow star-thistle	*Centaurea solstitialis*	Yes	Yes	No
field bindweed	*Convolvulus arvensis*	Yes	Yes	Yes

4. Carry out an early detection and rapid response system; this will include mapping and control of infestations.
5. Reduce the extent and density of established weed infestations to the point that economic and environmental impacts are minimized or eliminated.
6. Educate and inform the public, private landowners, public land managers, and decision makers about invasive weeds and their economic and environmental impacts.
7. Coordinate and standardize the mapping of infestations of all noxious and invasive weeds in North Dakota, and develop and maintain a database of noxious and invasive weed infestations.
8. Seek voluntary compliance with North Dakota weed laws. When necessary, apply enforcement of these laws in a fair and consistent manner.
9. The Service's "North Dakota Integrated Pest Management Plan" will be reviewed for possible modification to incorporate the state's goals that fit with Service policy, goals, and objectives of habitat management.

Invasive plants on Service lands have reduced wildlife habitat and biodiversity. The presence of invasive plants can alter the functioning of ecosystems by loss of wildlife habitat, displacement of native species, change in carrying capacity from reduced forage production, lower plant diversity, and increased soil erosion and sedimentation. These plants are not only problematic on the Service's fee-title lands, but invasive plants infest rangelands and croplands across North Dakota. The spread of invasive plants occurs by root spread or by seed dispersal via wind, water, district visitors, humans, equipment, or animals.

Fire

Historically, grasslands in the northern Great Plains co-evolved with various disturbance regimes such as fire and large-mammal grazing. Whether lightning-induced or deliberately set by Native Americans, historical fires have influenced the composition of the plant communities. A handful of fire-tolerant shrubs such as chokecherry, American plum, and leadplant were present, while other fire-sensitive woody species were restricted to areas that were protected from fire. A number of grass and forb species dominated the plant communities.

It is estimated that the historical wildland fire frequency for the North Dakota prairie was 5–7 years (Bragg 1995), although little information is available on the occurrence of fire during the early years on each of the districts. Potential exists for large wildland fires to occur; however, this has generally not been the case.

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Prescribed fire is an important tool for keeping grasslands healthy.

Local fire departments and area ranchers aggressively suppress wildfire. It is also the districts' policy to control all wildfires occurring on Service lands.

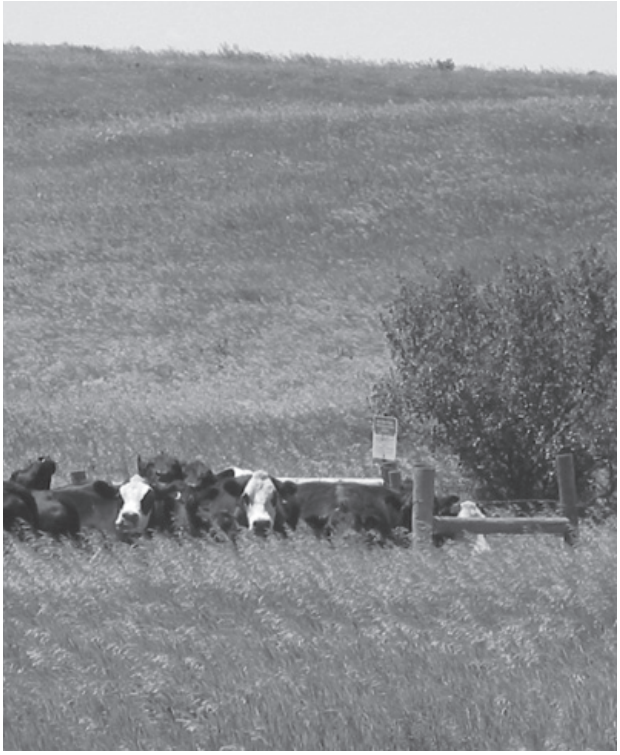
The district staffs use prescribed fire to simulate the historical influence wildland fire had on plant communities. Historically, wildfires likely would have occurred during the summer and fall. Most prescribed fires are applied in spring through early summer or in early fall to allow for some recovery of vegetation before winter. These periods present opportunities to use fire to manage invasive cool-season grasses, open up shorelines and vegetation-choked wetlands, and provide areas of green browse attractive to migratory waterfowl. During the last 15 years, prescribed fire has been increasingly used.

The combination of prescribed burning and grazing is a practice used to reduce the accumulation of organic litter. A fire creates a "flush" growth of new vegetation, which is then grazed to extend treatment of problem plants such as Kentucky bluegrass and smooth brome. Invasive plants including Canada thistle, absinth wormwood, and leafy spurge can be managed similarly. The districts have occasionally used this management strategy; however, the strategy shows promise for more frequent use in the future. Overall guidance for use of prescribed fire and management of wildland fire is in the descriptions of the fire management programs (appendixes E and F).

Grazing

Grazing greatly influences the structure and composition of grassland communities. Herbivores such as bison, elk, deer, pronghorn, and black-tailed prairie dog interact with soils, plants, other animals, and other processes to produce unique successional patterns in the northern Great Plains landscape at multiple scales.

Most plant species have growing points located at or near the ground surface, which allows the plant to be clipped off without killing it. Some contain bitter or toxic substances that cause animals to avoid grazing



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The districts use grazing in the uplands during spring and early summer and again in the fall.

on them. Some species have spines to cause injury to grazing animals' mouths. It is likely that herds of bison historically spent a considerable amount of time grazing native prairie found in the nine districts. Their grazing, trampling, trailing, and related activities likely had a significant effect on the development and maintenance of certain plant communities.

Free-ranging bison and elk are no longer present within the districts. Instead, district staffs work with local ranchers to mimic natural disturbances through livestock grazing. Seasonal grazing of the uplands stresses the invasive cool-season grasses and favors native grasses and forbs. The timing of grazing is also used to stress invasive plants and is prescribed seasonally during periods when specific plants are most palatable to livestock.

Wetland grazing reduces accumulations of organic litter at the surface. A large amount of organic litter often favors invasive plants such as Canada thistle. Grazing can also be used as part of an integrated pest management (IPM) program. Follow-up treatments tend to be easier to complete and are more effective after grazing.

Wildlife

This section describes the birds and mammals that are common within district lands, as well as the threatened and endangered species that occur in North Dakota and have habitats in district lands. Strategic planning for waterfowl is also described.

Birds

Lush, pristine, grasslands and wetlands that are dominated by a rich assortment of native grasses and sedges occur throughout the districts. This diverse grassland landscape holds an impressive concentration of waterfowl, shorebirds, and other open-water bird species. Within the upland prairie grassland, many species of raptors and songbirds breed and are widely distributed on protected district lands—making North Dakota a primary destination for outdoor enthusiasts. Bird species that occur at the districts are listed in appendix G.

Three vegetative groups distinguish the districts—mixed-grass prairie, tall-grass prairie, and the Turtle Mountains—and embrace a suite of primary and secondary bird species that are associated with each "area (see appendix H). These areas are defined primarily based on major proportional differences in prominence of plant and animal groups. The following text is from "Breeding Birds of North Dakota" (Stewart 1975).

Mixed-grass Prairie

Bird habitats of the mixed-grass prairie include a variety of shallow basin wetland, constructed wetlands, isolated small tracts of deciduous forest, and residential areas. Fluviatile (of river origin) wetlands include permanent and intermittent streams and their associated oxbows. Constructed wetlands are represented by stock ponds, dugouts, large shallow-stream impoundments, reservoirs, and sewage lagoons. Deciduous forests include (1) narrow bands of floodplain forest along the Sheyenne, James, and Mouse rivers and their tributaries, (2) local upland forests on river bluffs and high moraines and along margins of permanent lakes, (3) scattered thickets of small trees or aspen groves on the prairie, and (4) tree claims, shelterbelts, and other wooded habitats established by humans. Farmsteads, towns, and city suburbs commonly represent the partially wooded residential areas.

The breeding birds are mostly upland and wetland species that are characteristic of the north-central avifauna (bird species found in a particular geographic region), including endemic (restricted to a geographic region) and pandemic (prevalent over a region) species. Species typical of the eastern avifauna are common along permanent streams and in other wooded habitats on the northeastern and southern Drift Plains, but occur more sparingly elsewhere. Small local populations of a few species that belong to the western and northern avifaunas also occur in this area.

The characteristic breeding birds of this area include 16 primary species, 52 secondary species, and 79 tertiary species. The primary and secondary species in mixed-grass prairie are listed in appendix H.

Tall-grass Prairie

Because of the high fertility of the soils, agricultural development has modified nearly all of the cultivable land within the tall-grass prairie. Only a few, small, remnant tracts of the original, climax, tall-grass prairie remains. Large expanses of cropland are common throughout. The principal crops are small grains (chiefly wheat), corn, potatoes, sugar beets, soybeans, and sunflowers. Occasional narrow bands of floodplain forest along some of the larger streams break up the monotypic habitat. Brushy open woodlands that adjoin tracts of a distinct, sparsely vegetated type of prairie also occur on the limited areas of deltaic sand. In addition, wooded habitats established by people—including tree claims, shelterbelts, and landscaped yards—are found near farmsteads, towns, and city suburbs. Wetland habitats in this area include streams and associated oxbows, and a few widely scattered ponds and marshes.

The breeding birds are dominated by upland, pandemic species of the north-central avifauna in association with many species of the eastern avifauna. In addition, a few species of the northern avifauna and two species of the western avifauna (western kingbird and Brewer's blackbird) are common.

The characteristic breeding birds are categorized according to relative abundance and include 6 primary species that are often common or abundant, 29 secondary species that are fairly common, and 78 tertiary (minor) species that are uncommon or rare. The primary and secondary species for tall-grass prairie are listed in appendix H.

Turtle Mountains

Within this small, unique portion of North Dakota, natural basin wetlands are numerous and include many, deep, permanent ponds and lakes as well as many wetlands that are temporary, seasonal, or semipermanent. Swamps dominated by shrubs or trees are numerous. Other habitats of local significance include farmsteads and residential resort areas on some of the larger fishing lakes.

The main breeding birds are a mixture of species that typify the north-central and eastern avifaunas. Large populations of northern avifaunal species are common, and very limited numbers of five species of the western avifauna (turkey vulture, western kingbird, black-billed magpie, mountain bluebird, and Brewer's blackbird) are present.

The characteristic breeding birds in the Turtle Mountains include 19 primary species, 54 secondary species, and 60 tertiary species. The primary and secondary species for this area are listed in appendix H.

Strategic Planning for Waterfowl

Waterfowl habitat protection and restoration are the primary emphases of the wetland management districts. With strategic planning, the Service can make decisions on what habitats need protection and what landscapes have the greatest value to the health of waterfowl populations.

The Service's Habitat and Population Evaluation Team (HAPET) in Bismarck, North Dakota, conducts research and develops predictive models. Through the HAPET's research and modeling of the Prairie Pothole Region of North Dakota, the Service can predict duck pair density. This modeling tool provides the Service with information needed to conserve and restore wetland and grassland landscapes that will benefit waterfowl and other bird species. The Service bases its protection priority for wetland and grassland habitat on this modeling effort.

The Service's goal is to protect habitat capable of supporting 25 or more breeding duck pairs per square mile. Figure 8 shows the predicted concentrations of duck pairs throughout the districts. The coteau across North Dakota has the highest predicted concentrations, with up to 100 or more duck pairs per square mile. Consequently, district managers can prioritize habitat protection and management for WPA lands.

The Service uses ranking criteria to determine high, medium, and low priorities for management of WPAs in the districts.

Priority	
High	Meets minimum thresholds for at least three criteria.
Medium	Exceeds the minimum threshold for two criteria.
Low	Meets one criterion.

North Dakota's wetland management districts occur within various major landforms (for example, Missouri Coteau). The districts' WPAs vary in size, proportion of upland and wetland habitat, and surrounding land use (for example, cropland versus grassland). As such, each WPA has unique attributes that can be used to rank it relative to other WPAs within a district. Because each district is unique, specific thresholds need to be developed for each of the criterion below. WPAs purchased or managed for threatened and endangered species are exempt from this ranking process and are given high priority.

Criteria

1. *Waterfowl Pair Density.* Priority is given to WPAs within landscapes that support high densities of breeding waterfowl.

   These areas are spatially defined in available GIS databases, based on models that factor in the type and density of wetlands, developed by the HAPET.

   Example:

   WPAs in Audubon Wetland Management District have a higher ranking if they support >40 pairs of breeding waterfowl per square mile (see figure 8).

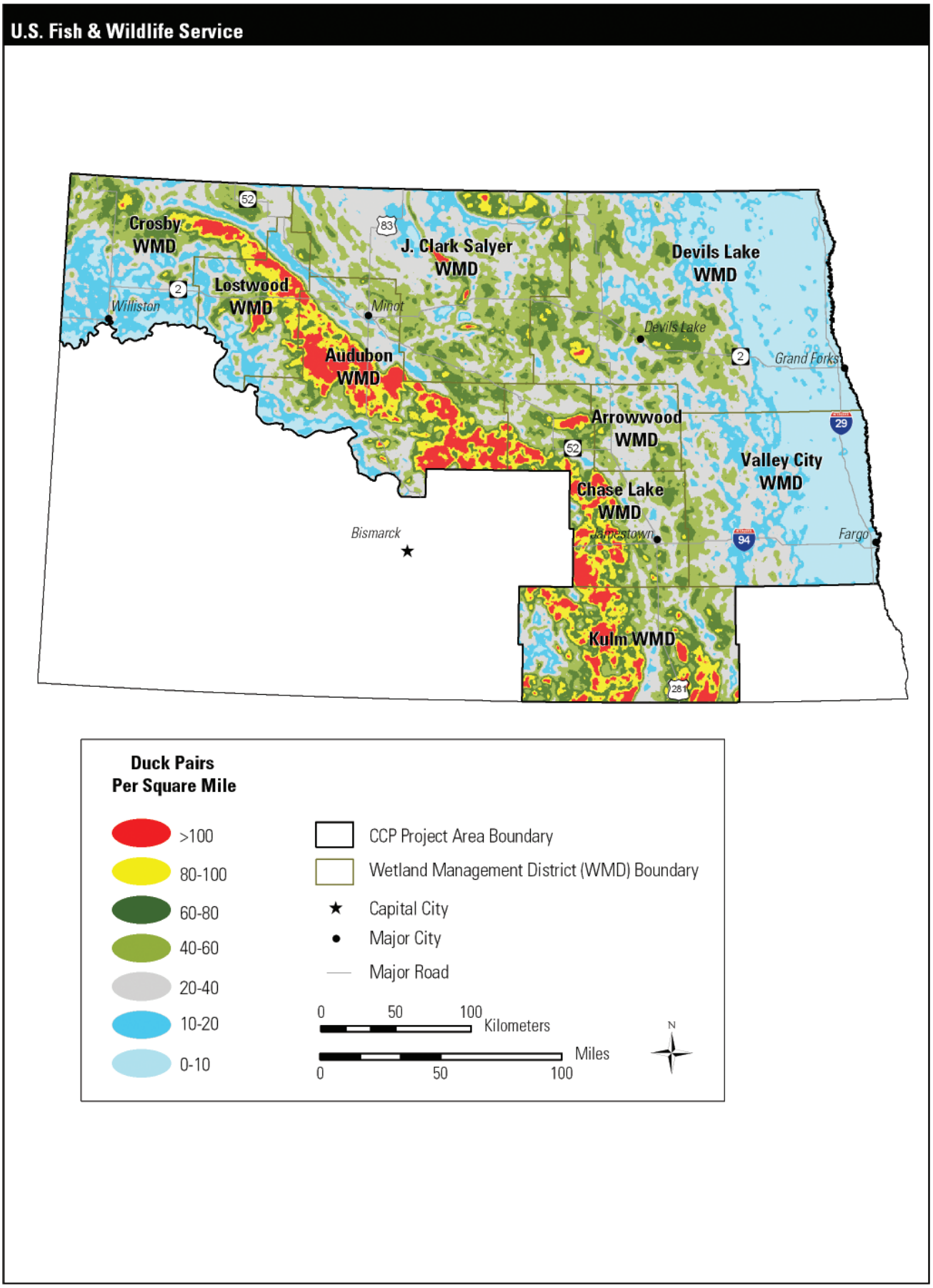

Figure 8. Map of the predicted duck-pair concentrations in the nine districts, North Dakota.

2. *Landscape Context.* Priority is given to WPAs within "conservation areas."

   Conservation areas (spatially defined through GIS databases developed by the HAPET) recognize landscape-level juxtaposition of wetland and grassland habitats that support characteristic species.

   Example:

   WPAs have a higher ranking if they are within grassland bird conservation areas (see figure 9).

3. *WPA Size.* Priority is given to large WPAs.

   Many wetland- and grassland-dependent species of wildlife prefer large patches of habitat. Regardless of surrounding land use, large WPAs are more valuable than small WPAs because they can be easier to manage and support a more diverse assemblage of plants and animals.

   Example:

   WPAs in Devils Lake Wetland Management District have a higher ranking if they are >125 acres in size.

4. *Ecological Integrity.* Priority is given to large tracts (independent of WPA size) of native prairie that is dominated by native grasses and forbs.

   WPAs dominated by native sod, without a previous cropping history, usually support more diversity of grassland-dependent species of wildlife. However, many areas of native sod are badly infested with undesirable plants and, thus, are less valuable and more costly to manage. By 2008, the vegetative composition of all Service-owned native sod >40 acres in North Dakota will have been inventoried.

   Example:

   WPAs in J. Clark Salyer Wetland Management District have a higher ranking if they have >80 acres of native prairie comprised of >30% native grasses and forbs and <40% smooth brome.

A 2007 report by the Government Accounting Office analyzed the effectiveness of Service acquisitions under the WPA program. As a result, the Service recently completed a "decision tree" matrix that outlines how to set priorities for grassland and wetland acquisitions. The details of this prioritization can be found in chapter 6 (6.3 Goals, Objectives, Strategies, and Rationale; Wetlands in Easements Objective 1; Uplands in Easements Objective 1) and appendix I.

Strategic planning increases the likelihood of making cost-effective decisions by avoiding misapplications of management treatments or investing in areas with limited potential to affect populations.

Mammals

There can be little doubt that the activities of the wild bison, which was extirpated (exterminated) from the Prairie Pothole Region of North Dakota and South Dakota in the 19th century, had a major influence on prairie wetlands in pristine times. Unfortunately, there is no documentation of how wetlands were affected by the feeding, drinking, dusting, or other activities of millions of bison as they roamed the prairies. Other grassland mammals extirpated from the area are the grizzly bear, kit fox, and plains wolf. These carnivores probably made only minor use of prairie wetlands (Kantrud et al. 1989).

Donna Dewhurst/USFWS

This gadwall finds sanctuary on a district pond.

Today at the districts, the representative group of mammal species includes coyote, red fox, white-tailed jackrabbit, eastern cottontail, deer mouse, badger, raccoon, muskrat, white-tailed deer, mule deer, thirteen-lined ground squirrel, striped skunk, mink, long-tailed weasel, prairie vole, and meadow vole.

In addition to these common mammal species, there are occasionally confirmed sightings of moose, elk, and pronghorn on or adjacent to district lands. Additionally, the district staff has received unconfirmed reports of mountain lion and gray wolf on Service lands.

Threatened and Endangered Species

Habitats for five federally listed species occur within one or more districts—piping plover, whooping crane, interior least tern, western fringed prairie orchid, and Dakota skipper (butterfly).

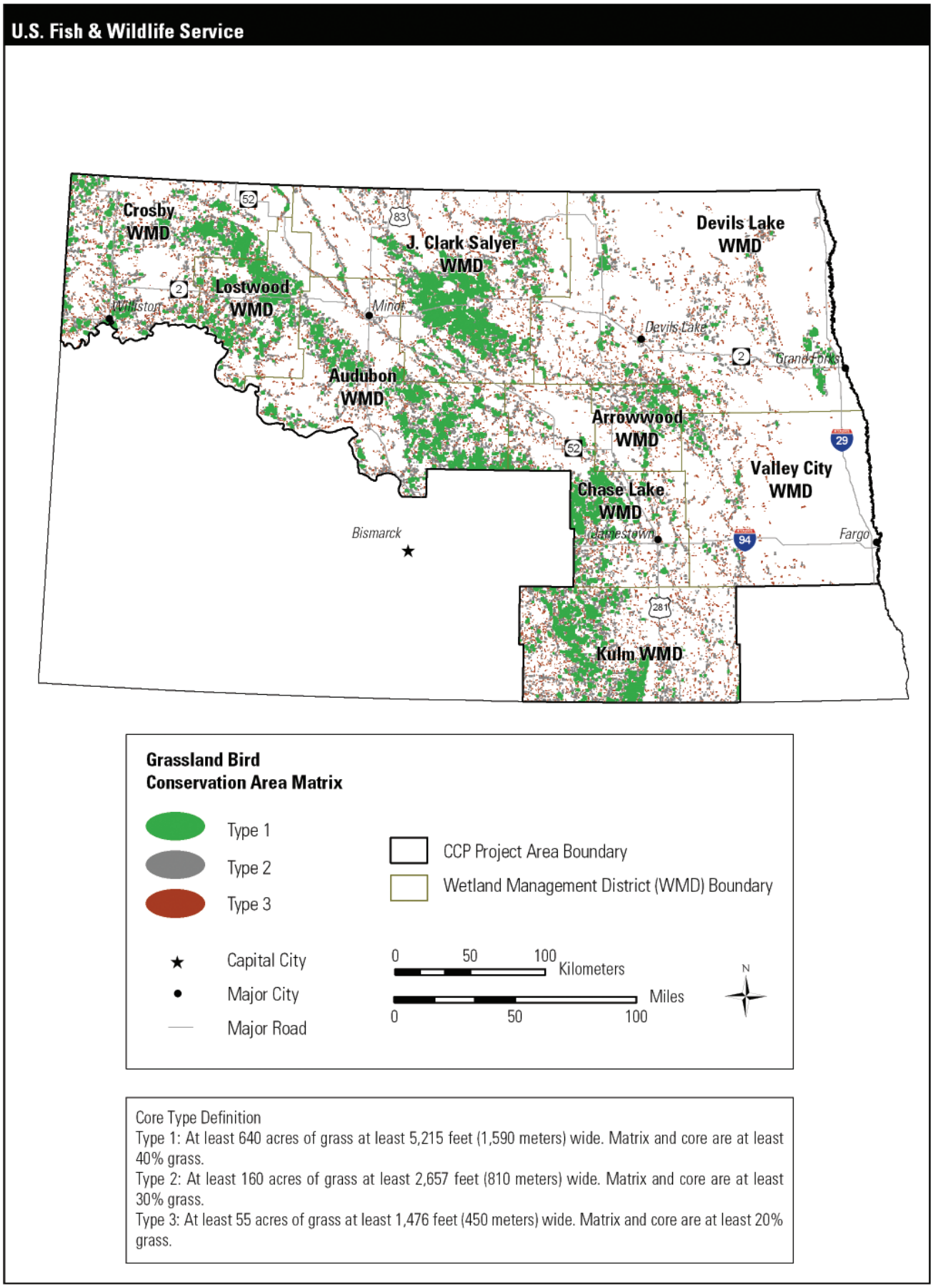

Figure 9. Map of the grassland bird conservation area matrix for the nine districts, North Dakota.

Laws passed in the late 1960s gave limited attention to endangered species; however, it was not until the Endangered Species Act was passed in 1973 that significant protection was granted to rare species. This landmark law, considered by some the most significant environmental law ever passed, has been amended and reauthorized by Congress on numerous occasions, most recently in 1988. The Service administers the law for all inland species and certain marine species.

When Congress authorized the Endangered Species Act they declared that species of "fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the nation and its people." The purpose of the act is to provide a means whereby endangered species and their ecosystems may be conserved. The intent of the Endangered Species Act is not to just list species as endangered or threatened, but rather, to recover the populations of these species to a point where they can be removed from the list. Appendix J shows the federally listed threatened and endangered species found in North Dakota.

Piping Plover (Threatened)

Breeding piping plovers occur in small numbers on numerous alkali wetlands in the Audubon, Crosby, and Lostwood wetland management districts. In any given year, 50–80% of the piping plovers that nest in the United States portion of the northern Great Plains do so in an eight-county area stretching from central North Dakota to northeastern Montana (see figure 10, map of the core area for piping plover). Plovers in this core area breed on barren shorelines associated with alkali lakes and wetlands.

Of the roughly 6,000 piping plovers left in the world, about half breed in the northern Great Plains. This population is declining between 6% and 12% annually (Larson et al. 2002, Plissner and Haig 2000, Ryan et al. 1993), and is expected to go extinct in 50–100 years unless significant conservation activities are started. The decline and poor prognosis led to the 1980s' listing of this population as "threatened" in the United States and "endangered" in Canada.

Whooping Crane (Endangered)

The whooping crane is one of the most endangered birds in North America. The only naturally occurring wild, migratory population in the world numbers fewer than 266 individuals (Martha Tacha, USFWS, personal communication; May 22, 2008).

Each spring and fall, whooping cranes use wetlands and agricultural fields in the districts as migratory stopover areas en route to their summer and winter grounds (see figure 11, map of whooping crane sightings).

© Jerome Negaard

Whooping cranes rest on wetlands near Crosby Wetland Management District.

Interior Least Tern (Endangered)

The interior least tern nests in North Dakota. This tern, the smallest member of the tern family, arrives on its breeding grounds in early May. The interior least tern nests in small, loosely defined groups on barren beaches of sand, gravel or shells, on dry mudflats and salt-encrusted soils (salt flats), and at sand and gravel pits along rivers. Nesting success depends on the presence of bare or nearly barren sandbars, favorable water levels during nesting and abundant food.

The terns nest in small colonies. The chicks leave the nest only a few days after hatching, but the adults continue to care for them, leading them to shelter in nearby grasses and bringing them food. The terns hover over and dive into standing or flowing water to catch small fish.

The interior least tern was federally listed as endangered in 1985, primarily due to the loss of nesting habitat as a result of dramatic alterations (channelization and impoundment) of important river systems. Water level fluctuations, vegetation of nesting habitat, and disturbance (from people, pets, predators, and livestock) continue to jeopardize nesting success.

Western Prairie Fringed Orchid (Threatened)

The Devils Lake and Valley City wetland management districts are within the range of and have suitable habitat for the western prairie fringed orchid, an endangered flower of the tall-grass prairie. However, there are no records of this orchid occurring in district lands. This orchid species is restricted to mostly west of the Mississippi River and currently occurs in Iowa, Kansas, Minnesota, Nebraska, and North Dakota in the United States and in Manitoba, Canada.

The orchids occur most often in wet, unplowed, tall-grass prairies and meadows but have been found in old fields and roadside ditches. The nocturnally fragrant flowers of these perennial orchids attract hawkmoths that feed on nectar and transfer pollen from plant to plant.

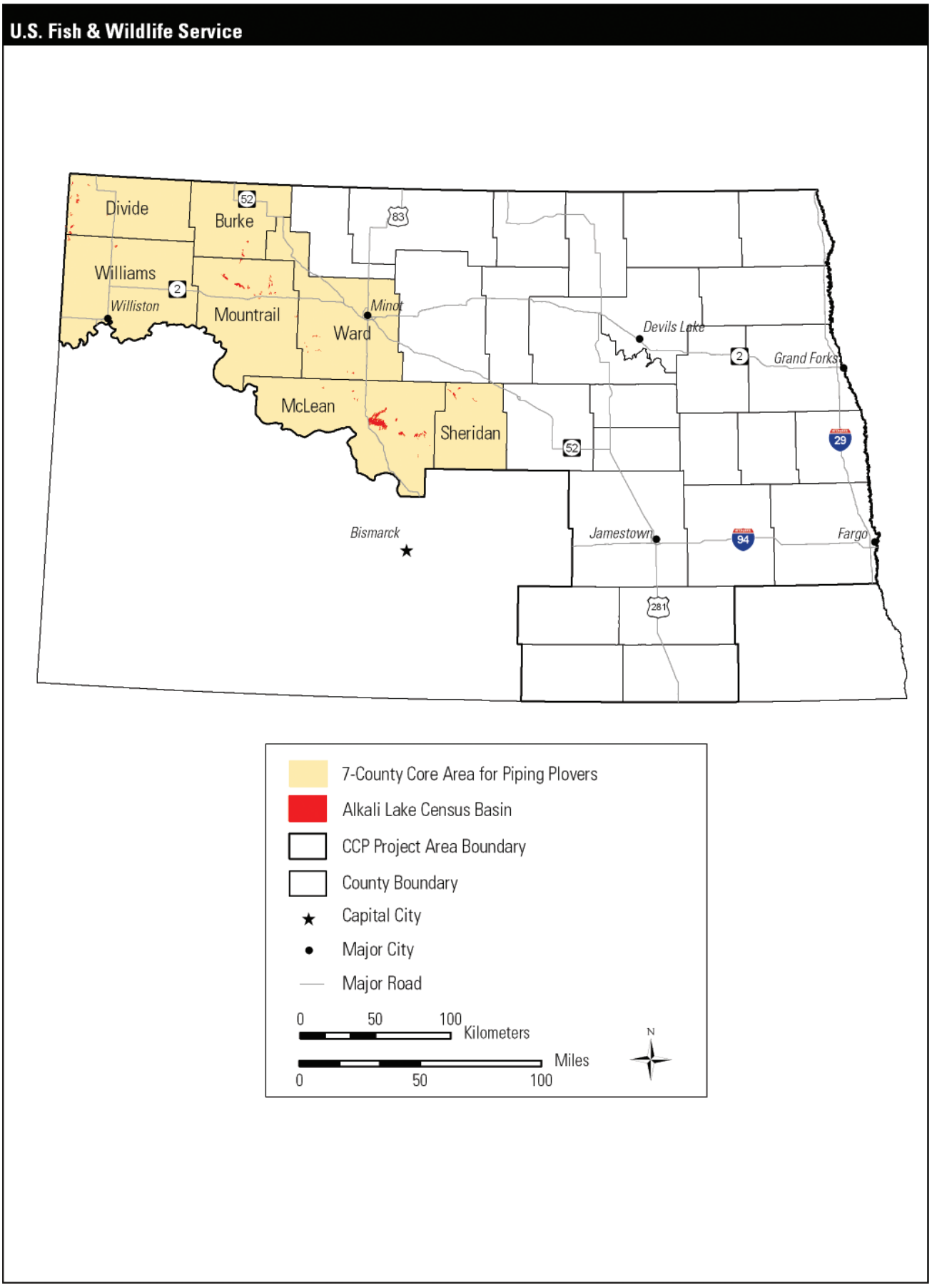

Figure 10. Map of the seven-county core area for piping plover in North Dakota.

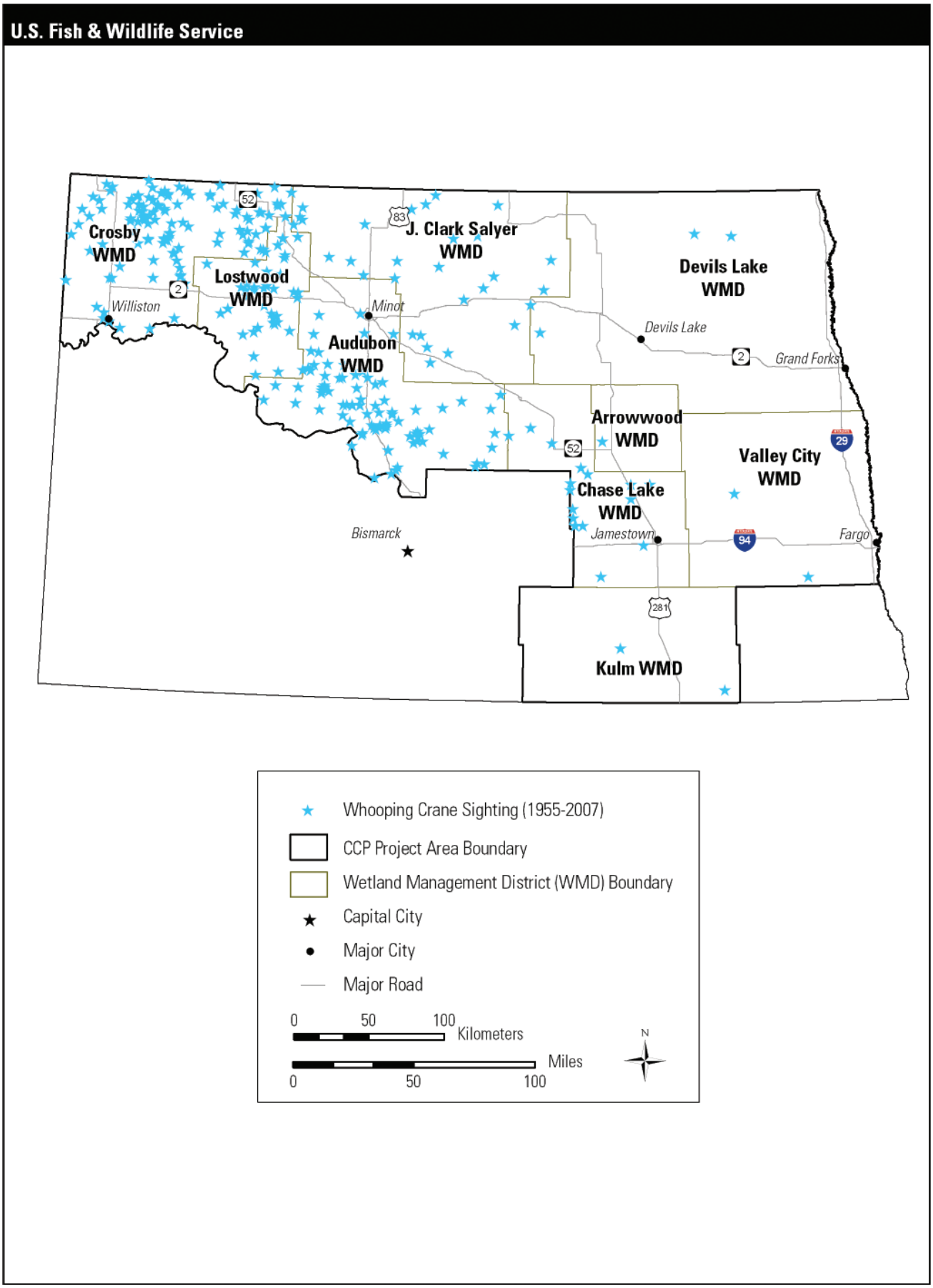

Figure 11. Map of the whooping crane sightings in the nine districts, North Dakota.

USFWS

Western prairie fringed orchid.

The greatest threat to the fringed orchid is habitat loss, mostly through conversion to cropland. Competition with invasive plants, filling of wetlands, intensive hay mowing, fire suppression, and overgrazing threatens these species.

Dakota Skipper (Candidate)

All of the districts contain habitat suitable for the Dakota skipper, and this species occurs within each district. The skipper is a small butterfly with a 1-inch wingspan. It has a thick body and a faster and more powerful flight than most butterflies.

The skipper is likely to occur throughout a relatively unbroken and vast area of grassland in the north-central United States and south-central Canada, occurring only in scattered remnants of high-quality native prairie. The most significant remaining populations of Dakota skipper occur in western Minnesota, northeastern South Dakota, north-central North Dakota, and southern Manitoba. The skipper's current distribution straddles the border between tall-grass and mixed-grass prairie; it occurs in two types of habitat (USFWS 2002):

- Flat, moist, native bluestem prairie in which three species of wildflowers are usually present—stage-wood lily, harebell, and smooth camas.
- Upland (dry) prairie that is often on ridges and hillsides; bluestem grasses and needlegrasses dominate these habitats and three wildflowers are typically present in quality sites—pale purple, upright coneflowers, and blanketflower.

Robert Dana/USFWS

The Dakota skipper is a prairie inhabitant whose numbers have decreased.

Dakota skipper populations have declined due to widespread conversion of native prairie for agriculture and other uses. This has left the remaining skipper populations isolated from one another in relatively small areas of remnant native prairie. In addition, many of the habitats where the species persists are threatened by overgrazing, conversion to cultivated agriculture, inappropriate fire management and herbicide use, woody plant invasion, road construction, gravel mining, invasive plant species, and historically high water levels in some areas.

4.3 Cultural Resources

This section is based on the cultural resource overview of the districts developed for the Service in 2007 by RMC Consultants, Inc.

Prehistoric Resources

The cultural history of North Dakota spans over 10,000 years and has been divided into several cultural traditions. From earliest to most recent, these traditions are as follows:

- Paleo-Indian tradition
- Plains Archaic tradition
- Plains Woodland tradition
- Plains Village tradition
- Equestrian Nomadic tradition (Horse Culture)

The Equestrian Nomadic tradition is the most recent tradition and represents protohistoric (initial European contact) and early historic times. Each of these traditions is a way of life that is relatively distinct in terms of variation in technology and subsistence practices.

Perhaps the most dramatic cultural changes in North Dakota prehistory are associated with the Plains Village tradition. This period began at approximately AD 1000 and lasted until 1780, when disease introduced by Europeans decimated village populations. The onset of the Plains Village tradition marks the incorporation of horticultural production into the hunting and gathering subsistence base. Horticultural production allowed for the creation of food surpluses, primarily of corn, and facilitated the aggregation of households

into larger, more sedentary earth lodge villages. In North Dakota, these earth lodge villages were most common in the southwestern and northwestern areas of North Dakota. Elsewhere in the state, settlement patterns were characterized by a combination of traits characteristic of the Plains Village tradition and the preceding Plains Woodland tradition. The generic term "Late Prehistoric" is used to describe post-Archaic resources that can be ascribed to neither the Plains Woodland nor Plains Village traditions.

Historical Resources

Before it was settled by Euro-Americans in the early 1800s, North Dakota was inhabited by several Native American tribes including Arikara, Assiniboine, Cheyenne, Hidatsa, Lakota, and Mandan.

Early Settlement

Scottish and Irish families along the Red River established the first community, Pembina, in the early 1800s (Info Please 2007). The location was originally that of trader Alexander Henry's Fort Pembina, a trading post that competed with the Hudson Bay Company (Robinson 1966). The area would eventually become northeastern North Dakota, but at the time was owned by Great Britain.

Trading posts were established at Fort Union and Fort Clark and at other lesser-known forts (Remele 1988). At these posts, meat and furs were exchanged for guns, metal, cloth, beads, and other trade goods. It was not long before the presence of the white traders was made evident in other ways; a high number of French-Canadian, Scottish, and English traders took Native American wives (mostly Chippewa, Cree, and Assiniboine). In time, a number of North Dakota trading posts and neighboring communities became predominantly populated by the offspring of these marriages, people referred to by the French as *bois brules* or *métis* (Robinson 1966).

Activity and settlement of European and Euro-American people had been consistent for some time in the North Dakota area, but was limited to discreet locations at and around military forts and trading posts. Increased settlement started in the late 1850s and early 1860s when a concerted effort was undertaken to link St. Paul with trading posts in eastern North Dakota (Robinson 1966).

History of Development

The St. Paul and Pacific Railroad reached the Red River in 1871 and brought growing numbers of people looking toward the Red River Valley as a desirable location to settle. The Northern Pacific Railroad reached the Missouri River shortly after (Remele 1988, Robinson 1966). These two major events—as well as increased boat traffic on the Red River, new stage lines in the area, plus the establishment of a land office in Pembina—opened the door for major settlement.

Numerous towns and settlements sprang up along the new railroad routes. Between 1879 and 1886, the state underwent a settlement boom, mostly by homesteaders, with the formation of some large, organized, mechanized ("bonanza") farms (Remele 1988). The population of North Dakota increased more than 1,000% between 1878 and 1890, and a second boom occurred after 1905 (Remele 1988, Robinson 1966). Many of the settlers were immigrants of Scandinavian or Germanic origin as well as Norwegian, Russian, and Scotch-Irish-English (Remele 1988). In 1915, more than 79% of the population was immigrants or the children of immigrants (Remele 1988). North Dakota achieved statehood on November 2, 1889 (Remele 1988).

Improved weather conditions, a wartime economy, and federal construction projects related to flood control and irrigation resulted in another economic boom during the 1940s (Remele 1988). Crop yields increased, America entered World War 2, and several large-scale construction projects were carried out along the Missouri, James, and Sheyenne rivers, including the Garrison Dam in the Missouri River.

The development of the state's natural resources began in the 1950s. Oil was discovered near Tioga in the Williston Basin in 1951, and coal resources were mined for use in newly constructed plants to generate electricity (Remele 1988). The communications and transportation networks were also expanded and improved throughout the 1950s (Remele 1988). North Dakota is "the most rural of all the states," and today 90% of the land is used for (1) farming including cultivation of crops such as wheat, barley, rye, sunflowers, beans, oats, flaxseed, sugar beets, and hay, and (2) for raising beef cattle, sheep, and hogs (Info Please 2007). The state also produces other resources including lignite, clay, sand, and gravel. Outdoor recreation is popular in North Dakota, particularly fishing and hunting.

4.4 Visitor Services

The Improvement Act emphasizes the importance of compatible, wildlife-dependent recreation. The act identifies these six priority public uses: hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

Hunting

Centuries ago, the Missouri Coteau was considered a prominent landmark to the Plains Indians and early European settlers who camped and hunted waterfowl and other game species within the wetlands and potholes areas. With the settlement of the prairie states, certain hunting restrictions were established for the protection and propagation of wildlife.

Migratory waterfowl hunting is allowed at WPAs, where only federally approved nontoxic shot is permitted. All other state regulations apply at WPAs.

Most of the WPAs are open to hunting for upland birds (ring-necked pheasant, sharp-tailed grouse, gray partridge). The districts also offer archery, rifle, and muzzleloader hunting for deer.

Fishing

Fishing is allowed year-round at the districts; although, during the winter months ice fishing seems to be the most popular. Restrictions on vehicle access into WPAs may be limited to designated trails. Permanent lakes at the districts offer fishing for northern pike, walleye, yellow perch, and a few other species.

The NDGF has also stocked many permanent wetlands. Anglers commonly seek yellow perch and northern pike in these areas.

Due to the abundance of aquatic life in the permanent wetlands, growth rates of fish are often very high. Fishing in WPAs, as with all fishing of Service lands, requires the angler to follow both state fishing regulations and special refuge regulations.

Wildlife Observation and Photography

The districts provide outstanding opportunities for viewing wildlife. They offer optimal viewing for waterfowl, grassland birds, and shorebirds from April through early June and from late August through October. Seasonal highlights include the spring courtship dances of sharp-tailed grouse and western grebe, spring and fall shorebird migrations, daily fall movements of thousands of waterfowl, and winter activities of various bird and mammal species.

Many wildlife species can be observed from public roads. In some areas, viewing blinds are available in the spring for visitor observation of wildlife in their native habitat.

Environmental Education and Interpretation

Each district has either a standalone headquarters or a headquarters co-located with a national wildlife refuge. Each headquarters facility has interpretative information associated with its small visitor center. The visitor center includes exhibits and a variety of informational pamphlets about the Service, district, Refuge System, and other natural resources-related information. There are generally kiosks located in front of each headquarters facility; kiosks contain information about prairie wetlands and wildlife species found throughout the district.

Jackie Jacobson/USFWS

The wetland management districts provide an outdoor experience for North Dakota's youth.

District staffs provide educational talks and tours for schools and other groups, on request. The environmental education and outreach programs expand beyond the boundaries of the districts. District staffs are involved in local, regional, and statewide programs.

Trapping

Recreational trapping is available at all WPAs and WDAs, in accordance with state trapping regulations. Authorized by 50 CFR, part 31.16, recreational trapping is administered by the Service.

4.5 Partnerships

The district staffs have established partnerships with local, state, and national groups in efforts to achieve habitat objectives and to improve and expand environmental education. Most districts have local partnerships with the following groups for projects ranging from control of invasive plants to protection of piping plover nests:

- weed boards
- water resource boards
- rural volunteer fire departments
- law enforcement departments
- Scouts
- 4-H clubs
- private landowners

The districts have worked closely with NDGF and North Dakota's health and agriculture departments on projects such as hunting and fishing opportunities, disease issues, and management of habitat and invasive plants.

The district staffs have partnerships with the following groups and agencies for habitat management, research, and environmental education:

- Army Corps of Engineers
- Bureau of Reclamation
- Delta Waterfowl
- Ducks Unlimited, Inc.
- The Nature Conservancy
- National Audubon Society
- National Turkey Federation
- National Wildlife Federation
- National Fish and Wildlife Foundation
- North Dakota Natural Resources Trust
- North Dakota Wildlife Federation
- USGS

The districts have also developed working relationships with various oil and wind industry companies.

4.6 Socioeconomic Environment

This section is based on the socioeconomic impact analysis for the districts that was completed for the Service in 2007 by BBC Research and Consultants.

The nine wetland management districts cover a majority of the area in the state north and east of the Missouri River. Related visitor activity—such as spending on food, gasoline, and overnight lodging in the local area—provides local businesses with supplemental income and increases the local tax base. Management decisions about visitor services, expansion of services, and habitat improvements at the districts may either increase or decrease visitation and, thus, affect the amount of visitor spending in the local economy.

Population and Demographics

The population of the nine districts' 34-county area represents about 70% of the total population of North Dakota. The population of this 34-county area has declined over the past 25 years from almost 460,000 in 1980 to 450,000 in 2005, similar to a 2% decline in the population of the entire state. The population decrease in North Dakota has come from nonmetropolitan areas of the state, while metropolitan areas have experienced some growth.

Population projections from the North Dakota State Demography Office suggest that the population of the 34-county area and the entire state will rebound slightly by 2010. Population growth in metropolitan areas is expected to be the driving force behind statewide growth in the future.

North Dakota has a rapidly aging population—a trend that is expected to become more marked in coming decades and have important policy implications as the "baby boomer" generation enters retirement.

Employment

The government (federal, state and local) claimed the largest portion of employment (17%) in North Dakota, followed by health care (12%), retail trade (11%), and farming (8%). Between 2001 and 2005, employment in the 34-county area grew from 318,000 to 333,000 jobs according to the Bureau of Economic Analysis. Within the 34-county district area, local unemployment rates ranged from 2.1% in Williams County to 9.3% in Rolette County in 2006. According to the Bureau of Economic Analysis, unemployment in North Dakota fell from a high of 3.6% in 2003 to 3.2% in 2006.

District Operations and Activities

In 2000, the total budget for all Service activities in North Dakota totaled more than $11,508,000. The Service employs about 170 people throughout the state, 66 of which are involved with management of the nine districts. Because many district employees work for both national wildlife refuges and wetland management districts, they cannot be considered full-time equivalents (FTEs) when examining the socioeconomic impact of districts alone. (A full-time equivalent is one or more job positions with tours of duty that, when combined, equate to one person employed for the standard government work-year). The nine districts support 49.5 FTEs in North Dakota.

The districts offer many recreational and educational opportunities, which include hunting, fishing, and nonconsumptive activities such as hiking, photography, and wildlife observation. Hunting is very popular at the districts, especially at Kulm, Audubon, and Devils Lake. The hunting of waterfowl, pheasant, grouse, and partridge is most popular. White-tailed deer are also commonly hunted in the districts. According to visitation data collected as part of the "Refuge Annual

Performance Plan" (RAPP), hunting accounts for 64% of all visitor days to North Dakota districts. Trapping is also permitted at all WPAs within the districts.

Nonconsumptive activities such as hiking and wildlife observation draw casual visitors, outdoor enthusiasts, educational tours, photographers, and others to the districts. Many districts have a good deal of interpretive material for recreational visitors, and they offer educational programs to school groups on an appointment basis. Visitors engaged in these recreational activities account for 27% of all visitor days to North Dakota districts.

Visitor Levels and Spending

According to 2007 RAPP data, visitation to the nine districts will have totaled 177,000 visitor days by the end of the year. The 2004 "Banking on Nature" (Caudill and Henderson 2005) study estimates total visitation for eight national wildlife refuges in region 6, two of which are located in North Dakota (Arrowwood and Audubon national wildlife refuges). According to the study, about 44% of visitors are nonresidents of the local areas surrounding the refuges visited. Applying this same rate of nonresident visitation to the districts, approximately 78,600 nonresident visitor days occur annually at the nine districts under consideration, of which 50,500 are for hunting, 7,200 are for fishing, and 20,800 are for nonconsumptive recreational activity.

Baseline Economic Activity

Combining the effects of Service employment and visitor spending, the total economic activity generated by the districts on their local economies is approximately $5,505,000 per year.

The districts affect their local economies through the visitor spending they generate and the employment they support. The districts generate direct local economic activity through employee earnings. The districts' 49.5 FTEs account for $2,674,000 in employee compensation, or roughly $54,000 per FTE. Using the Bureau of Labor Statistic's Consumer Expenditure Survey data for individuals in these income categories, roughly 79% of annual income is spent locally. Under this assumption, the districts contribute about $2,113,000 to North Dakota local economies through employee spending.

The districts' nonresident visitation of 78,600 visitor days per year, combined with spending averages reported in the 2004 Banking on Nature study (Caudill and Henderson 2005), total visitor expenditure generated by the districts is estimated to be almost $3,392,000 per year. Of this total, approximately $2,776,000 (82%) comes from hunting, $244,000 (7%) from fishing, and $373,000 (11%) from nonconsumptive recreational activity.

4.7 Operations

Funding for operations at the districts is for the staff, facilities, and equipment needed to carry out management activities to meet the purposes, goals, and objectives for the districts.

All but one of the districts, Kulm Wetland Management District, has staff and facilities that are shared to manage all the units in a "complex" (a complex is one or more refuges and one or more districts that are administratively grouped for management efficiency). Kulm Wetland Management District has its own staff and a standalone facility that are not part of a complex.

Because in most cases facilities are shared with complex staff and for administrative duties, office working conditions are tight and not conducive for conducting business. In addition, visitor centers and interpretive displays are inadequate and do not provide visitors an adequate space to learn about the benefits of the districts and their resources.