4 Alternatives and Environmental Consequences

This chapter describes the management alternatives and associated environmental consequences considered for the Souris River basin refuges. Alternatives are different approaches to planning unit management designed to achieve

the refuges' purposes, vision, and goals;

the mission of the Refuge System;

the mission of the Service.

Alternatives are 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:

- summary of alternatives
- summary of environmental consequences
- detailed description of alternatives and consequences (table 5)
- economic impacts of no-action and proposed action alternatives

SUMMARY OF ALTERNATIVES

Four alternatives, identified and evaluated, represent different approaches to enhance protection and restoration of fish, wildlife, plants, habitats, and other resources. Alternative A, the no-action alternative, describes ongoing refuge management. The no-action alternative is a basis for comparison of alternatives B–D. Alternative B is the Service's proposed action and basis for the draft CCP (chapter 5).

The planning team assessed biological conditions and external relationships affecting the refuges. This information contributed to the development of alternatives. As a result, each alternative 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 refuges and how it addresses core wildlife and habitat issues and threats. Where data are available, trends in habitat and wildlife are evaluated, and environmental consequences of each alternative are projected.

Gary Eslinger/USFWS

Black-eyed Susan

Elements Common to All Alternatives

Several elements of refuge management are common to all alternatives. Management activities that could affect natural, archaeological, and historical resources would be managed to comply with applicable laws, regulations, and policies.

All alternatives would provide equal protection and management of cultural resources. Individual projects may require additional consultation with North Dakota's State Historic Preservation Office. Additional consultation, surveys, and clearance may be required when activities potentially affect properties eligible for the National Historic Register.

Description of Alternatives

Management actions to advance the mission of the Refuge System and the purpose and vision of the Souris River basin refuges are summarized 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 wildlife and habitat goals. However, each is similar in its approach to managing the refuges.

Each alternative

would pursue the goals outlined in chapter 2;

would protect and enhance a diverse assemblage of habitats;

would promote wildlife-dependent recreational use;

would be consistent with the purpose of the refuges, and with the mission and goals of the Refuge System.

The focus and actions for each of alternatives A–D are summarized below.

Alternative A (Current Management, No Action)

Alternative A, the no-action alternative, reflects the current management of the Souris River basin refuges. It provides the baseline against which to compare other alternatives. It is also a requirement of the NEPA that a no-action alternative is addressed in the planning process.

Key elements of alternative A follow:

- Habitat and wildlife management practices to benefit migratory birds and other wildlife would continue at present levels unless staffing or funding were reduced. Refuge habitats would continue to be managed opportunistically and would continue to decline in terms of biological diversity, ecological integrity, and environmental health.
- The refuges would continue to perform only limited, issue-driven, scientific research and only monitor long-term changes in vegetation communities.
- Outreach, partnerships, and priority public uses that are compatible and wildlife-dependent (fishing, hunting, wildlife observation, wildlife photography, environmental education, and interpretation) would continue at present levels unless staffing or funding were reduced.

Alternative B (Proposed Action)

This alternative (the draft CCP) embodies the concept of "ecological triage." Triage is defined here as the assignment of priority order to habitats or habitat types on the basis of where funds and resources can be best used, are most needed, or are most likely to achieve success in meeting stated goals and objectives. Management under alternative B would acknowledge pre-existing declines in quantity and quality of native upland and wetland habitats as the result of human-induced modification of the local landscape. Because some of these changes are significant, many refuge habitats can no longer be fully restored to the condition existing prior to settlement of the region (1750–1850). In these cases, habitats or habitat units that are ranked as lower priority for restoration may be managed to meet other resource needs (for example, migratory bird production), or would be minimally managed until additional resources were available.

Key elements of alternative B follow:

- Significant gaps in current and projected funding and staffing would be assumed. These gaps would likely limit widespread, full-scale habitat restoration.
- Habitats and habitat units with the highest probability of restoration would be prioritized for management. Other habitats or habitat units may only be partially restored, and many habitats or habitat units would be minimally managed. As funding, staff, and knowledge change, restorations may be expanded to additional habitats or habitat units.
- Some visitor services would decrease as some staff and funding shifts to habitat restoration, while others remain at current levels.
- Environmental education, scientific research, and monitoring would improve.

Alternative C

Alternative C would emphasize enhancement of waterfowl habitat and production over other refuge activities, and acknowledges the significance of the Souris River basin refuges as important local and regional habitats for breeding and migrating waterfowl.

Key elements of alternative C follow:

- Waterfowl habitat management and waterfowl production would be emphasized over other refuge programs.
- Scientific research and monitoring would focus on actions that enhance waterfowl habitat, increase waterfowl nest densities, and increase nest and brood survival.
- Visitor service programs that use or enhance waterfowl-related activities such as hunting, environmental education, or wildlife viewing would be emphasized over other activities.

Alternative D

Alternative D would require restoration of all refuge habitats and habitat units to the fullest extent feasible. This alternative would assume significant increases in staffing, funding, and scientific knowledge relative to the other alternatives.

Key elements of alternative D follow:

- Full restoration of ecological processes, vegetation communities, and wildlife characteristics of the presettlement period (1750–1850) would be emphasized.

- Scientific research and monitoring would focus on strategies that enhance or restore native plant and animal communities.
- Public uses that are compatible or that support habitat restoration would be emphasized.
- Interpretation and environmental education would be expanded, with an emphasis on restoration of ecological processes (for example, fire and grazing) important for enhancing natural plant and animal communities.

Summary of Environmental Consequences

The planning team assessed the environmental consequences of implementing each alternative on the biological, physical, social, economical, cultural, and historical resources of the refuges.

Effects Common to All Alternatives

Some projected effects would be similar for all alternatives.

- The implementation of any alternative would follow the Service's best management practices.
- The alternatives would minimize impacts to federally threatened and endangered species, to the extent possible and practicable.
- The refuges, contractors, researchers, and other consultants would continue to acquire all applicable permits, for example, for future construction activities.

The sections below describe other projected effects common to all alternatives.

Cultural Resources

As a whole, cultural resources would be enhanced through protection of existing resources and by extending such protections to newly discovered cultural resources.

Cultural resource surveys at the refuges have been limited. Therefore, additional surveys would be required prior to any new construction or excavation to fully satisfy provisions of the NEPA and applicable acts and policies related to historical and archaeological resources.

Potentially negative effects from construction of trails or facilities would require review by the regional archaeologist (region 6) and consultation with the North Dakota State Historic Preservation Office.

Environmental Justice

None of the management alternatives described in this EA would disproportionately place any adverse environmental, economic, social, or health effects on minority or low-income populations.

Implementation of any action alternative that includes visitor services and environmental education is anticipated to benefit minority and low-income citizens living near the Souris River basin refuges.

Climate Change

All alternatives would prioritize preservation and restoration of natural resources to varying degrees, which would enhance carbon sequestration (explained further in this section). Carbon sequestration is one method to mitigate human effects related to human-induced global climate change.

The U.S. Department of the Interior requires consideration of potential climate change effects during long-range planning such as CCP development. The increases of carbon within the earth's atmosphere are linked to the gradual rise in surface temperature commonly referred to as global warming.

The U.S. Department of Energy defines carbon sequestration as the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere. Terrestrial biomes of all sorts (such as grassland, wetland, and forest) are effective in both preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon. The U.S. Department of Energy report notes that ecosystem protection is an important element in efforts to sequester carbon that might otherwise be released into the atmosphere.

The National Climate Data Center has entered into a long-term agreement with the Service to install and operate one of the National Oceanic and Atmospheric Administration's U.S. Climate Reference Network meteorological stations at the Des Lacs NWR. The station will provide data on long-term climate change in the northern Great Plains as one of a series of meteorological stations. The station will be located at the northwest end of the refuge, 2.2 miles south of the Canada border, and should be operational by 2006.

Soils

All alternatives would positively affect soil formation processes on the refuge lands. Some disturbances to surface soils and topography would occur at those locations selected for (1) administrative, maintenance, and visitor facilities; (2) introduced and invasive species removal and eradication; and (3) restoration of native prairie.

Water Quality, Wetlands, and Floodplains

All alternatives would positively affect water quality. Positive effects are anticipated from protecting groundwater recharge, preventing runoff, retaining sediment, and minimizing nonpoint source pollution. The management alternatives are not anticipated to

have any adverse effects on the areas' wetlands and floodplains, pursuant to EO 11990 and EO 11988.

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Unit 4 at Des Lacs NWR

Public Health and Safety

Based on the nature of each alternative, the location of the refuges, and current land use, all alternatives are anticipated to have no significant negative effects on the quality of the human environment, including public health and safety.

Detailed Description of Alternatives and Consequences

Management actions are prescribed for each alternative as the means for responding to problems and issues raised by Service managers, the public, and governmental partners. Because management would differ for each alternative, environmental and social effects resulting from implementation would likely differ as well.

Table 5 describes management direction of alternative A (current management) for comparison with action alternatives B–D. In most instances, proposed management (outlined in alternatives B–D) would differ significantly from current management (alternative A).

Table 5 is organized as follows:

- Columns in the table contain management actions for each alternative, organized in rows. For each alternative, these actions describe (1) a general management philosophy, (2) direction for managing ecological processes (such as soils, fire, and grazing), and (3) direction for managing plant communities.
- The predicted environmental consequences of carrying out the prescribed actions follow. The consequences are organized in rows by their projected effects following 15 years of CCP implementation. The planning team evaluated effects on (1) environmental processes, (2) plant community integrity and structure, and (3) trust wildlife species. The section "50 Years Hence" describes projected effects assuming 50 years of prescribed management.
- Management actions and their consequences are organized first by major habitats found on the refuges, followed by visitor services, research and science, and operations. Comparisons can be made across alternatives A–D for a given topic, for example, management actions for drift prairie or environmental effects of hunting.
- Unless otherwise noted, the actions and consequences apply to all three refuges.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Management Actions			
Des Lacs NWR—5,393 acres; J. Clark Salyer NWR—4,420 acres; Upper Souris NWR—3,680 acres			
GENERAL APPROACH Manage extensively but imprecisely, using a coarse, generic approach with little regards for special restoration needs and limitations of individual management units.	GENERAL APPROACH Emphasize the fullest possible restoration of a diverse native flora only on units with the greatest potential for success (for example, the most floristically intact). On other (most) units, concede to invasion by cool-season introduced grasses.	GENERAL APPROACH Emphasize tall, robust, undisturbed vegetation composed of grasses, forbs, and low shrubs. Directly control mammals that are potential predators of waterfowl nests (versus no direct species-specific or population control in other alternatives).	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and that discourages woody plants and introduced plant species (such as smooth brome, Kentucky bluegrass, sweetclover, and state-listed noxious weeds).
ECOLOGICAL PROCESSES ***Refuge Qualifiers*** *Des Lacs NWR:* Use fire and grazing extensively and generally, within a broad range across refuge units with regard to type, timing, frequency, and intensity of disturbances. *J. Clark Salyer NWR:* Use fire and grazing in selected units—within a broad range with regard to type, timing, frequency, and intensity of the disturbances—mainly to reduce litter and periodically rejuvenate grassland vegetation. *Upper Souris NWR:* Use grazing extensively and generally, within a broad range across refuge units with regard to type, timing, frequency, and intensity of the disturbances. Use fire to reduce litter and woody vegetation on areas where most feasible.	ECOLOGICAL PROCESSES Incorporate frequent, carefully timed fire and grazing disturbances (for example, in 4 of every 5 years) on high-priority units. Use intensive, locally focused, or specialized restoration methods as needed to restore processes. Account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of treeless grassland (the largest grasslands may include adjacent old cropland, prairie slope, and private grassland tracts).	ECOLOGICAL PROCESSES Use fire infrequently (for example, every 5–10 years), only to reduce excess litter and periodically restore plant vigor.	ECOLOGICAL PROCESSES *Same as alternative B, except* extend intensive effort throughout each refuge's drift prairie.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—* (Proposed Action)	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain a broad range of vegetation structure across units. Periodically remove plant litter. Use an integrated approach to control noxious weeds, especially leafy spurge. ***Refuge Qualifier*** *Des Lacs NWR and J. Clark Salyer NWR:* Reduce woody vegetation, including tree shelterbelts around old farmsteads.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority units, maintain relatively low levels of plant litter, mainly by frequent use of prescribed fire. On low-priority units, reduce plant litter as opportunities arise. Use an integrated approach to control noxious weeds, especially leafy spurge. Reseed native plants in the most degraded grassland dominated by smooth brome. Reduce woody vegetation, including tree shelterbelts around old farmsteads.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Provide late-successional grassland structure on most areas, with vegetation structure more important than composition. Periodically reduce excessive litter and restore plant vigor. Use an integrated approach to control noxious weeds, especially leafy spurge. Reduce trees and tall shrubs but enhance low shrubs such as western snowberry. Seed the most degraded areas of drift prairie to DNC.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore plant species diversity. Strive to attain plant communities dominated by native herbaceous species on all units. Allow vegetation structure to be a function of the dynamic, frequent disturbances that would be restored to units. Full restoration would require a much more intensive effort on the most degraded tracts. Use an integrated approach to control noxious weeds, especially leafy spurge.
DRIFT PRAIRIE—Environmental Consequences			
ECOLOGICAL PROCESSES ***Refuge Qualifiers*** *Des Lacs NWR and J. Clark Salyer NWR:* Grazing would be too infrequent to facilitate historical levels of nutrient cycling, hindering a diverse soil invertebrate fauna. Grazing also would be too infrequent to exert natural defoliation influences on plant competition via dynamic changes in physiology and morphology. *Upper Souris NWR:* Fire would be too infrequent for managing litter and woody vegetation.	ECOLOGICAL PROCESSES On tracts deemed most restorable (only the most floristically intact), fire and grazing disturbances would approximate historical frequency, timing, and intensity. Associated nutrient cycles would largely be restored. The relatively arid soil surface environment would be less hospitable to introduced plant species. Soil mycorrhizae and symbiotic relationships would be restored and maintained.	ECOLOGICAL PROCESSES Grazing rarely would be used as a plant defoliation method. Nutrient cycling would be restricted, limiting the diversity of soil invertebrate fauna. Grazing also would be too infrequent to exert natural defoliation influences on plant competition via dynamic changes in physiology and morphology. Fire would be infrequently applied to reduce tall woody vegetation and periodically control litter. *(continued)*	ECOLOGICAL PROCESSES *Same as alternative B, except* effects would be measurable and extend to most drift prairie units.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Environmental Consequences			
		ECOLOGICAL PROCESSES CONTINUED Slow and fast nutrient cycles would be significantly reduced (these are essential to plant competition and critical in the evolution and development of native plant communities).	
PLANT COMMUNITY INTEGRITY AND STRUCTURE The most-intact native prairie would not be restored and maintained due to the demands of an extensive management approach. Native plant abundance and diversity would continue to decline. Introduced cool-season grasses would continue to gradually increase, interspersed with sparse low shrub. The diversity of vegetation structure would continue to decline on multiple scales especially due to the prevalence of smooth brome, the abundance of which would be furthered by spring burning and infrequent grazing. A short–sparse structure would be underrepresented in the grassland landscape. ***Refuge Qualifiers*** *Des Lacs NWR:* Western snowberry communities would be degraded, while silverberry would regenerate more than *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE The plant community on restorable, high-priority units would become increasingly dominated by native herbaceous species. Low shrub species would occur infrequently (5–10% occurrence) on high-priority units. Tall woody vegetation would become increasingly rare. Vegetation structure across units would be diverse, including much short–sparse cover (0–2 inches spring visual obstruction reading [VOR]; some moderate cover (2–5.9 inches); and relatively little tall, robust cover (>5.9 inches). Structure would vary temporally and spatially within and among high-priority units. On low-priority units, native plant species would become more rare and, except for a few species of forbs, gradually disappear from some units.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Declines in native plant abundance and diversity would accelerate. Introduced, cool-season grasses would increase, sparsely interspersed with low shrub. The last opportunities for restoring the relatively few, potentially restorable native prairie tracts would be lost. The diversity of vegetation structure would have an accelerated decline on multiple scales, especially due to the expansion of smooth brome, which would be further encouraged by spring burning and infrequent grazing. Brome would continue to expand and replace low shrub communities, especially western snowberry. A short–sparse structural component would be nearly absent from the landscape.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as restorable, high-priority tracts in alternative B, except* that effects would extend to most drift prairie units as a result of extensively applied management. Complete restoration to a presettlement condition probably would not be biologically feasible on many or most tracts because they are too badly degraded.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED desired. Tall woody vegetation would become increasingly rare. *Upper Souris NWR:* The net (overall) invasion by tall woody vegetation would not be reversed because fire would be too infrequently applied on most refuge units where coulee woodland edge is a prominent landscape component.			
TRUST WILDLIFE SPECIES Endemic species of wildlife, plus many other species that historically were common, would be absent or rare (such as Richardson's ground squirrel, burrowing owl, chestnut-collared longspur, Baird's sparrow, northern pintail, and marbled godwit). ***Refuge Qualifiers*** *Des Lacs NWR:* The abundances of breeding bird species associated with woody cover would generally decline. Gradual reduction of scattered, isolated patches of tall shrub and green ash trees would result in decreased nest parasitism by brown-headed cowbirds and increased nest survival for songbirds because edge predators are reduced. *(continued)*	TRUST WILDLIFE SPECIES On restorable, high-priority units, the diversity of species that use grassland would increase, especially those that require early successional grassland and that avoid woody plants. The abundances of species that require tall woody plants would gradually decline.	TRUST WILDLIFE SPECIES *Many effects are the same as alternative A; additionally*, management to sustain plant structure ideal for nesting ducks would be successful in the short term (5–20 years), but not in the long-term due to significant changes in plant community composition, which ultimately affect plant structure. For example, management for nesting cover for mallards and gadwalls (average of about 5.9 inches spring VOR) would become less and less sustainable as smooth brome irreversibly replaced low shrub communities that would provide important nesting cover. As a result, duck nesting densities would decline and the makeup of nesting species would change. *(continued)*	TRUST WILDLIFE SPECIES *Same as restorable, high-priority tracts in alternative B, except* that wildlife species that require grassland with tall, robust structure (>5.9 inches spring VOR) would decline as such vegetation became less available.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED *Upper Souris NWR:* Abundances of breeding bird species associated with woody cover would increase. Grassland bird species that avoid woody vegetation (such as Baird's sparrow and grasshopper sparrow) would persist but would be sparsely distributed.		TRUST WILDLIFE SPECIES CONTINUED Nest survival of ducks and sharp-tailed grouse would be sustained at relatively high levels (versus other alternatives) via intensive, though expensive, annual predator control.	
50 YEARS HENCE Mallard, blue-winged teal, gadwall, Savannah sparrow, clay-colored sparrow, and bobolink would characterize the breeding and nesting bird community; few other bird species would be present. Richardson's ground squirrel colonies that once characterized the prairie would be absent. The plant community would be a homogenous, indistinguishable matrix of smooth brome, Kentucky bluegrass, and western snowberry, with almost no native plant species.	**50 YEARS HENCE** Prairies would be increasingly dominated by native herbaceous species. On high-priority units, the breeding and nesting bird community would become more diverse, characterized by at least 10 species including northern pintail, blue-winged teal, northern shoveler, burrowing owl, chestnut-collared longspur, Baird's sparrow, grasshopper sparrow, Savannah sparrow, Sprague's pipit, western meadowlark, marbled godwit, and upland sandpiper. Richardson's ground squirrels would occur, with colonies conspicuous on some restored tracts. On low-priority tracts (>75% of the drift prairie), plant community and trust species response would be similar to responses under alternative A, characterized by a continued, gradual decline in diversity of native flora and fauna.	**50 YEARS HENCE** *Same as alternative A, except* losses of native plant and animal species diversity would be accelerated.	**50 YEARS HENCE** *Same as restorable, high-priority tracts in alternative B, except* that effects would extend to most drift prairie units as a result of extensively applied management. Complete restoration to a presettlement condition probably would not be biologically feasible on many or most tracts because they are too badly degraded.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Management Actions			
Des Lacs NWR—4,231 acres; J. Clark Salyer NWR—almost none; Upper Souris NWR—11,225 acres			
GENERAL APPROACH Manage in concert with the adjacent drift prairie as contiguous units, using the same general approach for both.	GENERAL APPROACH Manage in concert with the adjacent drift prairie as contiguous units, using the same general approach for both. ***Refuge Qualifiers*** *Des Lacs NWR:* Regardless of priority rank of adjoining drift prairie, intensively manage several of the most extensive examples of south- to west-facing prairie slope, including an area readily visible to the public, to preserve near-pristine plant communities. *Upper Souris NWR (prairie slope is the most common upland habitat):* Carry out the fullest possible restoration of a diverse native flora on units with prairie slope that have the best potential for success (those most floristically intact).	GENERAL APPROACH *Same as alternative A.*	GENERAL APPROACH *Similar to drift prairie; plus* extend an intensive, comprehensive restoration effort throughout each refuge's prairie slope. Emphasize south- to west-facing prairie slope as a uniquely pristine native flora by including frequent monitoring and locally intensive restoration.
ECOLOGICAL PROCESSES *Similar to drift prairie;* use fire and grazing disturbances extensively, within a broad range of prescriptions as regards type, timing, frequency, and intensity.	ECOLOGICAL PROCESSES *Similar to drift prairie;* use intensive, locally focused, or specialized restoration methods as needed to restore processes on high-priority areas.	ECOLOGICAL PROCESSES *Similar to drift prairie;* use fire is infrequently. Use almost no grazing.	ECOLOGICAL PROCESSES *Similar to drift prairie;* use intensive, locally focused, or specialized restoration methods as needed to restore processes on all areas.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Periodically remove litter (although on mid- to upper-slopes, it accumulates at much slower rates than on drift prairie). Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use frequent prescribed fire to reduce litter in lower slopes of high-priority areas. Use an integrated approach to control noxious weeds, especially leafy spurge. Significantly reduce trees and tall shrubs on high-priority areas.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain late successional vegetation structure on lower slope areas by restricting disturbance, especially prescribed fire. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Similar to drift prairie.*
PRAIRIE SLOPE—Environmental Consequences			
ECOLOGICAL PROCESSES *Similar to drift prairie, except* the more arid microenvironment of south- to west-facing prairie slopes would have significant implications for invasion by woody and introduced plant species.	ECOLOGICAL PROCESSES On high-priority units, fire and grazing disturbances would approximate historical frequency, timing, and intensity. Associated nutrient cycles would be largely restored. The soil surface environment would remain arid and generally inhospitable to introduced plant species, especially on high-priority units. Soil mycorrhizae and symbiotic relationships would be restored and maintained on high-priority units.	ECOLOGICAL PROCESSES Compared with drift prairie, south- to west-facing prairie slopes are relatively arid, hostile environments for most introduced plant species, and competition would favor native plant species despite infrequent disturbance. (This generality would apply to middle and upper slopes.) Consequences for lower slopes would be similar to those for drift prairie. On north- to east-facing slopes, plant species diversity, nutrient cycling, soil mycorrhizae and invertebrate diversity would be reduced.	ECOLOGICAL PROCESSES *Same as alternative B, except* that effects would extend to most prairie slope units as a result of extensively applied management. Restored prairie slope would more likely represent a presettlement condition in the Souris River basin than would other habitats on the refuges.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE The diversity of native, herbaceous plant species would respond more favorably and rapidly to burning or grazing of south- to west-facing prairie slope than would the drift prairie. Introduced, cool-season grasses would continue to gradually increase along the lower slopes. ***Refuge Qualifiers*** *Des Lacs NWR:* Tall woody vegetation would become increasingly rare. *Upper Souris NWR:* The net (overall) invasion by tall woody vegetation would not be reversed because prescribed fire would be too infrequently applied on most refuge units where coulee woodland edge is a prominent landscape component.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Tall woody vegetation would become increasingly rare. Relatively low, sparse cover would typify middle and upper slopes on high-priority units, but structure on lower slopes of these units would vary. Native species would dominate the plant community. On low-priority units, south- to west-facing prairie slopes would be more floristically intact than drift prairie and would experience a slower rate of degradation from invasion by woody and introduced plant species.	PLANT COMMUNITY INTEGRITY AND STRUCTURE South- to west-facing prairie slopes would be more floristically intact and would experience a slower rate of invasion by woody and introduced plant species than adjoining drift prairie. Woody and introduced plant species would continue to expand on north- to east-facing slopes. Slow and fast nutrient cycles would be significantly reduced. These are essential to plant competition and critical in the evolution and development of native plant communities.	PLANT COMMUNITY INTEGRITY AND STRUCTURE The already diverse native plant community of south- to west-facing prairie slope would respond favorably and rapidly to burning or grazing. Introduced plant species would become increasingly rare and woody plants would become inconspicuous, subdominant components of the plant community. Restoration of many north- to east-facing slopes to nearly a presettlement condition probably would not be biologically feasible because they are so badly degraded.
TRUST WILDLIFE SPECIES Habitat on southwest-facing slopes would remain suitable for vesper sparrow and grasshopper sparrow. The value of lower slopes would continue to gradually decline for nesting ducks, clay-colored sparrow, and Savannah sparrow as smooth brome would continue to replace snowberry. Limited habitat for Sprague's *(continued)*	TRUST WILDLIFE SPECIES On south- to west-facing slopes of high-priority units, occurrences of some grassland bird species such as Sprague's pipit would increase. Woodland-edge species such as song sparrow, yellow warbler, and gray catbird would decline on these areas. On most north- to east-facing slopes, woodland edge species and those tolerant of smooth brome would increase gradually.	TRUST WILDLIFE SPECIES With the emphasis of nondisturbance, there would be an overall decline in occurrences of grassland bird species, especially along lower slopes and near shallow drainages and coulees. Conversely, there would be a gradual increase in breeding species associated with woody cover or tolerant of smooth brome.	TRUST WILDLIFE SPECIES Occurrence and abundance of grassland bird species would increase, although clay-colored sparrow and vesper sparrow would decrease slightly. For prairie ducks, nest-site habitat on lower slopes would shift to favor species associated with relatively short, herbaceous cover (such as blue-winged teal). Species associated with woodland edge would decrease.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED pipit would remain available along some upper slopes. ***Refuge Qualifiers*** *Des Lacs NWR:* Breeding bird species associated with woody cover would generally decline. *Upper Souris NWR:* Breeding bird species associated with woodland edge would increase. Grassland bird species that avoid woody vegetation would persist but would be sparsely distributed.			
50 YEARS HENCE Kentucky bluegrass, smooth brome, and woody vegetation would expand significantly on lower slopes and along drainages. Native herbaceous flora would remain relatively common on the middle and upper slopes. ***Refuge Qualifiers*** *Des Lacs NWR:* There would be little change in the breeding bird community on southwest-facing prairie slopes, but a marked reduction in woodland edge species on other slopes. Nesting success would improve measurably for some bird species as abundances of brown-headed cowbirds and nest predators associated with woodland edge *(continued)*	**50 YEARS HENCE** Tall woody vegetation would be increasingly rare. Kentucky bluegrass, smooth brome, and woody vegetation would expand significantly on lower slopes and along drainages. Native herbaceous flora would remain relatively common on the middle and upper slopes. There would be little change in the breeding bird community on southwest-facing prairie slopes, but a marked reduction in woodland edge species on other slopes. Nesting success would improve measurably for some bird species as abundances of brown-headed cowbirds and *(continued)*	**50 YEARS HENCE** Woody and introduced plant species would expand significantly. Diversity of breeding birds would be diminished, although some grassland bird species persist along south- to west-facing slopes. Despite desires to maintain western snowberry, smooth brome and tall shrubs would characterize most north- to east-facing slopes.	**50 YEARS HENCE** Tall woody vegetation would be increasingly rare. Prairie slopes would be dominated by native herbaceous species. Although the total number of birds would be unchanged, the number of common grassland bird species would increase measurably, as would their reproductive success. Once common, woodland-edge species such as brown-headed cowbird, yellow warbler, and spotted towhee would now be uncommon. Abundances of some woodland edge mammals such as white-tailed deer, deer mouse, and Franklin's ground squirrel would be diminished.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Environmental Consequences			
50 YEARS HENCE CONTINUED declined (for example, deer mouse). *Upper Souris NWR:* Species of wildlife associated with woodland edge would gradually displace species of grassland wildlife that are intolerant of woody vegetation.	50 YEARS HENCE CONTINUED nest predators associated with woodland edge declined (for example, deer mouse).		
PRAIRIE PARKLAND—Management Actions			
Des Lacs NWR—none; J. Clark Salyer NWR—9,580 acres; Upper Souris NWR—none			
GENERAL APPROACH Emphasize to the fullest extent possible, restoration of a diverse native flora on units with the greatest potential for success (for example, tree cover <30% and most floristically intact). Elsewhere, concede to invasion by aspen–oak woodland.	GENERAL APPROACH *Same as alternative A, except* extend management to smaller (40- to 100-acre) prairies mostly surrounded by aspen–oak woodland.	GENERAL APPROACH Minimally manage prairie parkland as resources are diverted to other habitats more suitable for waterfowl production. Passively manage, mainly using rest, to provide late-successional grassland structure that is tall and dense.	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and that discourages tall woody plants and introduced species of plants.
ECOLOGICAL PROCESSES Use prescribed fire intensively within high-priority units to reduce woody vegetation. Use grazing extensively within a broad range of prescriptions.	ECOLOGICAL PROCESSES *Same as alternative A, except* account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include adjacent old cropland, meadow, sandhill, and private grassland tracts.	ECOLOGICAL PROCESSES Use prescribed fire and grazing infrequently, mainly to reduce litter and periodically restore plant vigor.	ECOLOGICAL PROCESSES *Same as alternative B, except* extend intensive efforts to all prairie parkland units.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE PARKLAND—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Reverse woodland invasion and restore prairie in areas where cover of aspen–oak woodland is <30%. Elsewhere, concede to woodland invasion. On restoration units, control plant litter and reduce introduced species of plants—community composition (native herbaceous emphasized) is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* also control woody vegetation within the interiors of small (40- to 100-acre), but floristically intact, prairie patches.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use mainly rest to provide late-successional vegetation structure on most areas; vegetation structure is more important than composition. Minimally control woody plants. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Reverse woodland invasion in most prairies. Retain only the woodland patches >200 acres in size. Restore plant species diversity, to be characterized mostly by native herbaceous species. Allow vegetation structure to be a function of the dynamic, frequent disturbances restored to units; plant composition is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.
PRAIRIE PARKLAND—Environmental Consequences			
ECOLOGICAL PROCESSES The extent and frequency of grazing and fire would be adequate to facilitate historical levels of nutrient cycling only on areas where woodland extent were reduced. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover. Elsewhere, extensive woodland would limit use of grazing and fire as defoliation tools. Soil functions and symbiotic relationships would shift to those characteristic of woodlands.	ECOLOGICAL PROCESSES *Same as alternative A, except* effects would be extended to smaller (40- to 100-acre) prairies mostly surrounded by aspen–oak woodland.	ECOLOGICAL PROCESSES Slow and fast nutrient cycles would be significantly reduced. These are essential to plant competition and critical in the evolution and development of native plant communities. Grazing and fire would be inadequate to exert natural defoliation influences on plant competition.	ECOLOGICAL PROCESSES Grazing and fire would approximate historical frequency, timing, and intensity. Historical levels of nutrient cycling would be gradually restored over most areas. The relatively arid soil surface environment would be less hospitable to introduced plant species. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover.

(continued)

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE PARKLAND—Environmental Consequences			
			ECOLOGICAL PROCESSES CONTINUED Grazing and fire would be adequate to exert natural defoliation influences on plant competition.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen–oak woodland would be reduced or eliminated on tracts where it currently accounts for <30% cover, but would replace many small, isolated prairie tracts elsewhere. Native herbaceous plant species would increasingly dominate restoration tracts, but would decline elsewhere as woody and introduced plants increased. Vegetation structure would be variable and would be a function of dynamic, frequent disturbances, where they occurred.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A*, *except* effects would be extended to small (40- to 100-acre) prairies mostly surrounded by aspen–oak woodland.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Most remaining prairie would be gradually replaced by aspen–oak woodland. Declines in native plant abundance and species diversity would be accelerated. The last opportunities for restoring open grassland or parkland would be lost. Vegetation structure would be less variable, and would be typically tall and dense.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen–oak woodland and tall shrubs would be gradually reduced and, in some areas, eliminated. Native grass–forb and low shrub communities would increase. Complete restoration to a presettlement condition would be unlikely on some units that have been dominated by aspen woodland for more than 60 years. Vegetation structure would be variable and would be a function of dynamic, frequent disturbances.
TRUST WILDLIFE SPECIES Grassland-dependent wildlife species would occur only on areas where woodland cover was reduced (such as Sprague's pipit, Baird's sparrow, chestnut-collared longspur, and upland sandpiper). Elsewhere, woodland and shrubland wildlife species would increase.	TRUST WILDLIFE SPECIES *Similar to alternative A*, *except* smaller prairies would also provide habitat for Sprague's pipit, vesper sparrow, grasshopper sparrow, and clay-colored sparrow.	TRUST WILDLIFE SPECIES Abundance and diversity of grassland-dependent wildlife would gradually decline. Conversely, woodland and shrubland wildlife species would increase.	TRUST WILDLIFE SPECIES Abundance and diversity of grassland-dependent wildlife would gradually increase. Overall species diversity would decline, mainly because woodland and shrubland wildlife species would decline and, in some areas, would disappear.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B*— (Proposed Action)	*Alternative C*	*Alternative D*
PRAIRIE PARKLAND—Environmental Consequences			
50 YEARS HENCE The landscape would be less heterogeneous because patchy and edge habitats would be increasingly replaced by either grassland (restoration areas) or woodland (unmanaged areas). Grassland-dependent wildlife would be common in large, treeless grasslands. Important species would be vesper sparrow, clay-colored sparrow, Sprague's pipit, grasshopper sparrow, and upland sandpiper. Elsewhere, large woodland patches would support forest-interior species such as hairy woodpecker, rose-breasted grosbeak, ovenbird, and veery. Many edge and habitat-generalist wildlife species would be less common, found only in areas where woodland and shrubland occurred.	50 YEARS HENCE *Same as alternative A, except* several small, isolated grasslands would be restored as representative examples of intact prairie plant communities.	50 YEARS HENCE The landscape would be dominated by woodland and shrubland. Grassland area would be vastly reduced. Grassland-dependent wildlife would be increasingly replaced by species tolerant of woodland and shrubland.	50 YEARS HENCE The landscape would be less heterogeneous because woodland and shrub habitats would be increasingly replaced by grassland. Woodland cover would be widely and extensively reduced. Grassland-dependent wildlife would be common, increasingly dominated by species intolerant of woody vegetation (such as Sprague's pipit, grasshopper sparrow, Baird's sparrow, chestnut-collared longspur, and upland sandpiper). Woodland- and shrubland-associated wildlife species would persist, but would be sparsely distributed.
SANDHILLS—Management Actions			
Des Lacs NWR—none; J. Clark Salyer NWR—2,800 acres; Upper Souris NWR—none			
GENERAL APPROACH Manage in concert with prairie parkland. Restore a diverse native flora on the sandhills with the greatest potential for success (for example, aspen woodland cover <30% and more floristically intact).	GENERAL APPROACH *Same as alternative A.*	GENERAL APPROACH Minimally manage the sandhills as resources are diverted to other habitats (such as drift prairie, old cropland, meadow, and wetland) more suitable for waterfowl production.	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and discourages tall woody plants and introduced plant species.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—* (Proposed Action)	*Alternative C*	*Alternative D*
SANDHILLS—Management Actions			
ECOLOGICAL PROCESSES Use fire to reduce woody plant cover. Exclude cattle.	ECOLOGICAL PROCESSES *Same as alternative A, except* account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include prairie parkland, adjacent old cropland, meadow, and private grassland tracts.	ECOLOGICAL PROCESSES Use fire infrequently, mainly to reduce litter and periodically restore plant vigor. Exclude cattle.	ECOLOGICAL PROCESSES *Same as alternative A, except* extend intensive effort to all sandhill units. Exclude cattle until effective leafy spurge control is used. Restore sand blowouts.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Reverse invasion by aspen woodland. Restore prairie and oak savanna in conjunction with priority, prairie parkland units. Plant composition is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore plant species diversity—ideal savanna contains widely scattered patches of bur oak within a matrix of native prairie. Allow vegetation structure to be a function of the dynamic, frequent disturbances restored to units; plant composition is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.
SANDHILLS—Environmental Consequences			
ECOLOGICAL PROCESSES On areas managed in concert with priority, prairie parkland units, fire disturbance would be adequate to exert natural defoliation influences on plant competition. Broadly, nutrient cycling and defoliation influences on grassland plant *(continued)*	ECOLOGICAL PROCESSES *Same as alternative A.*	ECOLOGICAL PROCESSES Grazing and fire disturbances would be too infrequent to facilitate historical levels of nutrient cycling across most areas. Slow and fast nutrient cycles would be reduced. The characteristically arid soils of sandhills *(continued)*	ECOLOGICAL PROCESSES Grazing and fire would approximate their historical frequency, timing, and intensity; and would be adequate to facilitate historical levels of nutrient cycling over most areas. The characteristically arid soils of sandhills *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
SANDHILLS—Environmental Consequences			
ECOLOGICAL PROCESSES CONTINUED physiology and competition would not be achieved because grazing disturbance would be too infrequent. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover except in heavily wooded areas, where they would be characteristic of woodlands.		ECOLOGICAL PROCESSES CONTINUED would be inhospitable to introduced plant species, except leafy spurge.	ECOLOGICAL PROCESSES CONTINUED would be inhospitable to introduced plant species, except leafy spurge. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen woodland would be reduced in sandhills that are managed in conjunction with restored prairie parkland units. Native herbaceous plants would gradually increase on restoration tracts, but would decline elsewhere as woody plants increase. Without an effective method of control, leafy spurge would invade native prairie. The characteristically arid soils of sandhills would be inhospitable to introduced plant species, except leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Most remaining prairie and savanna would be gradually replaced by aspen–oak woodland. Leafy spurge would invade many remaining prairie tracts. Compared to other alternatives, declines in native plant abundance and species diversity would be accelerated. The last opportunities for restoring open prairie or savanna would be lost.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen–oak woodland and tall shrubs would be gradually reduced, and would be eliminated in some areas. Native grass–forb and low shrub communities would increase. Complete restoration to a presettlement condition would be unlikely on some units that have been dominated by aspen woodland for more than 60 years. Vegetation structure would be variable and would be a function of dynamic, frequent disturbances. Without an effective method of control, leafy spurge would invade native prairie.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
SANDHILLS—Environmental Consequences			
TRUST WILDLIFE SPECIES Grassland-dependent wildlife species would be common on areas devoid of tall woody plants. Elsewhere, woodland and shrubland species of wildlife would increase.	TRUST WILDLIFE SPECIES *Same as alternative A.*	TRUST WILDLIFE SPECIES Woodland and shrubland species of wildlife would gradually increase. Diversity and abundance of grassland-dependent species of wildlife would decrease.	TRUST WILDLIFE SPECIES Abundance and diversity of grassland-dependent wildlife would gradually increase. Woodland and shrubland species of wildlife would decline as woody plants were reduced.
50 YEARS HENCE The landscape would be less heterogeneous because patchy and edge habitats would be increasingly replaced by grassland or savanna (restoration areas) or by woodland (unmanaged areas). Grassland-dependent wildlife would be common in prairie parkland–sandhill complexes where aspen woodland was a minor component. Important species would be vesper sparrow, clay-colored sparrow, Sprague's pipit, and lark sparrow. Elsewhere, extensive patches of tall woody vegetation would support woodland and shrubland species such as black-and-white warbler and red-eyed vireo. Without an effective method of control, leafy spurge would become codominant with native herbaceous plants.	50 YEARS HENCE *Same as alternative A.*	50 YEARS HENCE The landscape would be predominantly woodland and shrubland. Remaining prairie would occur only on south- and west-facing slopes. Grassland-dependent wildlife would be increasingly replaced by woodland- and shrubland-associated species. Without effective control, leafy spurge would become codominant with native herbaceous plants.	50 YEARS HENCE The landscape would be predominantly grassland and savannah. Grassland-dependent wildlife would be common and widespread. Composition would be increasingly composed of species intolerant of woody vegetation (for example, Sprague's pipit and grasshopper sparrow). Woodland- and shrubland-associated wildlife species would persist, but would be sparsely distributed. Without an effective method of control, leafy spurge would become codominant with native herbaceous plants.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Management Actions			
Des Lacs NWR—1,816 acres; J. Clark Salyer NWR—7,675 acres; Upper Souris NWR—1,068 acres			
GENERAL APPROACH Continue to maintain herbaceous vegetation on old cropland areas by either using periodic farming and reseeding, or by maintaining current grass–forb stands, which typically are heavily invaded by introduced, cool-season species of grasses that are undesirable. If reseeding, treat only the most degraded stands, such as those dominated by smooth brome.	GENERAL APPROACH Establish native vegetation on most old cropland units that adjoin high-priority drift prairie tracts.	GENERAL APPROACH Seed and maintain DNC in all old cropland to provide attractive nesting cover for ducks. Reseed stands that become dominated by undesirable, cool-season grasses when tall, dense structure can no longer be restored and maintained. Reduce mammals that are potential nest predators in areas surrounding DNC stands that support high densities of nesting ducks.	GENERAL APPROACH Restore as closely as possible the floristic composition and structural characteristics of northern mixed-grass prairie.
ECOLOGICAL PROCESSES Occasionally use fire, haying, or grazing within a broad range of prescriptions. Continue to use a farming rotation as an option for periodically adding stands of robust vegetation.	ECOLOGICAL PROCESSES Use hay harvests to help establish native grass and forb species on old cropland areas of high priority (those adjacent to high-priority drift prairie and prairie slope). Then, apply mainly fire and grazing in concert with management of adjoining drift prairie and prairie slope to further competitiveness of native plant species. Account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include adjacent drift prairie, prairie slope, parkland, and private grassland tracts.	ECOLOGICAL PROCESSES Infrequently defoliate, emphasizing hay harvests and fire, only as necessary to reduce excess litter and restore plant vigor.	ECOLOGICAL PROCESSES Use hay harvests to help establish recently seeded native species, and then apply mainly fire and grazing treatments, managing old cropland in concert with management of adjoining drift prairie and prairie slope. Emphasize defoliation events to further competitiveness of native plants. Consider restoration of mycorrhizal fungi.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Attempt to establish perennial herbaceous cover that is dense and dominated by tall species. Strive to maintain this robust structure on at least some old cropland areas. Disregard species composition unless structure can no longer be restored by routine management treatments. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority units, emphasize a composition that is dominated by warm-season grasses. Remove nearby tree shelterbelts. Manage low-priority units opportunistically, disregarding structure and composition. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Maximize tall, dense, late-successional structure. Disregard native species as an important vegetation component on most or all old cropland units. Remove nearby tree shelterbelts. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore as closely as possible the floristic composition and structural characteristics of northern mixed-grass prairie. Remove nearby tree shelterbelts. Emphasize biological approaches for controlling noxious weeds.
OLD CROPLAND—Environmental Consequences			
ECOLOGICAL PROCESSES Excessive plant litter would be controlled and plant vigor would be stimulated through fire, haying, and occasional grazing. The farming cycle would be a major source of soil erosion, which would degrade adjoining native prairie. Compared to pristine native grasslands, the diversity of soil invertebrate species and nutrient cycling processes would be vastly simplified. The seeded stand would be markedly less efficient in capturing and transferring solar energy, sequestering carbon, and resisting disturbances such as weed species invasions. Seeded legumes would facilitate fixation of soil nitrogen.	ECOLOGICAL PROCESSES In high-priority areas, soil erosion potential would be negligible because perennial plant cover would be established and the cropping cycle would be eliminated. Carbon sequestration and nutrient cycling would be significantly greater in a more floristically diverse community.	ECOLOGICAL PROCESSES Management inputs would be increased; for example, the cropping rotation would be shortened to yield more years under an optimal range of structure. The farming cycle would be a major source of soil erosion, which would degrade adjoining native prairie. Nutrient cycling, carbon sequestration, and soil invertebrate diversity would be simplified and limited. Capture of sunlight for photosynthesis would be inefficient.	ECOLOGICAL PROCESSES Soil erosion potential would be negligible with permanent plant cover established and no cropping cycle. Fire and grazing disturbances would follow historical frequency, timing, and intensity. Associated nutrient cycles would be largely restored. Compared to denser, taller plant cover in other alternatives, the arid soil surface environment under this alternative would be less hospitable to introduced plant species. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—* (Proposed Action)	*Alternative C*	*Alternative D*
OLD CROPLAND—Environmental Consequences			
			ECOLOGICAL PROCESSES CONTINUED Carbon sequestration would be enhanced in the more floristically diverse community.
PLANT COMMUNITY INTEGRITY AND STRUCTURE The plant community would consist of only two or three introduced plant species that would be seeded intentionally, and up to several undesirable introduced species.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority areas, the native warm-season component would be enhanced, while introduced cool-season plant species would be discouraged, by prescribed fire applied with proper frequency and timing. Source sites for smooth brome and yellow sweetclover would be reduced significantly around high-priority drift prairie and prairie slope, which would help restore and protect native plant species composition in these areas.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* that the present DNC stands are, on average, of greater height and density. DNC stands would be homogenous, with almost no structural diversity.	PLANT COMMUNITY INTEGRITY AND STRUCTURE The plant community would be characterized by 6–10 native species, which would present a heterogeneous structure that varies spatially and temporally (a cool-season growth period would be followed by a warm-season growth period from spring to summer). Compared to DNC or old cropland invaded by undesirable, introduced plants, a varied structure would provide living space for a greater number of wildlife species.
TRUST WILDLIFE SPECIES Habitat for trust wildlife species associated with the tall-grass prairie component of northern mixed-grass prairie would be maintained or increased. ***Refuge Qualifier*** *Des Lacs NWR:* Nesting ducks would be attracted to some old cropland areas where they would experience mediocre nest survival (average annual nest survival in DNC at Des Lacs NWR is 15–20% [Mayfield *(continued)*	TRUST WILDLIFE SPECIES Vegetation structure generally would be less attractive to bird species that prefer the tallest, densest grass–forb cover possible. Mallard, gadwall, northern harrier, and sedge wren would be replaced by species attracted to mid-height density ranges such as blue-winged teal, short-eared owl, upland sandpiper, grasshopper sparrow, Savannah sparrow, and western meadowlark.	TRUST WILDLIFE SPECIES Structure of DNC in old cropland would be suited for bird species such as mallard, gadwall, and northern harrier, which prefer the tallest, densest, grass–forb cover possible for nest sites. Other grassland bird species would be uncommon or rare. Nest survival of ducks and sharp-tailed grouse would be sustained at relatively higher levels (versus other alternatives), because of annual predator control.	TRUST WILDLIFE SPECIES Numbers of bird species and of other vertebrates that rely on grasslands would increase, especially species that require early successional, short–sparse grassland and that avoid woody plants.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED Survival of ducklings probably would be limited in these areas, where open-water impoundments account for nearly all wetland habitat.			
50 YEARS HENCE DNC often would be dominated by smooth brome. Periodically available tall, dense cover would favor mallard, gadwall, northern harrier, sedge wren, bobolink, and Le Conte's sparrow.	**50 YEARS HENCE** Native warm-season grasses would dominate high-priority sites. Undesirable, introduced grasses would dominate low-priority sites. Breeding bird densities would decline on high-priority old cropland, but makeup of the community would be more diverse. Densities of early nesting species such as mallard and northern pintail would possibly decline, as might densities of species that use newly growing vegetation for nesting (such as gadwall).	**50 YEARS HENCE** Continuous, periodic farming would characterize management that would emphasize tall, dense herbaceous cover in old cropland for nesting ducks. Areas that border DNC stands would accumulate eroded topsoil and support only undesirable, introduced plant species.	**50 YEARS HENCE** *Same as alternative B, except* native plants would dominate all old cropland areas. In some areas, warm-season grasses would begin to reinvade adjoining drift prairie and prairie slope. Volunteer native forbs would be evident in most areas.
COULEE WOODLAND—Management Actions			
Des Lacs NWR—1,255 acres; J. Clark Salyer NWR—none; Upper Souris NWR—1,604 acres			
GENERAL APPROACH ***Refuge Qualifiers*** *Des Lacs NWR:* Reduce tall woody vegetation in all but the most contiguous woodland patches. Reverse invasion by introduced woody plants. *Upper Souris NWR:* Continue modest effort to slow invasion by tall woody vegetation on a limited area of the refuge uplands.	**GENERAL APPROACH** Strive to eliminate woodland and edge, particularly near high-priority drift prairie, prairie slope, and the largest tracts of open grassland.	**GENERAL APPROACH** Generally slow the spread of woodland edge, while principally managing for late successional cover on grasslands. Do not attempt to manage the largest, most contiguous woodland patches.	**GENERAL APPROACH** Ultimately, eliminate nearly all but the most mature, contiguous woodland patches. Among the latter areas, stop further woody expansion and reverse the rapid spread of common buckthorn and other introduced woody plants in the understory.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Management Actions			
ECOLOGICAL PROCESSES Apply recurrent fire. Use grazing animals to knock down dead woody fuels and create openings in the regenerating woody plant cover.	ECOLOGICAL PROCESSES *Same as alternative A.*	ECOLOGICAL PROCESSES Apply fire infrequently to woodland edge as a component of adjacent grassland-dominated units being treated by fire.	ECOLOGICAL PROCESSES *Same as alternative A;* apply recurrent fire widely and aggressively. Precisely time fire applied to woodland edge that borders drift prairie and prairie slope, as regards phenology and competitive abilities of native herbaceous plants.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Gradually decrease trees and tall shrubs that extend from edges of coulee woodlands into adjacent grasslands. Disregard the extent, distribution, and structure of contiguous coulee woodlands. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* completely remove woodland edge from and adjacent to high-priority drift prairie and prairie slope units. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use fire infrequently, chiefly to maintain late successional grassland cover, but, in some areas, to achieve simultaneously modest reductions in coulee woodland edge that may harbor predators of duck nests. Ignore structure and composition of coulee woodland. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Create an upland landscape nearly devoid of patches of trees and tall shrubs including those extending from contiguous woodlands. Restrict remaining tall woody to contiguous woodland in the deepest, broadest coulees into which fire can scarcely penetrate. Maintain this as mature woodland with a low edge-to-interior ratio, variably broken canopy, and variable densities of understory tall shrub and sapling trees. Use cutting and herbicides to eliminate introduced species of woody plants in interiors of coulee woodlands.

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Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
ECOLOGICAL PROCESSES Expansion of tall woody vegetation would be reversed where prescribed fire was applied at appropriate frequencies. Soil erosion would sometimes occur on steep slopes exposed after thorough burning of woody vegetation. Nutrient cycling and defoliation influences on grassland plant physiology and competition would not be achieved because grazing disturbance would be too infrequent.	ECOLOGICAL PROCESSES *Same as alternative A*; *however*, nutrient cycling, occurrence of mycorrhizal relationships, and overall competitiveness of native herbaceous plants would be more improved in high-priority areas where grass–forb vegetation mostly replaced tall woody vegetation.	ECOLOGICAL PROCESSES *Same as alternative A*, only the changes would be more severe. Major ecological processes important in the evolution of prairie plant communities would be disrupted including (1) patterns of nutrient cycling, (2) the diversity of soil invertebrates and their relationships with plants, (3) patterns of water uptake, and (4) site-related influences on plant morphology and physiology.	ECOLOGICAL PROCESSES Fire and grazing disturbances would approximate historical frequency, timing, and intensity. Associated nutrient cycles would be largely restored. The relatively arid soil surface environment would be less hospitable to introduced plant species. Soil mycorrhizae and symbiotic relationships would be largely restored and maintained. Restoration of some areas to a near-presettlement condition probably would not be biologically feasible because they already are so badly degraded.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Coulee woodland edge would be steadily diminished on most of the refuge. Some areas would be mostly open grassland, sometimes with mature woodland. Drift prairie and prairie slope would increase in area. Weedy forbs including noxious species (such as Canada thistle) would invade woodland edge immediately after burning, but gradually would be replaced by grasses over following years. *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Coulee woodland edge would be steadily decreased by frequently applied fire, especially near high-priority drift prairie and prairie slope. Some areas would begin to be characterized as open grassland and distinct, mature woodland with an abrupt transition between the two. Common buckthorn and other introduced species of shrub would be inhibited by fire away from contiguous woodland. Replacement of woody cover by smooth brome- *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Fire would be too infrequently applied to control expansion of coulee woodland edge over most of the refuges. Woodland edge would continue to be a widespread, conspicuous part of the landscape. Introduced species of shrubs would continue to expand, mainly in contiguous woodlands, and would replace native shrubs and tree saplings in the understory. Smooth brome expansion would not be reduced with infrequent, imprecisely timed fires *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B*, *only* the changes apply to coulee woodland and coulee woodland edge across each refuge.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (*Current Management*)	*Alternative B*— (*Proposed Action*)	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Invasion by smooth brome would be hastened at the expense of western snowberry communities. Common buckthorn and other introduced species of shrub would be inhibited by fire away from contiguous woodland. ***Refuge Qualifier*** *Upper Souris NWR:* The net (overall) invasion by tall woody vegetation would not be reversed because fire would be too infrequently applied on most refuge units where coulee woodland edge is a prominent landscape component.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED dominated types on high-priority areas would be markedly slowed by carefully timed, frequent grazing, and native herbaceous plants would more successfully reinvade.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED and little grazing. Loss of western snowberry as a nest site habitat would be rapid with infrequent disturbance. Heavy accumulations of plant litter in the grass understory would inhibit light penetration and decrease aridity at the soil interface, which would create inhospitable conditions for native herbaceous plant species.	
TRUST WILDLIFE SPECIES Habitat would increase for several common, grassland-dependent species, especially Savannah sparrow and bobolink. Habitat would decrease for edge-generalist bird species such yellow warbler. Occurrence of woodland species such as ovenbird and black-capped chickadee would be unaffected, although abundance would be reduced. Parasitism rates would decrease among nests of grassland birds in adjoining drift prairie and prairie slope, due to *(continued)*	**TRUST WILDLIFE SPECIES** *Same as alternative A; on high-priority areas, however*, the changes would be more rapid—reduction of habitat for woodland-edge birds would proceed quickly, while the increase in grassland bird habitat would be rapid. Conversely, the change would proceed slowly on low-priority areas. There would be parallel implications for nest parasites and nest predators.	**TRUST WILDLIFE SPECIES** There would be a net loss of habitat for grassland-dependent songbirds and an increase in habitat area for woodland-edge species. Security of bird nests in grassland intermixed with or adjoining woodland edge would continue to be compromised due to high predation and parasitism rates, although these negative affects would possibly be reduced by annual control of mammalian predators.	**TRUST WILDLIFE SPECIES** *Same as alternative A, only* the changes would be more rapid, widespread, and complete. Refuge uplands would begin to be characterized by distinctly different grassland and woodland bird communities, with almost no overlap or transition.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED decreased occurrence of brown-headed cowbirds and perches. Predation rates would decrease among nests of grassland birds in adjoining drift prairie and prairie slope, due to decreased occurrence of raccoons, great horned owls, deer mice, and other predator species. ***Refuge Qualifier*** *Upper Souris NWR:* Because there would be little change in the overall extent of woodland edge, change in abundances of bird species tied mainly to this habitat would be small. Nest parasitism and predation influences indirectly associated with prevalence of woodland edge would also be unchanged.			
50 YEARS HENCE Herbaceous cover, especially smooth brome, would dominate most areas that extend from coulees and were once variably interspersed with patches of tall shrubs and trees. Most areas of refuge uplands would be characterized by open grassland and contiguous woodland, with an abrupt transition between the two. Other than a few species of forbs, native herbaceous plants would seldom be found in areas formerly occupied by woodland edge. *(continued)*	**50 YEARS HENCE** *Same as alternative A;* reduction of woodland edge habitat would be thorough on units that included high-priority drift prairie or prairie slope, but less so on other units. There would be parallel implications for the distribution and local abundance of bird species associated with these habitats.	**50 YEARS HENCE** Woodland edge would be conspicuous across much of the upland landscape, merging with tall shrub and tree patches on north- to east-facing prairie slope. Almost no native herbaceous vegetation would remain as an understory component; the herbaceous vegetation would be irreversibly degraded, especially due to prevalence of smooth brome. Along with Savannah sparrows in open grassland, brown-headed cowbirds, yellow *(continued)*	**50 YEARS HENCE** Herbaceous cover, mainly a mix of native species and Kentucky bluegrass, would dominate areas that extend from coulees and were once variably interspersed with patches of tall shrubs and trees. Refuge uplands would be characterized by open grassland and contiguous woodland, with an abrupt transition between the two. Several bird species that rely on woodland edge and that were once abundant and widespread would be uncommon to *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
50 YEARS HENCE CONTINUED Several bird species that rely on woodland edge and that were once abundant and widespread would be far less common. Much more habitat would be available for grassland bird species, especially those sensitive to tall woody cover in the landscape. ***Refuge Qualifier*** *Upper Souris NWR:* Although variable across the refuge, habitat for shrub-associated and habitat-generalist bird species would increase and that for grassland-dependent species would decline. Kentucky bluegrass would be the dominant grass species in woodland edge habitat and almost no herbaceous native species would be found.		50 YEARS HENCE CONTINUED warblers, and clay-colored sparrow would be the most abundant songbirds. Despite goals for waterfowl production, nest survival of ducks and songbirds in adjacent grasslands would be compromised due to increased predation and parasitism rates.	50 YEARS HENCE CONTINUED rare. The area and security of habitat available for grassland bird species, especially those sensitive to tall woody cover in the landscape, would measurably support levels of reproductive success that contribute to population levels for the respective species.
RIPARIAN WOODLAND—Management Actions			
Des Lacs NWR—none; J. Clark Salyer NWR—2,470 acres; Upper Souris NWR—609 acres			
GENERAL APPROACH Manage in concert with adjacent meadow. Maintain current extent of riparian woodland.	GENERAL APPROACH Manage in concert with adjacent meadow. Maintain current extent of riparian woodland. Increase coordination among the refuges and other water users.	GENERAL APPROACH *Same as alternative B, except* install and maintain nesting structures to increase waterfowl recruitment.	GENERAL APPROACH Manage in concert with adjacent meadow. Where feasible, restore the presettlement extent and plant composition of riparian woodland.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—* (Proposed Action)	*Alternative C*	*Alternative D*
RIPARIAN WOODLAND—Management Actions			
ECOLOGICAL PROCESSES Make minor to modest efforts to reduce flooding that occurs outside the natural hydroperiod. Maintain Lake Darling at a maximum operational elevation of 1,597.0 feet above mean sea level. Suppress and exclude fire.	ECOLOGICAL PROCESSES Within existing physical and political constraints, restore natural frequency, timing, and duration of flooding. Reduce the occurrence and duration of summer flooding. Maintain Lake Darling at a maximum operational elevation of 1,596.0 feet above mean sea level. Suppress and exclude fire.	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES In conjunction with management of riverine wetlands and meadows, strive to fully restore natural frequency, timing, and duration of flooding. Suppress and exclude fire.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain current extent of woodland cover.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain current extent woodland cover. Attempt to restore American elm as the codominant tree species in riparian woodland. ***Refuge Qualifier*** *Upper Souris NWR:* Restore some or all riparian woodland.
RIPARIAN WOODLAND—Environmental Consequences			
ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. Summer flooding would occur more frequently than is desirable.	ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. The frequency and duration of summer flooding would be somewhat reduced by better coordination among the refuges and other water users.	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES Within ecological and political constraints, flooding would be mostly confined within the historical, natural hydroperiod.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
RIPARIAN WOODLAND—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE The current extent of riparian woodland would be preserved, except frequent or prolonged summer flooding may slightly reduce woodland area. American elm would persist but be sparsely distributed. Summer flooding periodically increases tree mortality.	PLANT COMMUNITY INTEGRITY AND STRUCTURE The current extent of riparian woodland would be preserved. American elm would persist but be sparsely distributed. Tree mortality would be reduced as the frequency and duration of summer flooding were reduced.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE The current extent of riparian woodland would be unchanged. Restoration of American elm would be contingent on development of new cultivars (cultivated varieties of a plant) resistant to Dutch elm disease. ***Refuge Qualifier*** *Upper Souris NWR:* Some riparian woodland would be restored if the area of Lake Darling were reduced during wetland restoration.
TRUST WILDLIFE SPECIES The current extent of riparian woodland habitat for woodland-dependent species of wildlife would be preserved or slightly reduced. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species.	TRUST WILDLIFE SPECIES The current extent of riparian woodland habitat for woodland-depend species of wildlife would be preserved. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species.	TRUST WILDLIFE SPECIES *Same as alternative B.*	TRUST WILDLIFE SPECIES *Same as alternative B, except* some habitat for wetland-dependent wildlife species would be replaced by habitats for woodland-associated wildlife species.
50 YEARS HENCE The current extent of riparian woodland would be preserved or slightly reduced, especially at Upper Souris NWR. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species. Veery, ovenbird, American *(continued)*	50 YEARS HENCE The current extent of riparian woodland would be preserved. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species. Veery, ovenbird, American redstart, hairy woodpecker, and *(continued)*	50 YEARS HENCE *Same as alternative B.*	50 YEARS HENCE *Same as alternative B;* composition of riparian woodland would be gradually restored with reintroduction of American elm. ***Refuge Qualifier*** *Upper Souris NWR:* The current extent of riparian woodland may increase.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
RIPARIAN WOODLAND—Environmental Consequences			
50 YEARS HENCE CONTINUED redstart, hairy woodpecker, and Cooper's hawk would be common. Widely scattered nesting colonies, mainly of herons, would continue to persist.	50 YEARS HENCE CONTINUED Cooper's hawk would be common. Widely scattered nesting colonies, mainly of herons, would continue to persist.		
MEADOW—Management Actions			
Des Lacs NWR—360 acres; J. Clark Salyer NWR—5,570 acres; Upper Souris NWR—1,570 acres			
GENERAL APPROACH Reduce tall woody vegetation and noxious weeds.	GENERAL APPROACH To the extent possible, restore a diverse native flora only on units with the greatest potential for success (the most floristically intact). Increase coordination among the refuges and other water users.	GENERAL APPROACH Reduce tall woody vegetation and noxious weeds. Increase coordination among the refuges and other water users. Control mammalian predators and install nesting structures to increase waterfowl production.	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and that discourages tall woody plants and introduced plant species such as quackgrass, reed canarygrass, and state-listed noxious weeds.
ECOLOGICAL PROCESSES Make minor to modest efforts to reduce flooding that occurs outside the historical natural hydroperiod.	ECOLOGICAL PROCESSES Within existing physical and political constraints, restore natural frequency, timing, and duration of flooding; reduce the occurrence and duration of summer flooding. Incorporate frequent, extensively applied haying on high-priority units. Reintroduce fire as an important defoliation disturbance. *(continued)*	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES Strive to fully restore the natural frequency, timing, and duration of flooding. Apply fire, grazing, and haying extensively to reduce woody vegetation.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW—Management Actions			
	ECOLOGICAL PROCESSES CONTINUED Account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include adjacent drift prairie, prairie parkland, and private grassland tracts.		
PLANT COMMUNITY INTEGRITY AND STRUCTURE Use haying to reduce cover of tall woody vegetation and noxious weeds. Control of tall woody vegetation is more important than trying to manage vegetation composition. Vegetation structure is largely a function of biannual haying. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use haying and fire on high-priority units to reduce the cover of tall woody plants and noxious weeds. Do not control woody vegetation in low-priority units. (Control of tall woody vegetation is more important than trying to manage composition of herbaceous vegetation.) Allow vegetation structure to be a function of biannual haying and periodic use of fire. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B, except* maximize tall and dense vegetation structure attractive to nesting waterfowl.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use haying, grazing, and fire extensively to reduce cover of tall woody vegetation and restore native plant communities. Emphasize restoration of native plant communities. Allow vegetation structure to be a function of dynamic, frequent disturbances restored to units. Use an integrated approach to control noxious weeds, especially leafy spurge.
MEADOW— Environmental Consequences			
ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. Summer flooding would occur *(continued)*	ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. The frequency and duration *(continued)*	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES The timing, frequency, and extent of flooding would more closely approximate the natural condition. Complete restoration of the historical natural fluvial *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW— Environmental Consequences			
ECOLOGICAL PROCESSES CONTINUED more frequently than desirable. Haying would replace grazing as an important defoliation disturbance. Disturbance would be inadequate for facilitating historical nutrient cycling.	ECOLOGICAL PROCESSES CONTINUED of summer flooding would be somewhat reduced by better coordination among the refuges and other water users. Natural nutrient cycles would be partially restored. Haying would replace grazing as an important defoliation. Fire would be reintroduced as a defoliation disturbance on high-priority meadows. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover, but only in high-priority meadows. Elsewhere, disturbance would be inadequate to restore these processes to historical levels.		ECOLOGICAL PROCESSES CONTINUED processes would be unlikely because of continued conflicts among water users and irreversible human-induced physical changes in river dynamics. Wet–dry cycles, fire, and grazing disturbances would approximate historical frequency, timing, and intensity. Haying would continue as an important method for controlling tall woody plants. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Tall woody vegetation would be controlled in the largest and most intact meadows. Elsewhere, tall shrubs and trees would gradually replace herbaceous vegetation. Native herbaceous species would gradually decline and be replaced by introduced species such as quackgrass, reed canarygrass, Canada thistle, and leafy spurge. *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Tall woody vegetation would be controlled in high-priority meadows. In low-priority meadows, tall shrubs and trees would gradually replace herbaceous vegetation. In intensively managed meadows, cover of native herbaceous vegetation would increase and cover of tall woody plants would decrease. Elsewhere, native herbaceous species would *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B, except* meadows would be less floristically diverse, because controlling woody vegetation and maximizing tall and dense structure would be more important than increasing cover of native species.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Cover of tall woody plants would be widely reduced. The diversity of native herbaceous plant species would gradually increase. Complete restoration to a presettlement condition would be unlikely on some units that have been dominated by tall woody plants or introduced grasses for more than 60 years. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW— Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED With haying as the main defoliation disturbance, meadows would alternate between years of tall-dense cover and moderate-dense cover.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED gradually decline and be replaced by introduced species such as quackgrass, reed canarygrass, Canada thistle, and leafy spurge. With haying as the main defoliation disturbance, meadows would alternate between years of tall-dense cover and moderate-dense cover. However, use of fire would increase structural heterogeneity.		PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Vegetation structure would be variable and would be a function of dynamic, frequent disturbance.
TRUST WILDLIFE SPECIES Meadow would provide important nesting habitat for many species of grassland- and wetland-dependent wildlife. Abundance of grassland and wetland bird species that avoid woody vegetation would increase in large, contiguous meadows where woody plants were reduced (such as Savannah sparrow, sedge wren, and Le Conte's sparrow). Wildlife species that are associated with woodland and shrubland would be common in meadows dominated by woody plants. Periodically, bird occurrence and nest survival would be reduced by summer flooding.	**TRUST WILDLIFE SPECIES** *Same as alternative A, except* the frequency of summer flooding would possibly decline, thereby increasing bird occurrence and nest survival.	**TRUST WILDLIFE SPECIES** *Same as alternative B, except* waterfowl nest survival would be enhanced via annual removal of mammalian nest predators.	**TRUST WILDLIFE SPECIES** The abundance and diversity of grassland- and wetland-dependent wildlife species would gradually increase as tall woody plants were reduced and native plant diversity increased. Wildlife species that are associated with woodland and shrubland would persist but would be sparsely distributed.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—* (Proposed Action)	*Alternative C*	*Alternative D*
MEADOW— Environmental Consequences			
50 YEARS HENCE The extent of open, treeless meadows would be relatively unchanged. Meadows would be less floristically diverse and increasingly dominated by introduced plant species. Meadow would provide important habitat for many species of grassland- and wetland-dependent wildlife.	50 YEARS HENCE The extent of open, treeless meadows would gradually increase. High-priority meadows would be more floristically diverse, dominated by native herbaceous species. Remaining meadows would be dominated by woody and introduced plant species. Meadow would provide important habitat for many species of grassland- and wetland-dependent wildlife. Some wetland-dependent species would increase, such as sandhill crane and yellow rail.	50 YEARS HENCE *Same as alternative B, except* waterfowl nest survival would be enhanced via annual removal of mammalian nest predators. Compared to alternative B, meadows would be less floristically diverse, because controlling woody vegetation and maximizing tall and dense structure would be more important than native plant composition.	50 YEARS HENCE Native herbaceous plants would dominate meadows. Grassland- and wetland-dependent wildlife diversity and abundance would increase. Wildlife species that are associated with woodland and shrubland would persist but would be sparsely distributed. Despite extensive restorations, potential effects associated with 70 years of altered river hydrology (especially hydroperiod) would remain poorly understood. Meadow would provide important habitat for grassland- and wetland-dependent wildlife species.
WETLAND—Management Actions			
Des Lacs NWR—6,800 acres; J. Clark Salyer NWR—26,000 acres; Upper Souris NWR—12,175 acres			
GENERAL APPROACH Under existing constraints, enhance the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Manage nonriverine wetlands in concert with the surrounding habitats (such as drift prairie and prairie parkland). Exclude carp from riverine wetlands.	GENERAL APPROACH To the fullest extent possible, prolong the capacity of riverine wetlands to support diverse plant and wildlife communities, especially on units with the greatest potential for success. To this end, increase coordination among refuges and other water users. Manage nonriverine wetlands in concert with the surrounding habitats (such as drift prairie and prairie parkland). Exclude carp from riverine wetlands.	GENERAL APPROACH *Same as alternative B.*	GENERAL APPROACH Strive to fully restore native plant communities and ecological processes that shaped them. Manage nonriverine wetlands in concert with the surrounding habitats (such as drift prairie and prairie parkland). Exclude carp from riverine wetlands. Develop effective coordination among Souris River water users, especially among the three refuges. Amend or modify existing river management plans to support restoration of the system.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (*Current Management*)	*Alternative B—* (*Proposed Action*)	*Alternative C*	*Alternative D*
WETLAND—Management Actions			
ECOLOGICAL PROCESSES To the extent possible, use water level management to coarsely mimic periodic wet and dry cycles. When applicable, manage impoundments according to the 1959 interim agreement (as modified) between Canada and the United States. Obtain remaining prescriptive water rights through North Dakota State Water Commission. Continue to monitor water quantity. ***Refuge Qualifiers*** *Des Lacs NWR:* Monitor water quality of releases from Kenmare sewage lagoon. *Upper Souris NWR:* Periodically supply water to marshes at J. Clark Salyer NWR and Upper Souris NWR.	ECOLOGICAL PROCESSES To the extent possible, use water level management to coarsely mimic periodic wet and dry cycles. Enhance coordination with all water users within the watershed to restore or mimic natural fluvial dynamics of riverine wetlands. Increase water quality monitoring and reduce nonpoint source pollution and sedimentation. Obtain remaining prescriptive water rights through North Dakota State Water Commission. Buy additional water rights. ***Refuge Qualifier*** *Des Lacs NWR:* Monitor water quality of releases from Kenmare sewage lagoon; enforce North Dakota standards.	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES Strive to fully restore historical natural fluvial dynamics, including hydrology and hydroperiod. Where feasible, remove dikes, dams, channels, right-of-way berms, spoil piles, and islands to restore processes or physical habitat features locally to sustain long-term form and function to a riverine marsh system. Obtain remaining prescriptive water rights through North Dakota State Water Commission. Enhance water quality monitoring and work to reduce nonpoint source pollution and sedimentation. ***Refuge Qualifier*** *Des Lacs NWR:* Monitor water quality of releases from Kenmare sewage lagoon; enforce North Dakota standards.
PLANT COMMUNITY INTEGRITY AND STRUCTURE To the extent possible, maintain a broad array of vegetation composition and structure, including annual, emergent, and submergent wetland plant species. Maintain varied interspersion of vegetation and open water (hemi-marsh is 50% open water and 50% emergent vegetation). *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE In high-priority units, emphasize long-term capacity of wetlands to support diverse wetland plant communities. In priority impoundments, use periodic disturbance to provide the full spectrum of wetland conditions, including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore fluvial dynamics to improve vegetation composition, structure, and interspersion. Restore wetlands to improve structure and function of wetland plant communities. Expand detection and control of invasive species such as purple loosestrife and salt cedar. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Use an integrated approach to detect and control noxious weeds, especially purple loosestrife and salt cedar.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED marsh (degenerative phase), and open water. Use an integrated approach to detect and control noxious weeds, especially purple loosestrife and salt cedar. ***Refuge Qualifiers*** *Des Lacs NWR and J. Clark NWR:* Evaluate construction of a bypass channel to improve wetland management.		PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Remove created wetlands and restore upland prairie communities in these sites.
WETLAND—Environmental Consequences			
ECOLOGICAL PROCESSES Disruption of natural fluvial dynamics and physical attributes of the Souris River would be extreme, because of low-head dams and other physical structures that have been constructed along the rivers. Wetlands would be semipermanent or lake-like compared to the natural, presettlement condition. Water-level fluctuations would be less dynamic that the historical condition, which would hinder soil and wetland functions. Wetland soils would remain perennially moist and be infrequently oxidized. The degree to which pollution and *(continued)*	ECOLOGICAL PROCESSES Although physically altering the Souris River system to a further extent (especially at Des Lacs NWR), attempts to restore significant ecological processes and wetland function would potentially prolong the functional lifespan of riverine wetlands in high-priority units. In high-priority wetland units, soils would periodically dry and oxidize during the dry-marsh phase. The degree to which pollution and sedimentation threats were addressed at the watershed level would determine their short- and long-term effects on riverine wetlands.	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES Wetland processes would be widely restored. In other units, restorations would be biologically impossible, politically constrained, or cost prohibitive. The physical disruption of hydrologic function would gradually decline as dikes, dams, channels, right-of-way berms, spoil piles, and islands were removed. Wetland soils would dry and be frequently oxidized during the dry-marsh phase. The degree to which pollution and sedimentation threats were addressed at the watershed level would determine their short- and long-term effects on riverine wetlands.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Environmental Consequences			
ECOLOGICAL PROCESSES CONTINUED sedimentation threats were addressed at the watershed level would determine their short- and long-term effects on riverine wetlands.			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Many wetland units would lack capacity to provide the full spectrum of wetland conditions, including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open marsh (degenerative phase), and open water. Some units would remain static, almost perpetually in either a densely vegetated or an open-water phase. The critically important drawdown (dry marsh) phase would be the most unattainable stage of the wetland cycle. Soils would remain relatively moist during drawdown; germination of important annual plants would rarely occur. When wetland units were successfully dewatered, annual, emergent, and submergent plant species would be common. Remaining units would be perennially dominated by algae and submerged aquatic plants (open-water phase) or robust emergent plant species (densely vegetated phase).	PLANT COMMUNITY INTEGRITY AND STRUCTURE In high-priority units, the capacity to provide the full spectrum of wetland conditions would increase. All phases would be represented including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open marsh (degenerative phase), and open water. Elsewhere, units would remain static, almost perpetually in either a densely vegetated or an open-water phase. As high-priority wetlands were cycled through all marsh phases, wetland plant species and structural diversity would increase. Annual, emergent, and submergent plant species would be common. Remaining units would be perennially dominated by algae and submerged aquatic plants (open-water phase) or robust emergent plant species (densely vegetated phase). The frequency of germination of important annual wetland plants (such as smartweeds) and the control of robust emergent vegetation would increase in high-priority units.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Collectively, riverine wetlands would gradually shift from a static lake-like system to a dynamic riverine system. Wetlands with seasonal and temporary water regimes would increase. The area of semipermanent wetlands would possibly decrease; the area of lakes would markedly decrease. Many wetlands would naturally cycle through the full spectrum of wetland conditions including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open marsh (degenerative phase), and open water. Wetland plant diversity would increase, especially annual wetland plants such as smartweeds. Complete restoration of wetland plant communities would be unlikely in units with significant sediment accretion or in units that have been dominated for more than 40 years by robust emergent vegetation, especially cattail and common reed.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B*— (Proposed Action)	*Alternative C*	*Alternative D*
WETLAND—Environmental Consequences			
TRUST WILDLIFE SPECIES Wetlands would provide important habitat for wetland-dependent wildlife species. The wildlife community would be dominated by species associated with semipermanent wetlands (dabbling and diving ducks, American coot, grebes, and gulls). Less common would be species associated with seasonal and temporary wetlands such as ducks, rails, songbirds, and shorebirds.	TRUST WILDLIFE SPECIES Wetlands would provide important habitat for grassland- and wetland-dependent wildlife species. Wildlife diversity would increase with more diverse wetland conditions. Dynamic wetland conditions would favor plant and invertebrate foods that attract breeding and migrating birds such as shorebirds. There would be declines in local abundances of species that rely on large, stable wetlands (such as white pelican, double-crested cormorant, western grebe, and walleye).	TRUST WILDLIFE SPECIES *Same as alternative B.*	TRUST WILDLIFE SPECIES Wetlands would provide important habitat for grassland- and wetland-dependent wildlife species. Wildlife diversity would increase with more diverse wetland conditions. Dynamic wetland conditions would favor plant and invertebrate foods that attract breeding and migrating birds such as shorebirds. Species that use temporary, seasonal, and semipermanent wetlands would increase. Species that rely on large, stable wetlands (such as white pelican, double-crested cormorant, and western grebe) would occur, but would not be widespread. Game fish, especially walleye and perch, would be rare.
50 YEARS HENCE With their limited lifespans, riverine impoundments would continue to decline in quality. The capacity to manage water levels would decline significantly because of high sedimentation rates and accretion of organic materials. Robust emergent plants would increase and dominate many wetland units. Riverine wetlands would remain important nesting *(continued)*	50 YEARS HENCE *Same as alternative A; however*, the rate of decline in wetland functions would be moderately to significantly reduced dependent on the degree to which wetland processes were restored. Without significant reductions in soil erosion and wetland destruction within the watershed (outside the refuges), wetland quality would continue to decline due *(continued)*	50 YEARS HENCE *Same as alternative B.*	50 YEARS HENCE Processes that create and maintain wetlands would be measurably enhanced. However, successful restoration would depend on agreement among water users within the Souris River basin to enhance the long-term capacity of wetlands to remain productive (potentially in conflict with other objectives that govern use of the Souris and Des Lacs rivers). *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Environmental Consequences			
50 YEARS HENCE CONTINUED and migration habitat for many species of wetland-dependent migratory birds. However, wildlife abundance and species diversity would be reduced.	50 YEARS HENCE CONTINUED to irreversible accretions of sediment, organic material, and pollution.		50 YEARS HENCE CONTINUED Despite extensive restorations, potential effects associated with 70 years of altered river hydrology (especially hydroperiod) would remain poorly understood. Without significant reductions in soil erosion and wetland destruction within the watershed (outside the refuges), wetland quality would continue to decline due to irreversible accretions of sediment, organic material, and pollution.
ISLANDS—Management Actions			
Des Lacs NWR—8 islands; J. Clark Salyer NWR—50 islands; Upper Souris NWR—28 islands			
GENERAL APPROACH Control predators during drought years to increase waterfowl recruitment. Give priority to islands that have historically attracted high densities of nesting waterfowl. ***Refuge Qualifier*** *Des Lacs NWR:* Annually control predators.	GENERAL APPROACH Control predators during drought years to increase waterfowl recruitment. Give priority to islands that have historically attracted high densities of nesting waterfowl. Remove islands that have perennially low waterfowl nest densities. ***Refuge Qualifier*** *Des Lacs NWR:* Annually control predators.	GENERAL APPROACH Annually control predators to maximize waterfowl production on all islands. Restore or reconstruct damaged and poorly constructed islands. Build more islands.	GENERAL APPROACH Remove all artificial islands.
ECOLOGICAL PROCESSES Use water-level management to attract waterfowl and increase nest survival. Increase open-water barriers surrounding islands. Periodically use fire to rejuvenate vegetation.	ECOLOGICAL PROCESSES *Same as alternative A.*	ECOLOGICAL PROCESSES *Same as alternative A, except* periodically reduce water levels in impoundments during winter to reduce mink survival.	ECOLOGICAL PROCESSES *No longer applies.*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B*— (Proposed Action)	*Alternative C*	*Alternative D*
ISLANDS—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Use water-level management to reduce emergent plant cover surrounding islands. Enhance island cover to attract nesting ducks and discourage gull nesting.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* use Rodeo® herbicide to augment water-level management to reduce emergent plant cover surrounding islands.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *No longer applies.*
ISLANDS—Environmental Consequences			
ECOLOGICAL PROCESSES In most years, island characteristics (such as surrounding open-water barrier and water depth) would be a function of natural wet-to-dry cycles and management of water levels to meet wetland objectives. Fire would periodically reduce plant litter and stimulate nutrient cycling. Some islands would be prone to wind and wave erosion during extended periods of high water. Management of marsh water levels to protect and enhance islands as predator-free nesting habitat would possibly conflict with management goals and objectives for marsh units.	ECOLOGICAL PROCESSES *Same as alternative A,*	ECOLOGICAL PROCESSES *Same as alternative A.*	ECOLOGICAL PROCESSES With islands removed, there would no longer be potential conflicts between their management and wetland management. Soil erosion would be reduced.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
ISLANDS—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Cover of emergent vegetation (especially cattail and common reed) surrounding islands would be reduced, making islands more attractive to nesting waterfowl. Planted, dense patches of low shrub would increase duck nesting and reduce gull nesting. Leafy spurge, Canada thistle, and wormwood would be common on some islands and would be dispersion seed sources to mainland shorelines.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority islands, cover of emergent vegetation (especially cattail and common reed) surrounding islands would be reduced, making islands more attractive to nesting waterfowl. On unproductive islands, cover would possibly be burned annually to reduce nesting. Some unproductive islands would be removed and would revert to wetland. Leafy spurge, Canada thistle, and wormwood would be common on some islands and would be dispersion seed sources to mainland shorelines.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On all islands, surrounding and shoreline emergent cover (especially cattail and common reed) would be reduced to make nesting islands more attractive to waterfowl. Opportunities for using muskrats to manage wetland vegetation would be mostly lost because water levels would be kept intentionally low during winter to reduce occurrence of mink. Leafy spurge, Canada thistle, and wormwood would be common on some islands and would be dispersion seed sources to mainland shorelines.	PLANT COMMUNITY INTEGRITY AND STRUCTURE About 50–100 acres of upland island habitat would be converted to wetland habitat. Islands would no longer be seed sources for leafy spurge, Canada thistle, and wormwood.
TRUST WILDLIFE SPECIES Islands would increase local waterfowl recruitment, especially for gadwall, mallard, and Canada geese. Effects would be significant during drought years when wetland habitat outside refuges was limited and in conjunction with predator control. Conversely, during high water years, mink would possibly reduce duck nest survival and recruitment.	TRUST WILDLIFE SPECIES *Same as alternative A*, *except* perennially unproductive islands would be removed, reducing risk of some islands functioning as "population sinks."	TRUST WILDLIFE SPECIES *Same as alternative A* , *except* islands would be more frequently and extensively managed. During high-water years, extra effort would be required to remove mink. When present, mink would significantly reduce duck nest and brood survival.	TRUST WILDLIFE SPECIES Some ducks, geese, double-crested cormorants, American avocets, and other waterbirds that nest on islands would be displaced to upland or overwater nest sites. Local waterfowl production would decline.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B*— (Proposed Action)	*Alternative C*	*Alternative D*
ISLANDS—Environmental Consequences			
50 YEARS HENCE Objectives for wetland management and island management would periodically conflict. Island maintenance would be expensive. Islands would enhance local waterfowl production.	50 YEARS HENCE *Same as alternative A, except* resources expended on islands would dilute management of other habitats.	50 YEARS HENCE *Same as alternative A, except* waterfowl production would be greater than for other alternatives.	50 YEARS HENCE Local waterfowl production would decline.
CULTURAL RESOURCES—Management Actions			
Continue to protect cultural resources as they are found. Inventory resources only for construction projects.	*Same as alternative A, plus* promote interpretation of cultural resources.	*Same as alternative A, plus* promote interpretation of cultural resources.	Inventory and protect cultural resources. Enhance the understanding of cultural resources through research and interpretation.
CULTURAL RESOURCES—Environmental Consequences			
Existing and newly discovered cultural resources would be protected.	*Same as alternative A, plus* public and refuge staff awareness of the cultural history prior to and during refuge establishment would be enhanced.	*Same as alternative A, plus* public and refuge staff awareness of the cultural history prior to and during refuge establishment would be enhanced.	Existing and newly discovered cultural resources would be inventoried and protected. Public and refuge staff awareness of the cultural history prior to and during refuge establishment would be enhanced. Scientific knowledge about the role of human habitation in or near refuges would increase.
VISITOR SERVICES, *Hunting*—Management Actions			
Continue hunting programs to manage wildlife and provide recreational hunting opportunities.	Provide hunting opportunities only when resources needed to administer hunting do not negatively affect the ability to carry out habitat management.	Evaluate opportunities for waterfowl hunting (may require congressional approval). Review and evaluate the effects of other hunting programs on breeding and migrating waterfowl.	*Same as alternative A.*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A *(Current Management)*	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
VISITOR SERVICES, *Hunting*—Environmental Consequences			
There would be no significant change to the hunting program.	There would be no significant change to hunting programs that do not adversely affect the ability to carry out habitat management.	Waterfowl hunting opportunities would possibly be added or expanded. There would be no significant change to the other hunting programs that do not adversely affect waterfowl management. Waterfowl hunting would possibly disturb or cause resting waterfowl to leave the refuge, thereby negatively affecting waterfowl hunting outside the refuge boundary. Hunting would possibly increase refuge visitation. Habitat changes would possibly shift hunting opportunities from one species group to another. For example, increases in tall shrubs and trees could affect the attractiveness of upland habitats to game birds (for example, sharp-tailed grouse hunting opportunities would decline and ruffed grouse hunting opportunities would increase). Effects on deer populations would be negligible.	*Similar to alternative A, except* habitat changes would possibly shift hunting opportunities from one species group to another. For example, decreases in tall shrubs and trees could affect the attractiveness of upland habitats to game birds (for example, sharp-tailed grouse hunting opportunities would increase and ruffed grouse hunting opportunities would decline).
VISITOR SERVICES, *Fishing*—Management Actions			
Continue recreational fishing. ***Refuge Qualifier*** *Des Lacs NWR:* Do not provide fishing.	Provide recreational fishing opportunities only when resources needed to administer fishing do not negatively affect the ability to carry out habitat management.	Review and evaluate the effects of fish population dynamics (for example, stocking and predators) and recreational fishing on breeding and migrating waterfowl.	Continue a recreational fishing program, but limit stocking to the reintroduction of locally native fish species. Investigate the effects of introduced biota not native to the Hudson Bay headwaters/mixed-grass prairie drainage.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (*Current Management*)	*Alternative B*— (*Proposed Action*)	*Alternative C*	*Alternative D*
VISITOR SERVICES, *Fishing*—Environmental Consequences			
There would be no significant change to the fishing program. ***Refuge Qualifier*** *Des Lacs NWR:* Fishing would not be provided.	Fishing opportunities would remain relatively unchanged. However, populations of yellow perch and walleye may periodically decline due to more frequent winterkill. Fish habitat would improve in conjunction with more dynamic water level fluctuations, thereby enhancing fish populations over the long term.	*Same as alternative B.*	Fishing opportunities would be dramatically reduced. Fishing visits would possibly decrease drastically. Stocking would be limited to locally native species.
VISITOR SERVICES, *Wildlife Observation, Wildlife Photography, Interpretation, Environmental Education*—Management Actions			
Continue recreational wildlife observation and photography. Continue minimal interpretation and environmental education.	Maintain or increase development of wildlife observation and photography programs and facilities. Expand interpretation and environmental education with an emphasis on natural plant and animal communities and habitat restoration.	Maintain or increase development of wildlife observation and photography programs and facilities. Expand interpretation and environmental education with an emphasis on waterfowl.	*Same as alternative B.*
VISITOR SERVICES, *Wildlife Observation, Wildlife Photography, Interpretation, Environmental Education*—Environmental Consequences			
There would be no significant change to these programs. Interpretive value would be diminished with the continued decline of native prairie flora.	*Similar to alternative A, except* improved habitat conditions in some areas would possibly result in more opportunities for observation and photography of a greater diversity of native wildlife and plants. Interpretive and education programs would enhance awareness of prairie and wetland ecology and management.	*Similar to alternative A, except* improved habitat conditions would possibly result in more opportunities for observations and photography of waterfowl and other wildlife. Opportunities for viewing endemic grassland birds would decline. Interpretive and education programs would enhance awareness of waterfowl ecology and management.	Improved habitat conditions would result in more opportunities for observation and photography of a greater diversity of prairie wildlife and plants. Interpretive and education programs would significantly enhance awareness of prairie and wetland ecology and management and engage the public in prairie restoration efforts.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (*Current Management*)	*Alternative B*— (*Proposed Action*)	*Alternative C*	*Alternative D*
VISITOR SERVICES, *Non-wildlife Dependent Recreation*—Management Actions			
Permit non-wildlife-dependent recreational activities (such as canoeing and hiking), when compatible under compatibility guidelines.	*Same as alternative A.*	*Same as alternative A.*	*Same as alternative A.*
VISITOR SERVICES, *Non-wildlife Dependent Recreation*—Environmental Consequences			
Based on compatibility guidelines, changes would possibly occur in some of the non-wildlife-dependent uses.	*Same as alternative A.*	*Same as alternative A.*	*Same as alternative A.*
RESEARCH AND SCIENCE—Management Actions			
Emphasize inventory and applied research over short- and long-term monitoring. Limit research to evaluations of strategies to enhance native plant communities and discouraging invasive plants. Track only broad, long-term vegetation succession. Focus efforts mainly on baseline inventories and basic assessments of trust wildlife species–habitat interactions. Collaborate on, cooperate with, or otherwise support relevant research by outside parties.	Emphasize inventory and applied research over short- and long-term monitoring. Limit research to evaluations of strategies to enhance native plant communities and discouraging invasive plants. Intensively assess changes in vegetation composition and structure on high-priority units; otherwise, monitor only long-term, general vegetation changes. Focus efforts mainly on baseline inventories and basic assessments of trust wildlife species–habitat interactions. Collaborate on, cooperate with, or otherwise support relevant research by outside parties.	Expand research to focus on methods that enhance waterfowl production, especially nest density, nest survival, hen survival, and brood survival. Track nest survival as an index to recruitment rate. Assess extent and effectiveness of predator control.	Expand research to focus on restoration of ecological processes (such as landscape factors, and fire– and grazing–plant interactions) important in maintaining northern prairie and wetland plant communities. Carry out rigorous, experimental approaches as well as case history studies. Expand research to predict trust wildlife species responses to habitat restoration. Expand baseline assessments to include invertebrate communities. Collaborate on, cooperate with, or otherwise support relevant research by outside parties.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—* (Proposed Action)	*Alternative C*	*Alternative D*
RESEARCH AND SCIENCE—Environmental Consequences			
Many invasive plant issues would remain unresolved. Small, annual changes in vegetation composition on upland sites would continue unrecognized until plant communities became compromised, to the point that future restorations would be unlikely. Knowledge of some vegetation management strategies would be enhanced. Limited inventory, research, and monitoring would be conducted in wetland systems, resulting in a poor ability to defend management actions. Basic relationships of bird species to their habitats would be understood, but investigations would be limited to high-priority management issues.	Inventory and applied research would be emphasized over monitoring. Knowledge regarding effects of invasive plant species; prairie management methods; and prairie vegetation, community dynamics would increase. Most emphasis would be placed on monitoring and applied research of upland habitat restorations. Without additional staff, limited inventory, research, and monitoring would be conducted in wetland systems, resulting in a poor ability to defend management actions. Basic relationships of bird species to their habitats would be understood, but investigations would be limited to high-priority management issues.	Methods that attract waterfowl and increase recruitment would be investigated. Annual waterfowl production would be estimated. Significant knowledge gaps would remain regarding invasive plant species management; prairie management; and prairie vegetation, community dynamics. Important changes in vegetation composition on upland sites would be unrecognized. Effects of waterfowl habitat and population management (such as predator control) on nontarget wildlife species are unknown.	Extensive inventories, short- and long-term monitoring and applied research would vastly increase. The adaptive resource management process would be fully implemented. There would be a significant increase in biological staffing to support research, monitoring, and inventory. The Souris River basin refuges would serve as demonstration sites for habitat management and restoration.
OPERATIONS—Management Actions			
Continue the current level of operations and maintenance for natural resources, existing visitor service facilities, and administrative infrastructure. ***Refuge Qualifiers*** *Des Lacs NWR:* Retain current staffing of 13 full-time equivalent (FTE) employees (2 FTEs assigned to the refuge; 11 FTEs assigned to the Des Lacs NWR Complex). *(continued)*	Increase funding to support ecological restoration efforts. ***Refuge Qualifiers*** *Des Lacs NWR:* Attain target (minimum) staffing level to carry out this alternative—19 FTEs (assign 5 FTEs to the refuge; assign 14 FTEs to the Des Lacs NWR Complex). *(continued)*	Increase funding for waterfowl habitat and visitor service facilities. ***Refuge Qualifiers*** *Des Lacs NWR:* Attain target (minimum) staffing level to carry out this alternative—19 FTEs (assign 5 FTEs to refuge; assign 14 FTEs to Des Lacs NWR Complex). *(continued)*	Increase funding to support ecological restoration efforts and visitor service facilities. ***Refuge Qualifiers*** *Des Lacs NWR:* Attain target staffing level to carry out this alternative—29 FTEs (assign 8 FTEs to refuge; assign 21 FTEs to Des Lacs NWR Complex). *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (*Current Management*)	*Alternative B*— (*Proposed Action*)	*Alternative C*	*Alternative D*
OPERATIONS—Management Actions			
J. Clark Salyer NWR: Retain current staffing of 16 FTEs (12 FTEs assigned to the refuge; 4 FTEs assigned to the J. Clark Salyer NWR Complex). *Upper Souris NWR:* Retain current staffing of 7.0 FTEs.	*J. Clark Salyer NWR:* Attain target (minimum) staffing level to carry out this alternative—22 FTEs (assign 18 FTEs to the refuge; assign 4 FTEs to the J. Clark Salyer NWR Complex). *Upper Souris NWR:* Attain target (minimum) staffing level to carry out this alternative—9.5 FTEs.	*J. Clark Salyer NWR:* Attain target (minimum) staffing level to carry out this alternative—22 FTEs (assign 18 FTEs to refuge; assign 4 FTEs to J. Clark Salyer NWR Complex). *Upper Souris NWR:* Attain target (minimum) staffing level to carry out this alternative—9.5 FTEs.	*J. Clark Salyer NWR:* Attain target (minimum) staffing level to carry out this alternative—33.5 FTEs (assign 25 FTEs to refuge; assign 48.5 FTEs to J. Clark Salyer NWR Complex). *Upper Souris NWR:* Attain target (minimum) staffing level to carry out this alternative—18.0 FTEs.
OPERATIONS—Environmental Consequences			
There would be no significant change to staffing and funding levels. Target (minimum) staff and resources would carry out this alternative, which would be inadequate to conserve prairie and wetland resources.	Target (minimum) staffing levels, with adequate funding, would carry out this alternative—only priority areas would improve, others would continue to degrade. Under triage management, the amount of conservation and restoration work done would be commensurate with the amount of available staffing and funding. Additional staff and resources would ensure that a greater range of priority areas would receive attention.	Target (minimum) staffing levels, with adequate funding, would carry out this alternative—certain habitats would not receive needed restoration.	Target (minimum) staffing levels, with adequate funding, would carry out this alternative. If additional staffing and funding were provided, all habitat areas would improve.

Economic Impacts of the No-action and Proposed Action Alternatives

This section analyzes the local economic impacts associated with current management activities (alternative A) at each refuge and the change in management activities associated with the proposed action (alternative B).

Impacts from Refuge Administration

Each year, the refuges purchase a wide variety of supplies and services for operations and maintenance activities.

Refuge Spending

Purchases that are made locally contribute to the local economic impacts associated with the refuge. Major local expenditures for all refuges include: (1) auto repairs, parts, and fuel; (2) equipment; (3) supplies and services related to building maintenance; (4) miscellaneous supplies; and (5) utilities.

Another major annual local expenditure for J. Clark Salyer NWR is easement payments to landowners.

In 2005, the nonsalary budget was $264,594 for Des Lacs NWR, $303,727 for J. Clark Salyer NWR, and $372,900 for Upper Souris NWR. According to refuge personnel, Des Lacs NWR purchases approximately 21% of annual nonsalary budget expenditures locally in the towns of Kenmare and Bowbells, J. Clark Salyer NWR purchases approximately 70% within Bottineau and McHenry counties, and Upper Souris NWR purchases approximately 47% within Ward and Renville counties. Table 6 shows the current impacts (alternative A) associated with the nonsalary budget purchases made locally for each refuge.

The local work-related purchases by Des Lacs NWR account for $70,500 in local output annually (2005$). This generates a total impact of $20,600 in personal income and 0.8 of a job annually in the Kenmare and Bowbells area (table 6). The local work-related purchases by J. Clark Salyer NWR account for $243,800 in local output annually, which generates a total impact of $40,800 in personal income and 2.1 jobs annually in Bottineau and McHenry counties. The local work-related purchases by Upper Souris NWR account for $228,200 in local output annually, which generates a total impact of $80,200 in personal income and three jobs annually in Ward and Renville counties.

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Prairie Rose

According to refuge personnel, under the proposed action (alternative B), annual nonsalary expenditures are anticipated to remain similar to alternative A for Des Lacs NWR, increase by $108,894 for J. Clark Salyer NWR, and increase by $149,100 for Upper Souris NWR. It was assumed the proportion spent locally would remain the same as for alternative A for each refuge. The resulting economic impacts associated with nonsalary budget purchases made locally for each refuge for alternative B in table 7.

The change in local nonsalary spending impacts between alternative A and alternative B are shown in table 8. The local work-related purchases by Des Lacs NWR under alternative B are expected to be the same as under alternative A. The local work-related purchases by J. Clark Salyer NWR under alternative B are expected to account for $331,100 in local output annually, which would generate a total impact of $55,400 in personal income and 2.8 jobs

Table 6. Economic impacts of local nonsalary budget purchases for alternative A for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$70,500	$243,800	$228,200
Income ($/year)	$20,600	$40,800	$80,200
Jobs	0.8	2.1	3.0

annually in Bottineau and McHenry counties. This represents an increase of $87,300 in local output, $14,600 in personal income, and 0.7 of a job as compared to alternative A (table 8). The local work-related purchases by Upper Souris NWR under alternative B are expected to account for $319,300 in local output annually, which would generate a total impact of $112,200 in personal income and 4.2 jobs annually in Ward and Renville counties. This represents an increase of $91,000 in local output, $32,000 in personal income, and 1.2 jobs as compared to alternative A (table 8).

Refuge Employee Spending

Refuge employees reside and spend their salaries on daily living expenses in communities near their refuge, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals/households to industries for goods and services used for personal consumption. The IMPLAN modeling system contains household consumption spending profiles that account for average household spending patterns by income level. These profiles also capture average annual savings and allow for leakage of household spending to outside the region.

In 2005, the salary budget (including benefits) was $431,168 for Des Lacs NWR, $820,013 for J. Clark Salyer NWR, and $553,500 for Upper Souris NWR. Table 9 shows the current impacts (alternative A) associated with local staff salary spending for each refuge. Spending of salaries by Des Lacs NWR staff accounts for $328,200 in local output annually (2005$). This generates a total impact of $71,600 in personal income and three jobs annually in the Kenmare and Bowbells area. Spending of salaries by J. Clark Salyer NWR staff accounts for $705,100 in local output annually, which generates a total impact of $70,400 in personal income and 4.3 jobs annually in Bottineau and McHenry counties.

Table 7. Economic impacts of local nonsalary budget purchases for alternative B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$70,500	$331,100	$319,300
Income ($/year)	$20,600	$55,400	$112,200
Jobs	0.8	2.8	4.2

Table 8. Change in local nonsalary spending impacts between alternatives A and B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$0	+$87,300	+$91,000
Income ($/year)	$0	+$14,600	+$32,000
Jobs	0	+0.7	+1.2

Table 9. Local economic impacts of salary spending by refuge personnel for alternative A for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$328,200	$705,100	$600,700
Income ($/year)	$71,600	$70,400	$125,100
Jobs	3.0	4.3	5.9

Table 10. Local economic impacts of salary spending by refuge personnel for alternative B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$328,200	$889,000	$917,600
Income ($/year)	$71,600	$89,800	$191,200
Jobs	3.0	5.5	9.1

Table 11. Change in salary spending impacts between alternatives A and B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$0	+$193,900	+$316,900
Income ($/year)	$0	+$19,400	+$66,100
Jobs	0	+1.2	+3.2

Spending of salaries by Upper Souris NWR staff account for $600,700 in local output annually, which generates a total impact of $125,100 in personal income and 5.9 jobs annually in Ward and Renville counties.

According to refuge personnel, under the proposed action (alternative B), the annual salary budget is anticipated to remain similar to alternative A for Des Lacs NWR, increase by $295,181 for J. Clark Salyer NWR, and increase by $292,000 for Upper Souris NWR. The resulting economic impacts associated with local staff salary spending for each refuge for alternative B are presented in table 10.

The changes in salary spending impacts between alternative A and alternative B are shown in table 11. Spending of salaries by Des Lacs NWR staff under alternative B are expected to be the same as alternative A. Spending of salaries by J. Clark Salyer NWR staff under alternative B are expected to account for $889,000 in total output annually, which would generate a total impact of $89,800 in personal income and 5.5 jobs annually in Bottineau and McHenry counties. This represents an increase of $193,900 in total output, $19,400 in personal income, and 1.2 jobs as compared to alternative A. Spending of salaries by Upper Souris NWR staff under alternative B are expected to account for $917,600 in total output annually, which would generate a total impact of $191,200 in personal income and 9.1 jobs annually in Ward and Renville counties. This represents an increase of $316,900 in local output, $66,100 in personal income, and 3.2 jobs as compared to alternative A.

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Visitors of all ages enjoy the refuges.

Visitor Spending

Spending associated with recreational visits to national wildlife refuges generates considerable economic activity. A visitor usually buys a wide range of goods and services while visiting an area. Major expenditure categories include lodging, restaurants, supplies, groceries, and recreational equipment rental. The recent Service report, "Banking on Nature: The Economic Benefits of National Wildlife Refuges Visitation to Local Communities," estimated the impact of national wildlife refuges on their local economies (Caudill and Henderson 2003). According to the report, more than 35.5 million visits were made to national wildlife refuges in fiscal year 2002, which generated $809 million of sales in regional economies. Spending by national wildlife visitors generated nearly 19,000

jobs and more than $315 million in employment income (Caudill and Henderson 2003).

In fiscal year 2002, hunting- and fishing-related visitors typically spent longer amounts of time at national wildlife refuges than nonconsumptive users, but nonconsumptive users generated approximately 30% more economic activity because the numbers of nonconsumptive use of wildlife at many refuges far exceeded the number of hunters and anglers (Caudill and Henderson 2003). Table 12 summarizes estimated current refuge visitation (alternative A) by type of visitor activity.

Table 12. Estimated annual refuge visitation for alternative A for the Souris River basin refuges, North Dakota.

Visitor Activity	*Number of Visits*	*Percentage (%) of Nonlocal Visits*[1]	*Number of Nonlocal Visits*	*Number of Hours Spent at the Refuge*[1]	*Number of Nonlocal Visitor Days*[2]
Des Lacs NWR					
Nonconsumptive use	9,400	75	7,050	2.7	2,379
Fishing	0	0	0	0	0
Big game hunting	800	25	200	8.0	200
Waterfowl and migratory bird hunting	300	80	240	8.0	240
Upland game hunting	175	25[2]	44	8.0	44
Total	10,675	—	7,534	—	2,863
J. Clark Salyer NWR					
Nonconsumptive use	10,030	75	7,523	4.8	4,514
Fishing	400	0	0	0	0
Big game hunting	2,000	65	1,300	8.0	1,300
Waterfowl and migratory bird hunting	1,800	97	1,746	8.0	1,746
Upland game hunting	600	50	300	8.0	300
Total	14,830	—	10,873	—	7,860
Upper Souris NWR					
Nonconsumptive use	12,462	16	1,994	3.3	822
Fishing	53,000	15	7,950	8.0	7,950
Big game hunting	2,200	21	462	8.0	462
Waterfowl and migratory bird hunting	0	0	0	0	0
Upland game hunting	50	34	17	8.0	17
Total	67,712	—	11,489	—	9,256

[1] *Estimates were based on visitor survey results conducted by Sexton et al. (2005).*
[2] *One visitor day = 8 hours.*

Results from USGS visitor surveys provided the average spending estimates for most visitor activities. The visitor survey asked respondents to report the amount spent in the categories of lodging, food and drink, transportation, and other expenses during their most recent visit to the refuge. Total nonlocal visitor spending per day by visitor activity for each refuge is reported in table 13. The average spending for upland game hunters was $129 per person per day, as reported in the "2001 National Survey of Fishing, Hunting, and Wildlife-associated Recreation" (U.S. Department of the Interior and U.S. Department of Commerce 2002).

Current Visitation Levels (Alternative A)

For each refuge, the resulting economic impacts associated with current visitation (alternative A) are shown in table 14. Nonlocal Des Lacs NWR visitor spending accounts for $156,000 in local output annually (2005$). This generates a total impact of $50,000 in personal income and 2.6 jobs annually in the Kenmare and Bowbells area (table 14). Nonlocal J. Clark Salyer NWR visitor spending accounts for $561,600 in local output annually, which generates a total impact of $144,900 in personal income and 9.9 jobs annually in Bottineau and McHenry counties. Nonlocal Upper Souris NWR visitor spending accounts for approximately $1.16 million in local output annually, which generates a total impact of more than $317,500 in personal income and 16.7 jobs annually in Ward and Renville counties.

Visitation Levels Associated with the Proposed Action (Alternative B)

According to refuge personnel, under the proposed action (alternative B), the total number of refuge visits is anticipated to decrease at Des Lacs NWR, and increase at J. Clark Salyer NWR and at Upper Souris NWR. Table 15 shows the estimated annual number of visits by activity for each refuge and the conversion of nonlocal visits to visitor days. At Des Lacs NWR, visits related to hunting activities are anticipated to remain similar to alternative A while nonconsumptive activities are expected to decline by 900 visits annually because of an increased focus on habitat rather than visitor services under alternative B. At J. Clark Salyer NWR, all visitor activities are anticipated to increase as compared to alternative A, from 14,830 to 22,930 total annual visits (tables 12 and 15). At Upper Souris NWR, visits related to big game hunting are anticipated to remain similar to alternative A while all other visitor activities are expected to increase, from 67,712 to 88,200 total annual visits (tables 12 and 15).

Table 13. Average nonlocal visitor spending per person per day for the Souris River basin refuges, North Dakota.

Visitor Activity	*Des Lacs NWR*	*J. Clark Salyer NWR*	*Upper Souris NWR*
Nonconsumptive use	$35.89	$31.23	$94.42
Fishing	*(not an activity)*	*(no nonlocal visitors)*	$81.00
Big game hunting	$24.15	$24.15	$88.95
Waterfowl and migratory bird hunting	$111.94	$111.94	*(not an activity)*
Upland game hunting	$129.00	$129.00	$129.00

Table 14. Annual local economic impacts of nonlocal visitor spending for alternative A for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$156,000	$561,600	$1,160,000
Income ($/year)	$50,000	$144,900	$317,500
Jobs	2.6	9.9	16.7

Table 15. Estimated annual refuge visitation for alternative B for the Souris River basin refuges, North Dakota.

Visitor Activity	*Number of Visits*	*Percentage (%) of Nonlocal Visits*[1]	*Number of Nonlocal Visits*	*Number of Hours Spent at the Refuge*[1]	*Number of Nonlocal Visitor Days*[2]
Des Lacs NWR					
Nonconsumptive use	8,500	75	6,375	2.7	2,152
Fishing	0	0	0	0	0
Big game hunting	800	25	200	8.0	200
Waterfowl and migratory bird hunting	300	80	240	8.0	240
Upland game hunting	175	25	44	8.0	44
Total	9,775	—	6,859	—	2,635
J. Clark Salyer NWR					
Nonconsumptive use	16,130	75	12,098	4.8	7,259
Fishing	1,400	0	0	0	0
Big game hunting	2,500	65	1,625	8.0	1,625
Waterfowl and migratory bird hunting	2,050	97	1,989	8.0	1,989
Upland game hunting	850	50	425	8.0	425
Total	22,930	—	16,136	—	11,297
Upper Souris NWR					
Nonconsumptive use	21,850	16	3,496	3.3	1,442
Fishing	64,000	15	9,600	8.0	9,600
Big game hunting	2,200	21	462	8.0	462
Waterfowl and migratory bird hunting	0	0	0	0	0
Upland game hunting	150	34	51	8.0	51
Total	88,200	—	13,609	—	11,555

[1] *Estimates were provided by refuge personnel.*
[2] *Estimates were based on visitor survey results conducted by Sexton et al. (2005).*
[3] *One visitor day = 8 hours.*

The economic impacts associated with refuge visitation for alternative B are presented in table 16. The change in impacts between alternative A and alternative B are shown in table 17. Nonlocal Des Lacs NWR visitor spending under alternative B is anticipated to account for $145,700 in local output annually (2005$). This would generate a total impact of $46,600 in personal income and 2.4 jobs annually in the Kenmare and Bowbells area (table 16). This represents a decrease of $10,300 in local output, $3,400 in personal income, and less than half of a job as compared to alternative A (table 17).

Table 16. Annual local economic impacts of nonlocal visitor spending for alternative B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$145,700	$749,900	$1,458,100
Income ($/year)	$46,600	$197,200	$399,100
Jobs	2.4	13.2	21.0

Table 17. Change in visitor-spending impacts between alternatives A and B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	-$10,300	+$188,300	+$298,100
Income ($/year)	-$3,400	+$52,300	+$81,600
Jobs	-0.2	+3.3	+4.3

Nonlocal J. Clark Salyer NWR visitor spending under alternative B is expected to account for $749,900 in local output annually, which would generate a total impact of $197,200 in personal income and 13.2 jobs annually in Bottineau and McHenry counties. This represents an increase of $188,300 in local output, $52,300 in personal income, and 3.3 jobs as compared to alternative A (table 17). Nonlocal Upper Souris NWR visitor spending under alternative B is expected to account for $1.46 million in local output annually, which would generate a total impact of $399,100 in personal income and 21 jobs annually in Ward and Renville counties. This represents an increase of more than $298,100 in local output, $81,600 in personal income, and 4.3 jobs as compared to alternative A (table 17).

Summary and Conclusions

Table 18 summarizes the total economic impacts for all refuge management activities at Des Lacs NWR for alternative A and for alternative B and the change in impacts between alternatives. All refuge activities would account for $607,700 in total output, $142,200 in personal income, and 6.4 jobs in the Kenmare and Bowbells area (table 18). Current refuge management activities account for 0.44% of local employment and 1.44% of local income. Alternative B would slightly decrease total employment by 0.2 of a job and total personal income by $3,400 because of anticipated decreases in refuge visitation.

Table 19 summarizes the total economic impacts for all refuge management activities at J. Clark Salyer NWR for alternative A and for alternative B and the change in impacts between alternatives. All refuge activities would account for $1.51 million in total output, $256,100 in personal income, and 16.3 jobs in Bottineau and McHenry counties (table 19). Current refuge management activities account for 0.29% of local employment and 0.08% of local income. Alternative B would increase total employment by 5.2 jobs and total personal income by $86,300 because of anticipated increases in refuge staffing, local nonsalary spending, and visitation.

Table 20 summarizes the total economic impacts for all refuge management activities at Upper Souris NWR for alternative A and for alternative B and the change in impacts between alternatives. All refuge activities would account for $1.99 million in total output, $522,800 in personal income, and 25.6 jobs in Ward and Renville counties (table 20). Current refuge management activities account for 0.03% of local employment and 0.07% of local income. Alternative B would increase total employment by 8.7 jobs and total personal income by $179,700 because of anticipated increases in refuge staffing, local nonsalary spending, and visitation.

Table 18. Summary of the economic impacts of all refuge management activities for alternatives A and B for Des Lacs NWR (Kenmare and Bowbells area), North Dakota.

	Alternative A	*Alternative B*	*Difference*
Local Output ($/year)	$607,700	$597,400	-$10,300
Income ($/year)	$142,200	$138,800	-$3,400
Jobs	6.4	6.2	-0.2
Percentage of total local income	1.14%	1.13%	-0.02%
Percentage of total local employment	0.44%	0.42%	-0.01%

Table 19. Summary of the economic impacts of all refuge management activities for alternatives A and B for J. Clark Salyer NWR (Bottineau and McHenry counties), North Dakota.

	Alternative A	*Alternative B*	*Difference*
Local Output ($/year)	$1,510,500	$1,980,000	+$469,500
Income ($/year)	$256,100	$342,400	+$86,300
Jobs	16.3	21.5	+5.2
Percentage of total local income	0.08%	0.10%	0.02%
Percentage of total local employment	0.29%	0.35%	0.07%

Table 20. Summary of the economic impacts of all refuge management activities for alternatives A and B for Upper Souris NWR (Ward and Renville counties), North Dakota.

	Alternative A	*Alternative B*	*Difference*
Local Output ($/year)	$1,988,900	$2,695,000	$706,000
Income ($/year)	$522,800	$702,500	$179,700
Jobs	25.6	34.3	8.7
Percentage of total local income	0.03%	0.04%	0.01%
Percentage of total local employment	0.07%	0.08%	0.01%