6 Implementation of the Proposed Action (Draft CCP)

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Group on trail.

The draft CCP described in this chapter presents the details of how the Service would carry out its proposed action (alternative C) for management of Sullys Hill National Game Preserve.

The planning team recommends a proposed action that best achieves the refuge purposes, vision, and goals and helps fulfill the Refuge System mission. The implementation of the final CCP begins once the Service selects and finalizes the preferred management alternative, the CCP has been approved by the regional director, and the Service has notified the public of its decision. If alternative C is selected as the preferred alternative, the objectives and strategies presented in this chapter would become the final plan to be carried out over the next 15 years. The CCP would serve as the primary management document for the refuge until it is formally revised. The Service would carry out the final CCP with assistance from partner agencies, organizations, and the public. The management direction in this chapter meets the purposes, vision, and goals of the refuge. This chapter also discusses objectives and strategies that serve as the steps needed to achieve the CCP goals.

6.1 PROPOSED GOALS, OBJECTIVES, AND STRATEGIES

A *goal* is a descriptive, broad statement of desired future conditions that conveys a purpose but does not define measurable units.

An *objective* is a concise statement that indicates what is to be achieved, the extent of the achievement, who is responsible, and when and where the objective should be achieved.

The *rationale* for each objective provides context, such as background information, assumptions, and technical details.

The *strategies* describe the actions needed to achieve the objectives.

Note: The overall guidance for use of prescribed fire and management of wildland fire is found in the description of the fire management program (appendix E).

Woodland Goal

Manage for healthy native woodlands of various age classes and structure to provide habitat for migratory birds, in balance with bison, elk, and other indigenous wildlife.

Woodland Objective 1

Develop woodland restoration units with a target of 80 acres in 15 years within the big game forest. Place emphasis on increasing the understory species composition to approximately 500 bur oak seedlings/saplings per acre, 1000 green ash seedlings/saplings per acre, 200 American elm seedlings/saplings per acre, and 500 basswood seedlings/saplings per acre.

Strategies

- Define and identify priority restoration units within the big game forest.
- Establish exclusion barriers to prevent ungulate browsing on these selected restoration units.
- Initiate scarification techniques within the restoration units, including prescribed fire, selective harvest efforts to stimulate copious sprouting, hand planting of native stock, and direct seeding of tree species.
- Fuel treatments (including prescribed fire and other mechanical treatments) will be used to reduce hazardous fuels to minimize the threat to life and property.
- Partner with the North Dakota Forest Service for monitoring the described understory species, approximately every 5 years, within the restoration units.
- Use IPM strategies to control leafy spurge, wormwood, and Canada thistle that occur in the big game forest.

Rationale

Some populations of woodland birds who use prairie woodlands have declined in the past several decades (Peterjohn et al. 1995, Rodenhouse et al. 1995). Numerous forest-interior breeding species, as well as Neotropical migrants, are considered highly area-sensitive and will respond negatively to fragmentation of woodland habitats (Robbins et al. 1989). It is evident that the total densities and species richness of forest-interior birds and Neotropical migrants are greater per area in large blocks of habitat; however, the presence of many individual species is dependent on localized vegetation structure, composition, or diversity (Finch 1991). As an example, the density of breeding birds in bur oak forests is related to several factors, including successional stage, canopy cover, and density of the shrub layer (Faanes and Andrew 1983). Further, North Dakota woodlands that are comprised of green ash are considered critical habitats for breeding birds in the state (Faanes 1984, Gaines and Kohn 1982, Hopkins et al. 1986). One study on green ash woodlands in South Dakota determined that closed-canopy stands possess greater densities of trees and shrubs than open-canopy stands, correlating with higher bird numbers in the closed-canopy stands (Hodorff et al. 1988). Based on research by Hodorff et al. (1988), the overall number of birds in closed-canopy stands of woodlands is significantly greater than in open-canopy stands. Birds likely use the dense, multiple layers for courtship and display stations, nesting sites, protection from predators, shelter from physiological stress, and additional substrates for food (Wiens and Rotenberry 1981). Closed-canopy stands with a diversity of size and age classes of trees likely perpetuate themselves, compared to the open-canopy stands with a sparse over-story and absent midstory (Hodorff et al. 1988).

Overgrazing of woodland areas by cattle may result in negative impacts, most seriously, a reduction in vegetation height profiles that may cause a change in bird species composition (Medin and Clary 1990, Verner 1984). A primary impact of overgrazing is the creation of open-canopy stands that consist of a low shrub layer, a sparse overstory, and an almost complete absence of intermediate vegetation layers. A disappearing tree canopy reduces biological diversity, as wildlife such as birds that are dependent on the vegetative composition and structure are displaced (Irby et al. 2000). In addition, large openings may impact the nesting success of focal species (those with particular management concern) because these areas attract nest parasites such as the brown-headed cowbird, and egg/chick predators such as blue jays and common grackles. Faanes (1987) also determined that avian species diversity and foliage volume in the high-ground layer, consisting of taller grasses and forbs, larger woody seedlings, and young shrubs, were significantly correlated. Ironically, this layer is often the first to be impacted by overgrazing activity. In extreme situations, lack of successful reproduction and replacement by trees and shrubs may lead to the conversion of woodlands into grass/forb communities (Dobkin 1992).

Sullys Hill National Game Preserve represents a unique native woodland community in the drift prairie physiographic region of North Dakota. Many forest-interior breeding birds (such as broad-winged hawk, veery, and ovenbird) that are absent from more open, small woodlands of the surrounding region are present at the refuge. Many of these species are long-distance Nearctic-Neotropical migrants. A recent forest inventory at the refuge estimated that regeneration levels were below 1%, likely due to overgrazing by refuge ungulates (Harsel 2006). If this percentage is maintained or decreased, the native woodland

habitat will continue to be degraded and possibly even lost. Several degraded areas within the big game forest primarily attract generalist types of bird species such as house wrens, blue jays, and cowbirds, rather than specific forest species. As a result, this associated objective describes a method to restore various blocks across the big game forest, with the intent that such an effort can increase the habitat functionality for forest-breeding birds. According to Hoover et al. (2001), a positive response is possible with exclusion of grazing by using fenced exclosures on riparian communities. They saw results within two years, especially in restoring understory vegetation. The size of the restoration units at the refuge will vary across the big game forest, totaling 80 acres. It is estimated that restoration of 80 acres every 15 years will result in the entire big game forest being restored in less than a 100-year time period (acres of the big game forest are approximately 467). This 80-acre restoration determination seemed reasonable based on the needs of browsing ungulates in balance with the necessary workload and efforts required for the restoration units. In addition, the restoration units need to be large enough blocks to positively impact migratory bird habitat use.

Based on data gleaned from the "Forest Resource Management Plan" (Harsel 2006), it is estimated that ungulate exclusion from 80 acres of habitat throughout the big game forest will increase seedlings and saplings in the understory. If seedlings and saplings develop and persist, it is likely the efforts to create a multilayer, closed forest canopy in the restoration units are progressing. To establish a baseline, targeted numbers of seedlings and saplings were obtained from data collected in the lower and south forests of the refuge, which are ungrazed and possess trees of varying age classes throughout the layers of the canopy (Harsel 2006). Essentially, the lower and south forests of the refuge are considered the most optimal habitat for forest-breeding birds that can be attained within the native woodlands of the refuge. The refuge plans to partner with the North Dakota Forest Service to do the appropriate monitoring using protocols used in the Harsel (2006) management plan.

Woodland Objective 2

Establish 5-year interval surveys to monitor the presence and density of birds in the ungrazed forests (lower and south forest units), the restoration areas outlined in objective 1, and current grazed areas of the big game forest using American redstart, red-eyed vireo, and ovenbirds as target species. This presence and density data across three survey areas will be used to evaluate the avian response to restoration efforts.

Strategies

- Partner with a university, the U.S. Geological Survey, or the Habitat and Population Evaluation Team to develop survey protocol.
- Recruit one GS-9 wildlife biologist to conduct surveys and other biological studies and management programs.
- Synthesize data and use the results to assess management efforts and identify further research needs.
- Recruit a graduate student to study ovenbird reproduction in the restoration units at least 5 years into the restoration.

Rationale

Limited baseline data exists on woodland birds at the refuge, with the primary data being an inventory conducted 2003–2004 (Cutting 2004). Using results from this inventory, input from experts, and data from the literature, the listed target species were selected. These three birds are considered breeding species that use various layers of the forest. Specifically, the American redstart requires a closed overstory, dense midstory and understory, and well-developed undergrowth. Nests usually occur in an upright fork of a deciduous understory sapling, shrub, or tree (Sallabanks 1998). Baseline data results indicate that the American redstart was identified 54 times across the 2-year survey period in the woodland habitats across the refuge. The American restart is considered a species of "High Sensitivity" based on Herkert et al. (1993), indicating they are least tolerant of habitat fragmentation. Next, the red-eyed vireo is considered a species of "Moderate Sensitivity," meaning they demonstrate an intermediate response to habitat fragmentation. This species occurred 227 times over the duration of the bird inventory at the refuge. The red-eyed vireo also nests in a forked tree branch and depends heavily on the midstory layer of the forest (Cimprich et al. 2000, Rosenberg et al. 2003). Finally, the ovenbird possesses a 'High Sensitivity' to fragmentation (Herkert et al. 1993) and was readily detectable across the woodland habitat of the refuge, with 169 individuals recorded over the two seasons of the survey. The ovenbird is considered a ground nesting bird and therefore uses the forest floor and associated materials to build its nest (Van Horn and Donovan 1994). The assumption is that if restoration units provide habitat for these three species, it is likely other forest birds will benefit as well.

As indicated in the objective, the surveys will be established in three areas of the refuge that are

under varying management regimes. First, the actual woodland restoration units described in objective 1 will be surveyed. Next, the portions of the big game forest that are not part of the restoration units which will still be grazed by bison, elk, and deer will be surveyed. Finally, the lower forest unit that is not under active management or undergoing restoration will be surveyed. Collecting data from these three areas should allow for comparison of results, while considering certain spatial, temporal, and climatic variables. To expand this monitoring effort, a graduate student will be recruited to determine the avian reproduction response in the restoration units. This project will not occur until 5 years after restoration has been implemented, and the target species will be the ovenbird. Such a project should give immediate feedback on the success of restoring understory and closed canopies when considering avian reproduction on the forest floor.

Prairie Habitat Goal

Maintain prairie plant communities representative of the historical mixed-grass prairie to support healthy populations of grassland-dependent migratory birds in balance with bison, elk and other indigenous wildlife.

Big Game Prairie Unit Objective

Create a diverse vegetative composition and structure that contains ≥50% native grasses (cool and warm season), 5–15% native forbs, ≤2% native shrubs, while controlling invasive cool season grasses at ≤30%, and controlling noxious weed infestations to <10% coverage on the grazed prairie areas within the big game prairie. This managed native prairie will be utilized over the next 15 years by grazing bison and elk while still providing habitat for migratory birds dependent on forest-edge habitat.

Strategies

- Implement typical prairie management activities, including prescribed fire, prescribed grazing, and various IPM strategies that are appropriately timed to enhance native plants while reducing the presence of invasive species. Where possible, fire will be permitted to burn into woodland margins and from one native grass remnant to another.
- Mow and cut to remove brush and shrub for maintenance of subsequent prairie and savanna-like areas.
- Develop another water source for better disbursement of ungulates.
- Partner with the Natural Resource Conservation Service to establish "Natural Resource Inventory" survey points within the big game prairie to monitor the results of management.
- Fuel treatments (including prescribed fire and other mechanical treatments) will be used to reduce hazardous fuels to minimize the threat to life and property.
- Overgrazing of grasslands would be managed by reducing ungulate populations (<20 bison, <18 elk, and <18 white-tailed deer).

Rationale

Prairie areas throughout North America continue to decline in quantity and quality, due in part to invasion by exotic plant species (Bragg and Steuter 1995, Samson and Knopf 1994). Such degradation is likely a principal factor in declines of several grassland birds (Johnson and Igl 2001). Multiple invasive plants occur across the native prairie areas within the big game prairie region of the refuge. Smooth brome is a rhizomatous, sod-forming species that is also a prolific seed producer (Willson and Stubbendieck 1997). It often excludes other plant species, effectively altering the species composition, native species diversity, and biomass of native prairie areas (Willson 1990, Willson and Stubbdieck 1997). Kentucky bluegrass frequently impacts native prairie in a similar way once invasion occurs (Grace et al. 2001). Christian and Wilson (1999) indicate that certain introduced grasses not only displace native species and consequently reduce diversity, but they also alter pools and flows of energy and nutrients in the prairie ecosystem. These species tend to dominate and overtake native species, essentially degrading the habitat. Wilson and Belcher (1989) evidenced that Eurasian plant species in the North American prairie not only replace the native plant community but also impact species compositions at higher trophic levels (the position that a species occupies in a food chain). Smooth brome poses a particularly serious management problem on the drift prairie. Because it seems more difficult to control than other introduced cool-season grasses (Murphy and Grant 2005), smooth brome more significantly alters the quality and structure of a prairie (Blankespoor 1987) and can alter the soil environment to further its own invasion (Jordan et al. 2008).

Noxious weeds, such as leafy spurge, Canada thistle, and absinth wormwood, occur across prairie regions throughout the refuge. These species also threaten the prairie biodiversity, tending to form monotypic stands through rapid

spread and growth (Bedunah 1992, Hutchison 1992, Svedarsky and Van Amburg 1996, Trammel and Butler 1995, Watson 1985, Wrage and Kinch 1981). State law mandates the eradication and control of these species. IPM practices have been implemented, such as biological controls for leafy spurge, mowing of weed patches, and herbicide treatment.

Another threat to the integrity of the refuge's prairie is the expansion of woody species into native prairie and savanna-like areas resulting from suppression of fire. According to Murphy (2005), invasion of native prairie by shrub species like western snowberry and silverberry is a principal threat to native plant diversity in North Dakota. Long-term episodes of rest (such as limited grazing and burning on prairie areas) allow for the expansion of woody species.

Burning and grazing are instrumental in maintaining prairie and producing optimal grassland bird habitat (Powell 2006). Bison are an appropriate herbivore for management of current-day northern mixed-grass prairie areas (Plumb and Dodd 1994). Historical references indicate that bison grazed heavily on a localized scale, and along with their wallowing, trampling, and rubbing activities would have created a vegetative mosaic across the prairie. Such use patterns regulated the occurrence of particular vegetation, altered vegetative structure, and produced ecosystem conditions to which other wildlife adapted (England and DeVos 1969). Grazing, at a minimum, is a tool to manipulate the grass community to reduce invasive plants, maintain vigor in the grasses, enhance forb production, and increase or decrease fuels for prescribed fire. Prescribed fire can also be used to stimulate and increase climax plant species and reduce invasive species (Franklin and Brand 1991).

Across the native prairie areas of the refuge, staff will strive to implement management that will reduce invasion of exotic and invasive species and maintain and increase native species. Historically, grazing occurred throughout the year at varying intensities across the big game forest and prairie. Recently, the high numbers of bison held at the refuge resulted in overgrazing of the prairie areas. Such management left an increase in Kentucky bluegrass, which can be reduced with prescribed fire (Murphy and Grant 2005). In addition, using prescribed fire on these areas will likely also reduce the woody species encroachment of species like western snowberry, silverberry, and chokecherry into the prairie and savanna areas. Specifically on the big game prairie, prescribed burns will occur from one native grass remnant to another, often burning into the woodland margins in between. Combining bison and elk grazing management with appropriately-timed prescribed fire should achieve the vegetation composition percentages indicated in the objective. Both of these management techniques will be necessary, especially as numbers of grazing ungulates are planned to be decreased in this CCP.

Monitoring plant species composition changes will be an integral part of management efforts to determine whether the refuge's management practices (such as burning and grazing) and their associated timing (for example, late fall four- to five-leaf stage of smooth brome) benefit or harm native plant communities. For the big game prairie areas, the U.S. Department of Agriculture (USDA) NRCS will train the refuge staff, and in some cases, conduct monitoring according to the standards of the "Natural Resources Inventory." The USDA, NRCS "Field Office Technical Guide" (1975) provided baseline information on expected species composition for the big game prairie. This information, along with input from Jeff Printz, State Range Conservationist for NRCS North Dakota, provided the percentages documented in this objective.

South Prairie Unit Objective

Increase native grass and forb grouping to >70%, decrease Kentucky bluegrass and smooth brome grass groupings each to <5%, and decrease shrub component to <5% on the 150-acre south prairie to provide habitat for grassland-nesting birds.

Strategies

- Recruit one GS-9 wildlife biologist to conduct surveys and other biological studies and management programs (same position described in woodland strategies).
- Implement typical prairie management activities, including prescribed fire, prescribed grazing, and various IPM strategies that are appropriately timed to enhance the native plants and reduce the prevalence of invasive plants.
- Fuel treatments (including prescribed fire and other mechanical treatments) will be used to reduce hazardous fuels to minimize the threat to life and property.
- Use mowing and burning to manage western snowberry and silverberry shrubs.
- Remove the tree belt on the north boundary of the south prairie (see figure 7, vegetative communities map).
- Use the belt-transect (Grant et al. 2004) method to monitor vegetative response to

management (see current plant association sheet in appendix D).

- Use point counts to monitor singing male bird presence and densities to evaluate management actions.
- Use transects and protocol established by Dr. Ron Royer to monitor butterfly response to management (Royer et al. 1998).

Rationale

Grasslands are recognized as one of the most imperiled ecosystems across the globe. The bird species that use these areas have shown dramatic and consistent declines (Knopf 1994). According to Knopf (1995) and Rich et al. (2004), as an overall group, grassland birds show higher declines than birds of other North American vegetative associations. Breeding bird survey data from 1966–1996 indicate that populations of 13 species of North American grassland birds declined significantly, and conversely, populations of only two species increased (Peterjohn and Sauer 1999). It is hypothesized that major contributing factors to this decline are grassland fragmentation and habitat loss. In this region, the native sod conversion to cropland directly impacted wetland and grassland birds by reducing and fragmenting the available breeding cover for grassland-nesting species (Batt et al. 1989, Sugden and Beyersbergen 1984). Further, many grassland- and wetland-dependent birds have few alternatives to the Great Plains (Igl and Johnson 1995); whereas birds associated with woody vegetation appear to have larger distributions across the continent (Johnson et al. 1994).

The background information regarding invasive plant species presented in the previous objective's rationale also applies to this discussion. Specifically, most of the native prairie in the region is heavily invaded by a number of exotic invasive grasses (such as smooth brome and Kentucky bluegrass) and forbs (such as Canada thistle and leafy spurge). Across Service lands, these and other exotic species have greatly reduced the coverage of native grasses and forbs, leading to reduced species composition and structural (height-density) diversity that is generally equated to a reduction in use by breeding grassland-dependent birds. Invasion by greater-than-historical extent by certain native low shrub species (for example, western snowberry, silverberry) also prevails on native prairie areas. Due to past management, or lack thereof, these native low shrub species have greatly increased their coverage compared to the pre-settlement era when frequent fire and herbivore grazing would have kept woody species to a minimum.

The refuge's south prairie is still a fairly intact native prairie community, with notable invasion by invasive and introduced plants. Through targeted and science-driven management, refuge staff will continue to strive to reverse the declines in vegetative heterogeneity and to resist invasion by exotic cool-season grasses and other plants. The assumption is that maintaining this area to approximate pre-settlement conditions will likely provide favorable habitat for grassland-dependent birds such as bobolink, grasshopper sparrow, and Sprague's pipit, to name a few. Prescribed fire occurred on this unit for three subsequent years, using the Willson and Stubbendieck (2000) model for smooth brome reduction. In addition, patches of silverberry were mowed as post-fire treatment to reduce encroachment. Future burning intervals will be based on data from several sources that recommend intervals of approximately every 3–5 years (Higgins 1986, Johnson and Temple 1990, Kirsch and Higgins 1976, Miller 1971, Svedarsky and Van Amberg 1996, Wright and Bailey 1982), as well as whatever is necessary to maintain the optimal floristics and ecological functionality of this site, considering exotic plant invasion. Efforts will also be made to pursue grazing management as another treatment to maintain and improve this site.

Bluestem.

The south prairie supports both cool- and warm-season native graminoid species (such as greenneedle, blue grama, junegrass, porcupine, little bluestem, and big bluestem) and forb species (such as purple coneflower, blanket flower, prairie lily, blazing star species, prairie coneflower, prairie turnip, and pasque flower). Baseline data indicates that 24.43% of the unit is comprised of Kentucky bluegrass groups, and 7.08% is smooth brome groupings based on the belt-transect method (Grant et al. 2004). Groupings that were used are listed on the plant association sheet in appendix D. These two invasive grasses will continue to pose challenges in management, and properly timed fire and grazing activities are necessary to achieve the percentages listed in the objective. Native grass and forb type groupings occurred at 61.45% across the unit, and low shrub types occurred at about 7%. Maintaining or reducing this shrub percentage will also be a focus of management. Western snowberry and silverberry are native shrubs that sometimes dominate grasslands devoid of management such as prescribed fire and grazing at regular intervals. As indicated by the objective, the intent is to manage these shrubs at a level where they do not dominate or expand across this native prairie. According to NRCS range site descriptions applicable to this site, the small shrub component should make up <10% by weight and only a few percent (2%–3%) composition by cover (Jeff Printz, USDA, NRCS, personal communication; USDA 1975). In addition, management to reduce smooth brome, Kentucky bluegrass, and small shrubs should enhance and ultimately increase the native grass and forb groupings to 70% as indicated in the objective.

The core area of this grassland is also intended for expansion by the removal of the planted tree row that borders the north end of the south prairie and south end of the western hayland (figure 7, vegetative communities map). With this removal, the size of this area will go from 150 acres to approximate 250 acres. According to Bakker's (2003) synthesis of the literature, most pertinent research indicate that woody vegetation negatively affects the presence, abundance, and nesting success of nongame grassland birds. A few studies suggested that woody vegetation did not effect grassland birds; however, few demonstrated a positive association (Bakker 2003). Regardless, patterns of area sensitivity probably vary for grassland birds (Davis et al. 2006), and likely this native prairie area will provide appropriate habitat size and composition for certain grassland-dependent birds including grasshopper sparrow, Savannah sparrow, bobolink, Le Conte's sparrow, sedge wren, spragues pipit, Nelson's sharp-tailed sparrow, upland-nesting shorebirds, and various waterfowl.

East Hayland Unit Objective

Restore eastern hayland to diverse, multiple species seed mixtures that after establishment maintain >60% cover of native grassland groupings based on the belt transect method (Grant et al. 2004) by year 15.

Strategies

- Prepare sites for seeding using multiple years of seed bed preparation (for example, cropping followed by multiple years of chemical fallowing using glyphosate-based herbicides).
- Develop a seed mixture with a nearly equal cool- to warm-season grass and forb component.
- Drill or broadcast the native flora mixture on-site.
- Implement a variety of tools in post-seeding management, including clipping, prescribed fire, prescribed grazing, and necessary IPM strategies.
- Fuel treatments (including prescribed fire and other mechanical treatments) will be used to reduce hazardous fuels to minimize the threat to life and property.
- Use the belt-transect (Grant et al. 2004) method to monitor restoration.
- Use point counts to monitor bird singing male presence and densities to assess the response to restoration.
- Establish transects to monitor butterfly response to restoration using Royer et al. (1998) protocol.
- Recruit partners to research the establishment of native vegetation and monitor the wildlife response.

Rationale

Both of the hayland units at the refuge are formerly cultivated areas and will therefore be referred to as "old cropland" throughout this document. These areas were reseeded to herbaceous mixtures that included species such as cool-season introduced grasses and legumes (intermediate wheatgrass, tall wheatgrass, smooth brome, and alfalfa or sweetclover), and primarily provided nesting cover for mallards and other ducks. This seed mixture has been referred to as dense nesting cover (DNC). Although a viable mixture and beneficial on multiple levels,

this mixture requires intensive inputs to maintain long-term. First, DNC has a limited lifespan, providing attractive cover to nesting ducks for perhaps only 6–8 years after seeding and up to 15 years with certain management (Higgins and Barker 1982, Lokemoen 1984). At the end of the DNC lifecycle, the field is typically cultivated and farmed for 2–3 years and then reseeded. This leads to a rotation of seeding—managing—farming—seeding and so on into perpetuity. Often times, these fields are not re-seeded at the prescribed frequencies, leaving decadent, weed-infested uplands across the landscape that are limited in attractiveness to migratory birds. The need to repeat this rotation on a regular basis negatively impacts other ecological factors in the surrounding environment such as promoting soil erosion when the area is cultivated, and necessitating herbicide use to prepare the seedbed for each new seeding.

In this CCP the refuge will reclaim the eastern hayland of old cropland by revegetating it with a diversity of native flora that, with modest management, is relatively resistant to invasion by introduced species and noxious weeds. This is seen as a benefit to grassland and wetland birds because providing habitat that is closest to the historical vegetative condition likely provides habitat for more obligate grassland wildlife. According to Howell (1988) re-creating the elements found in the original communities quite possibly is the optimal method for ensuring continued species interactions and natural selection. As an example, Baird's sparrows and Sprague's pipits appear to use short, sparse grass structure, and mostly associate with native bunch grasses, rather than the broad-leaved, introduced species used for DNC mixes (Madden et al. 2000). Further, according to Stewart (1975), and Kantrud and Higgins (1992), marbled godwits and willets typically select native grass cover over tame-grass cover. Native prairie areas that have not been cultivated typically possess a diversity of plant forms including short rhizomatous graminoids, taller bunchgrasses, a low shrub component, and finally a variety of forbs. This structural diversity is usually lower in fields dominated by introduced vegetation (most commonly, smooth brome, Kentucky bluegrass, and noxious weeds such as wormwood or leafy spurge), which possess a more homogeneous height across a field (Wilson and Belcher 1989). Grassland-obligate birds adapt to the diverse native prairie structure, whereas DNC-type mixtures limit this diversity, likely attracting only bird species that key in on this tall, dense cover.

Another notable benefit of using native seed mixtures to restore former cropland areas compared to using a DNC mixture is longevity. In theory, native seed mixtures should persist into perpetuity under appropriate management, including disturbances that emulate natural regimes at frequencies that sustained wildlife populations prior to human interventions. Management of refuge lands in North Dakota typically involves various tools to emulate the defoliation activities under which prairie plants evolved, including prescribed fire and rotational grazing. The frequency of certain activities depends on the particular habitat components; a pristine native prairie tract may require a burn every 3–5 years and intermittent, rotational grazing of domestic cattle. This is distinctly less activity over time than the rotation required to sustain DNC-seeded fields.

Experimentation with native seeding that took place 10–20 years ago in the Drift Prairie and Red River Valley areas of North Dakota usually included 3–5 native warm-season grasses. Current research indicates that this may not be an optimal mixture for successful establishment and management. Tilman et al. (1996) state that biological diversity is dependent on the functionality and sustainability of the ecosystem, leading to the idea that grassland restorations should attempt to include diverse seed mixtures. Guo et al. (2006) completed their research in North Dakota and indicate that the saturation rate for one of their studied sites was determined to be somewhere between 16 and 32 species. Inclusion of forbs in native mixtures appears to be necessary in attempts to restore variables such as nutrient cycling and energy flow (Pokorny et al. 2005). Sheley and Half (2006) indicate that seeding a wide range of forbs increases the likelihood that more niches will be filled and facilitates overall survival of the forbs. The use of multiple forbs may help to overcome temporal weather variations because at least some species should germinate and respond to the dynamic weather conditions that annually persist (Sheley and Half 2006). More specifically, varying numbers and combinations of species in differing developmental phases may be a requirement for a native-seeded area to achieve the best possible results. It is likely also that as a stand matures, a diverse mixture may play an important role in the below-ground community, providing a well-developed root system for sustainability over time (Guo et al. 2006). Further, another benefit to native flora establishment is the suggestion that species-rich seed mixtures may reduce weed invasion on restored grasslands (Blumenthal et al. 2003, Carpinelli 2001, Pokorny 2002, Sheley and Half 2006, Tilman 1996). A study by Pokorny et al. (2005) determined that indigenous forbs resisted invasion by spotted knapweed better than grasses. The overall theory in the literature indicates that seeding a diverse seed mixture

increases the inclusion of various functional groups among plant species. With extremely limited data on the reestablishment of native flora mixtures in North Dakota, there is a need to initiate long-term research in this area. Ensuring science-based management for re-seeding these areas is paramount to the perpetuation of grassland resources. The Devils Lake WMD Complex staff will continue to monitor and study this concept on refuge lands, not only at Sullys Hill National Game Preserve, but throughout the district.

With the establishment of native seed mixtures, challenges exist with controlling noxious and invasive plants. In the event that the previously mentioned management techniques fail to control weeds such as Canada thistle, IPM strategies will be used to control the infestation. It is anticipated that smooth brome will persist as a problematic invasive species. The anticipated plan is to reduce the impacts of this species by following the model provided by Willson and Stubbendieck (2000). Similar protocol will be followed to reduce Kentucky bluegrass invasion.

As a final impetus for the refuge staff to focus on using native plants to restore this hayland, are the mandates in the Improvement Act. This includes an "Integrity Policy," stating that refuges are to promote biological integrity, diversity, and environmental health and attempt the restoration of historical conditions on refuge lands.

Western Hayland Unit Objective

Provide habitat structure of > 9.8-inch visual obstruction reading (VOR) (Robel et al. 1970) on the western hayland during the primary avian nesting season (approximately May 1–August 1), and continue to provide winter forage for refuge ungulates.

Strategies

- Use rotational haying so the same area is not hayed each year.
- Use a flushing bar on the swather to reduce negative impact on nesting bird species.
- Reseed area with warm-season grasses and a forb component such as alfalfa, purple prairie clover, or vetch.
- Monitor bird use of this hay field using Robel readings to identify the VOR using Robel et al. (1970) methodology.
- Implement typical prairie management activities, including prescribed fire, prescribed grazing, and various IPM strategies that are appropriately timed to enhance the native plants and reduce the prevalence of invasive plants.
- Fuel treatments (including prescribed fire and other mechanical treatments) will be used to reduce hazardous fuels to minimize the threat to life and property.

Rationale

Currently, the primary vegetative cover of this hayland is smooth brome grass interspersed with alfalfa. Although this area lacks floristic diversity, the presence of perennial grass cover likely supports several species of birds that are considered generalists and may be more tolerant of forest edge effects. Species that may use this area include songbirds such as clay-colored sparrow, chipping sparrow, common yellow throat, as well as some species of waterfowl. By waiting until August 1 to implement defoliation through haying, most of the ground-nesting birds should have completed nesting by this date, reducing one potential negative impact of this management activity.

Reseeding the area with warm-season grasses will increase the opportunity to reduce smooth brome invasion. The addition of the legume component will increase the structure (height and density) to provide more attractive nesting cover for certain bird species, allowing for the attainment of the planned VOR.

Aaron Mize/USFWS

Antler in marsh marigolds.

Wildlife Population Management Goal

Carry out management practices that ensure healthy populations of Rocky Mountain elk, plains bison, and other indigenous wildlife species that exemplify the genetic integrity of historical prairie wildlife.

Wildlife Population Management Objective 1

Maintain the purpose of the refuge as a big game preserve by retaining a bison herd size of <20 animals, an elk herd size of ≤18 animals, and a white-tailed deer herd size of ≤18 animals for the purpose of improved habitat conditions while maintaining public viewing and interpretive opportunities.

Strategies

- Use the draft carrying-capacity study and associated model developed by Bertie and Sweitzer (2008) to maintain ungulate populations within carrying-capacity levels.
- Use prescribed fire and grazing to manage grassland areas to maintain refuge floristics (see prairie habitat and woodland habitat objectives) and provide optimal forage for grazing bison and elk.
- Adaptively manage ungulate populations based on monitoring the ungulate-induced habitat impacts (methods for monitoring habitat and migratory birds are documented under prairie and woodland objectives).
- Transfer and reduce bison herd based on the Service-wide meta-population management plan as outlined in the document, "A Framework for Bison Conservation in the Department of the Interior."
- Reduce elk and deer at appropriate intervals to maintain the populations stated in the objective.

Scott Ralston/USFWS

Yellow warbler in oak tree.

Rationale

Large ungulates such as bison, elk, and deer often impact their associated ecological systems through disturbances (horning, rubbing, wallowing), grazing, and nutrient deposition (Campbell et al. 1994, Coppedge and Shaw 1997). Although these and other activities of native ungulates are a natural part of large, open ecosystems, in relatively small, fenced, or semi-isolated areas such as Sullys Hill National Game Preserve, these activities may cause damage when ungulate densities are too high (Howell et al. 2002, Zeigenfuss et al. 2002). In small confined systems, detailed information on ungulate movements, habitat use, behavior, and diets can provide critical data for estimating habitat carrying capacity (Norland et al. 1985). Behavior is considerably more important in closed systems compared to large free-range situations because large ungulates may habitually damage habitat in these relatively small enclosures. Monitoring data will provide management guidelines for determining appropriate populations of ungulates, balanced with other multiple-use management directives.

In the past, ungulate populations at the refuge were based on the refuge's "Fenced Animal Management Plan" (Veikley 1984). This document states that, dependent on the time of the year (winter versus summer), bison numbers should range from 25–40 animals, elk from 15–25 animals, and white-tailed deer from 10–30 animals. These estimates are based on the best professional judgment at the time. Currently, to ensure that ungulate numbers within the big game forest and prairie are in balance with the needs of other wildlife at the refuge, including migratory birds, refuge staff partnered with the University of North Dakota to conduct population management research. Results of this study provide a multi-species model of the carrying capacity for the three large ungulates at the refuge and recommendations for management of herd sizes under different scenarios of weather and public viewing. In addition, the refuge also received detailed habitat GIS layers to provide baseline data on refuge floristics, which also serve as an aid for habitat management decisions (Bertie and Sweitzer 2008).

Briefly, the model uses data on diets and seasonal annual forage requirements for each ungulate, along with the annual forage production for the different plants consumed by bison, elk, and white-tailed deer as inputs. The outputs of the model provide population size scenarios predicted to be within overall carrying capacity. A primary reason for initiating this study was to study overbrowsing throughout the forest habitat, and determine methods for improving forest regeneration in the big game forest. The "standard livestock" model seemed somewhat liberal in considering forest recovery, therefore, four different management scenarios for recovery were developed. The estimates for recovery were labeled "standard," "moderate," "management," and "recovery" and were determined by using forage production estimates for unfavorable years. These categories were based on USDA NRCS data on range site use. These categories, as defined for the Bertie and Sweitzer (2008) model, are listed as standard = 70% use, moderate = 50% use, management = 30% use, and recovery = 10% use. The intent is that the majority of the grazed areas of the big game forest will be in recovery mode, meaning that the habitat is practically undisturbed and only key forage species are grazed (Bertie and Sweitzer 2008).

Based on the results of running the preliminary model, keeping 70% of the big game forest in the recovery category allows for 15 elk, 5 deer, and 19 bison. Since the described model focused more on the woodland habitat, there are under-use concerns for the big game prairie. Grasslands devoid of appropriate management will deteriorate, as described in rationales under the prairie habitat goal. A study by Norland et al. (1985) indicates that the major detrimental effect of maintaining the bison herd at the Teddy Roosevelt National Park to a base level was the underuse of certain plant communities. Excessive accumulation of litter may suppress the native grass stands and create an environment more conducive to Kentucky bluegrass, smooth brome, and woody plant establishment. Further, bison may actually avoid areas of excessive litter build-up despite the presence of adequate forage (Norland et al. 1985). As documented in the prairie habitat objectives, fire will be employed as a tool to control litter build-up, which according to Norton et al. (1985), might increase the attractiveness of these areas to bison. On areas of the big game prairie, prescribed fire will be used to maintain the native prairie vegetation and manipulate bison distribution. Further, the placement of mineral blocks (listed in the next objective) will be focused on prairie areas to attract ungulates to those areas.

The herd sizes listed in the objective were developed after considering the concerns for underuse of the prairies and overuse of the forests, and factoring in the Bertie and Sweitzer (2008) model. The indicated population sizes will allow for adaptive management of the ungulates based on the planned monitoring documented in all of the biological objectives. As an example, one strategy of decreasing brainworm on Sullys Hill National Game Preserve is to drastically decrease or eliminate the deer population. This objective allows for the reduction of deer depending on the herd health issues discussed in the following objective. In addition, if prairie areas are showing signs of underuse, the bison population could be increased to 20 animals using the described methods for attracting them to the prairie areas. If monitoring determines that the forested areas are still showing limited regeneration, bison numbers could be reduced (see woodland habitat objective for proposed monitoring). The associated monitoring will drive the management of the ungulates, and this objective provides the flexibility to respond to both habitat and herd health needs.

Wildlife Population Management Objective 2

Reduce the prevalence of brainworm and lungworm in elk so no animals exhibit clinical infection externally over the life of this CCP. Also, reduce and where possible, eliminate introgression risks of CWD, brucellosis, and any other non-endemic disease of wild native ungulates or cattle.

Strategies

- Determine alternatives to current winter feeding operations.
- Reduce ungulate populations to within habitat carrying capacities and monitor habitat conditions (indicated in the prairie and woodland objective sections) to adaptively manage ungulate populations. Specific species (such as bison and elk) will be preferentially conserved over another native species (deer) in keeping with the refuge purposes.
- Continue to use elevated feeders to keep food off the ground in years where feeding is necessary.
- Rotate feeding grounds to varying sites across the big game forest and prairie.
- Remove accumulated manure as needed around feeding grounds.
- Use medicated mineral blocks and other methods of treatment for nematode parasites.

- Recruit a graduate student to conduct a study on lungworm to determine its significance in elk and find measures for reducing its impact.
- Regularly communicate with NDGF and the Service's Wildlife Heath Office to identify and reduce the risk factors related to CWD infection and reduce the risk of introduction of other non-endemic diseases.
- Keep gates closed in the winter when cattle guards fill with snow, to reduce co-mingling with ungulates outside the refuge.
- Conduct opportunistic CWD surveillance through sampling found-dead or euthanized cervids.
- Submit CWD samples under the NDGF's direction to ensure appropriate coordination for prevention of this disease.
- Reduce feral dog and cat entrance into the refuge.
- Conduct a herd health surveillance program in coordination with the Wildlife Health Office.
- Monitor brucellosis status at the refuge through sampling of euthanized or recently deceased bison, and also bison relocated to other sites.
- Introduce new animals into the refuge, that are compliant with all state and federal regulations, at appropriate intervals to maintain the overall genetic health of the herds.
- Eliminate or drastically reduce the population of white-tailed deer.

Rationale

As of 2004, disease testing on ungulates residing in Sullys Hill National Game Preserve became more frequent with the hiring of a regional wildlife veterinarian. During this same time period, there were heightened concerns about CWD. Dr. Tom Roffe and refuge staff have conducted 14 complete necropsies (post mortem examinations) on elk, and 1 complete necropsy on a bison. Overall, the 22 CWD samples collected from elk and 31 samples collected from white-tailed deer have been negative.

Elk necropsy results positively indicate that lungworm occurs regularly in animals at the refuge. Two classes of lungworm have been identified in refuge elk, *Dictyocaulus* (likely species *hadweni*) and *Protostronglyus*. *Dictyocaulus* has a direct lifecycle (does not require an intermediate host) and can infect bison, deer, and elk. Adult *Dictyocaulus* live in the lungs, producing eggs which are coughed up and then swallowed. They are excreted through feces, mature in about a one-week time period into a third stage (L3), and are then consumed by the host during foraging. The maturation period from L1 to L3 can be extended by cooler temperatures. In addition, L3 larva can invade the fungus *Pilobolus spp.* Fungal sporulation can disperse *Dictyocaulus* L3 larvae up to 10 feet, thereby widening the infected area. After ingestion by the host ungulate, L3 larvae mature into L4 larvae, which migrate to the lungs through blood and lymphatic vessels, mature to adults, and the cycle is completed. Because *Dictyocaulus* has a direct life cycle, management strategies that enhance animal density, fecal contamination, and repeated use of the same ground increase this parasite's impact on host populations (Dr. Tom Roffe, USFWS, personal communication).

Protostrongylus also infects deer, elk, and other ungulates but requires an intermediate gastropod (typically snail) host to complete its lifecycle. Adult *Protostrongylus* live in the lungs, migrate to the stomach, and are excreted in the L1 stage through feces. Once on the ground, they must contact and penetrate the intermediate host, where they mature to L3. Infective L3 larva reenter the host when the infected gastropod is ingested during grazing. Once released from the snail, L3 larvae penetrate the intestinal wall, migrate through the lymphatic system while maturing to L4, and eventually make their way to the lungs through blood and lymph vessels. Because of the requirement for specific intermediate hosts, *Protostrongylus* distribution is limited by the distribution of specific species of snails. Management strategies that affect both host and snail distributions can reduce this parasite. Because most intermediate hosts require moist environmental conditions, dry environments tend to have less *Protostrongylus*. In addition, *Protostrongylus* tends to be more pathogenic (disease-causing) in sheep than in other wild ungulates (Dr. Tom Roffe, USFWS, personal communication).

Lungworm infections generally are asymptomatic to the casual observer. Their primary pathological impact is airway obstruction and minor tissue damage from migrating L4 larvae. Adult, egg, and larval irritation of airways results in accumulation of exudate. Symptoms are directly related to the total parasite burden, with clinical cases generally only observable with large numbers of worm accumulations. Minor infections can be unapparent while the animal is at rest, but the animal is subject to exercise intolerance. Secondary bacterial infections can occur, complicating verminous pneumonia with bacterial pneumonia as well (Dr. Tom Roffe, USFWS, personal communication).

In wild unrestricted wildlife herds, lungworm is generally not significant because densities are low enough that the wildlife are less likely to forage in areas during the approximate one-week time period of maturation of the larva from L1 to L3. Where wildlife movements are restricted, or environmental carrying capacities exceeded (resulting in regrazing of contaminated areas), lungworm infestations can rapidly increase and cause clinical disease in the host (Dr. Tom Roffe, USFWS, personal communication).

Lungworm infection is diagnosed by detecting larvae in feces using Baermann's sedimentation method. Fresh (< 24 hours old) fecal material can be collected in early spring and shipped, chilled, to a diagnostic lab to determine if lungworms are present, which class of lungworm constitute the infection, and how much is present. Management methods to reduce infestation include redistributing wildlife across larger landscapes, eliminating feeding programs, altering habitats to minimize intense focal aggregations, and other similar measures. Treatment, using medicated blocks, has been tried in free-ranging bighorn sheep but has not proven effective (Dr. Tom Roffe, USFWS, personal communication).

Of the nine Sullys Hill National Game Preserve elk sampled between January 2004 and February 2007, five had positive results for lungworm at low levels. Four of the five came from a single January 2006 culling sample. None of 4 bison sampled in January 2005, or 40 bison sampled in November and December 2006, had detectable lungworm infections. These data suggest bison, at this point, are not affected by the species of lungworm on site. Lungworm species, however, tend to be host specific, and therefore, further investigation of the prevalence and quantitative parasite burdens in elk are warranted. Because of the small habitat base and historical use of winter grain feeding at Sullys Hill National Game Preserve, both elk and bison should be monitored. Wildlife health, and parasitic problems in particular, would be best managed by maintaining ungulate populations within winter habitat carrying capacity, manipulating habitat to increase forage for grazing ungulates, encouraging wildlife dispersal across the refuge, and elimination of winter grain feeding (Dr. Tom Roffe, USFWS, personal communication).

Brainworm/meningeal worm *(Parelaphostrongylus tenuis)* also appears to persist at the refuge. This nematode parasite occurs in parts of the cranium of its host (Anderson and Prestwood 1981). The normal definitive host for *P. tenuis* is the white-tailed deer, while several other ungulate species demonstrate susceptibility to infection by this parasite. The host becomes infected when they ingest a gastropod infected with third-stage larvae (L3) of *P. tenuis* (Anderson 1963, 1965). The larva travels from the stomach to the cranium approximately 40 days after initial ingestion. Worms continue to mature and migrate into the cranium, staying in the subdural space or entering the venous sinuses. Worms mate and eggs are deposited in the veins and travel to the lungs where they hatch into L1 larvae. These larvae cross the bronchial tree, are swallowed by the host and are passed out with the feces. The period between initial infection and the first diagnostic stage is typically 82–92 days but can be 115 days or more (Anderson and Prestwood 1981, Samuel et al. 1992).

Maskey and Sweitzer (2004) estimated that *P. tenuis* prevalence in the white-tailed deer population at the refuge was at 83.3% based on their assessment of 17 deer heads and fecal samples. Environmental conditions such as temperature and rainfall, along with deer density likely effect the prevalence of this parasite at a particular site (Behrend and Witter 1968, Gilbert 1973, Karns 1967, Schmitt et al. 1989). There is no evidence that *P. tenuis* is a significant pathogen of white-tailed deer, as deer typically tolerate infection very well. The most serious implication of *P. tenuis* infection in white-tailed deer is lung damage caused by eggs and larvae that may make deer more susceptible to other minor infections.

USFWS

Winter on Devil's Lake.

P. tenuis causes fatal neurological disease in hosts other than white-tailed deer, including elk. Neurological disease in other hosts is the result of prolonged migration through neural tissue which causes tissue destruction. Worms can also invade and damage the central spinal cord canal (Anderson and Prestwood 1981). Signs of neurological disease include loss of fear, blindness, holding head to one side, walking aimlessly or in circles, weakness in hindquarters, and paralysis (Anderson 1965, Carpenter et al. 1973, Olson and Woolf 1978). Elk calves are especially susceptible to fatal infection (Anderson et al. 1965, Samuel et al. 1992, Woolf et al. 1977). *P. tenuis* may limit host populations; although there is no documentation of extirpation caused by this parasite (Carpenter et al. 1973, Raskevitz et al. 1991

Since refuge staff began consistently recording elk mortality incidences in 2001, approximately eight elk had clinical signs and/or pathology consistent with *P. tenuis* or *Dictyocaulus spp.* infection. Several of these observed animals possessed a declining body condition, loss of fear, and a slow, stiff gait. On necropsy, several elk had remnant chronic pleuritis and fibrous nodules throughout the lungs (chronic pneumonia). Lungworm has been frequently observed during necropsy and brainworm occurs frequently across the refuge (Maskey and Sweitzer 2004). Refuge staff will assess the impact of these parasites and implement management to reduce their prevalence across the refuge. The goal is to have elk free of clinical disease. Necropsies and consistent field monitoring of ungulate populations for clinical disease will be important components of this effort. If less invasive management strategies do not reduce brainworm prevelance, more dramatic measures like the reduction and elimination of white-tailed deer will be necessary.

At the time of this CCP, CWD has not been detected in North Dakota. Specific details of this disease and the refuge's contingency planning for possible infection are documented in the associated step-down plan. Annual surveillance will continue to occur at the refuge in cooperation with NDGF.

North Dakota is currently a certified brucellosis-free state. Testing on bison at the refuge has occurred since the early 1980s on dispatched bison, with samples being sent in to the USDA Animal and Plant Health Inspection Service. More recently, the Regional Wildlife Health Office has processed samples, with results being provided to the North Dakota Bureau of Animal Health. All sampled refuge bison tested negative for brucellosis.

North Dakota is also currently considered a bovine tuberculosis-free state. During necropsies on bison, lungs will be examined for any indication of this disease, and any transferred bison will be tested in accordance with North Dakota Bureau of Animal Health regulations.

Several of the strategies address changes in feeding operations at the refuge, which directly impact the overall health of the ungulates. Currently, winter feeding includes a mixture of grains and hay fed to animals from approximately November to April. Based on necropsies conducted, elk and bison on the refuge possess more than an adequate amount of fat reserves for optimal health. Considering this, winter feeding will be reduced to grassland hay only, except for short periods when grain feed will be used as a tool in animal handling operations or during an extreme winter. Such an effort should not only reduce the occurrence of digestive tract problems such as acidosis, but also reduce parasitic worm ingestion. The hay, because of its roughage, is excellent for good ruminant digestive health, and in comparison to the grain, is most similar to the grassland plants that animals ingest throughout the spring, summer, and fall at the refuge. Concerns related to winter survival without grain can be addressed by considering the physiology of digestion. Aside from the digestible energy in hay, energy is provided through volatile fatty acids produced by rumen flora fermentation. These fatty acids in turn are absorbed into the blood stream and are optimal sources for energy in ruminants. In addition, one byproduct of rumen fermentation is heat, which helps keep the animals warm in the winter (Dr. Tom Roffe, USFWS, personal communication).

Wildlife Population Management Objective 3

Retain a bison herd at Sullys Hill National Game Preserve that meets the standards of the "Management of Bison in the National Wildlife Refuge System" document and actively participate in the meta-population management of bison genetics.

Strategies

- Annually report on statistics of the herd and transfer needs.
- With input from the Regional Wildlife Health Office, refuges with bison will make decisions on meta-population management annually.
- Attend the annual refuge bison coordination meeting.
- Participate in continued genetic testing.

- Establish infrastructure at the refuge for safely handling animals for herd health and transfer purposes.

Rationale

With the recent transfer of the refuge's original bison herd to Fort Niobrara National Wildlife Refuge, Sullys Hill National Game Preserve is already an active participant in the Service-wide plan to manage bison across the Refuge System as a meta-population. It is recognized that Sullys Hill National Game Preserve will play a small role with limited habitat and its intentions to maintain a small herd, however, the bison currently in residence have no detectable cattle hybridization and are from the National Bison Range herd, which possess several private alleles unique to the National Wildlife Refuge System. The surplus bison from the current herd can serve as a source of genetic material to other Service herds that can use the augmentation for diversity purposes. Similarly, as needed, Sullys Hill National Game Preserve staff will work with the Regional Wildlife Health Office to bring in new genes from appropriate herds to reduce inbreeding issues and maintain germplasm (a collection of genetic resources) that may be most beneficial to the overall meta-population. Additional details can be found in the Service-wide meta-population initiative entitled, "A Framework for Bison Conservation in the Department of the Interior."

Refuge limitations to participation in meta-population management may be caused by the absence of permanent facilities for round-up and transfer. For past genetic testing and recent transfer of the original herd, staff set up temporary corral systems and baited the animals into the facilities. This is costly and labor intensive and likely will not meet the overall objectives in the future as needs arise to implement further genetic testing, animal transfer, and herd health management. As the meta-population initiative progresses, this should be addressed and funding found to obtain the necessary infrastructure.

Wildlife Population Management Objective 4

Manage the black-tailed prairie dog population to provide appropriate environmental education and outreach opportunities while protecting habitats by maintaining a town size of 1.5 acres.

Strategies

- Develop a prairie dog management plan.
- Survey population regularly to identify average annual recruitment levels.
- Reduce the population as necessary to maintain a size of 1.5 acres.

Rationale

The established prairie dog town at the refuge has an estimated population of several hundred. This species was introduced to the refuge in 1974, primarily as a tool for interpretation and education. Across North Dakota, the historical range for prairie dogs is west and south of the Missouri River (Sidle et al. 2001) and not necessarily in the wetter mixed-grass and tall-grass prairies of the state. The original acreage for the town at Sullys Hill was 1.5 acres, and currently the town has expanded to nearly double this size. With very few natural predators, the town will continue to expand, with possible adverse impacts to surrounding woodland and prairie habitats, and cultural resources. A step-down plan will be developed to address this issue and balance the size of the dog town with outreach needs and habitat preservation.

Environmental Education, Interpretation, And Outreach Goal

Deliver quality, interactive environmental education programming to regional schools, communities, organizations, Spirit Lake Nation, and local governments to garner support and appreciation for Sullys Hill National Game Preserve, North Dakota's wetland and grassland resources, and the conservation role of the U.S. Fish and Wildlife Service. Appendix F contains a draft compatibility determination for the environmental education and interpretation uses proposed for Sullys Hill National Game Preserve.

Environmental Education, Interpretation, and Outreach Objective 1

Develop wetland and grassland conservation education programs for 7,500 elementary and high school students within the Devils Lake Watershed, fostering an environmental ethic to aid future conservation efforts within the Devils Lake WMD Complex.

Strategies

- The current GS-11 series 025 park ranger position would have a job title of visitor services manager.
- The GS-9 wildlife biologist would assist in developing environmental education programs (position identified in woodland strategies).

- Recruit additional volunteers to assist with environmental education programs.
- Service staff, educators, and partners will develop a wetland and grassland conservation curriculum and use existing environmental education team trunks. The curriculum will emphasize current wetland and grassland conservation issues, dependent wildlife species, and ecological functions of these habitats. The curriculum will be structured with multiple lessons that build upon previous lesson plans.
- Develop a partnership with a local teacher to serve as a dedicated environmental educator.
- The curriculum will focus 1/3 on wetland science and conservation; 1/3 on grassland science and conservation; and the remaining 1/3 would focus on Sullys Hill National Game Preserve, the Refuge System, and general wildlife conservation programming.
- All environmental education programs will be designed to engage students in the process of learning by incorporating the use of all five senses: sight, hearing, touch, smell, and taste. Programming will be designed to use the outdoor classroom of the refuge when practical.
- Develop a set of lesson plans that teachers will be able to use in their classrooms. These lesson plans will focus on topics such as wetlands, grasslands, forests, migratory birds, fisheries, and big game and include all necessary teaching aids such as a teacher's guide, student workbooks, video presentations, props, and testing materials. These lesson plans will be available for loan to teachers with preference given to those teachers that will teach on-site at the Sullys Hill education and visitor center.
- Develop a partnership with the Spirit Lake Nation wildlife department to assist with environmental education programming.
- Monitor the success of these programs by including pre- and post-testing (including asking simple questions at the end of a session to gauge understanding), teacher incorporation of materials into existing curriculum, and student participation.
- Refuge staff will plan and initiate regular off-site programming to local schools within a 90-mile radius of the refuge.
- Use refuge waters that support a viable fishery to provide environmental education programs on fish species and their lifecycles, along with an introduction to fishing techniques.
- Recruit local students to participate in Youth Conservation Corps (YCC).
- Environmental education programs will be designed to meet state and local education standards.

Rationale

The children of today are tomorrow's landowners and like many adults, lack the general knowledge of wetlands and grasslands and how they function. They often do not recognize the environmental benefits these systems provide and do not understand that these critical habitats support many of our continent's migratory bird populations. Additionally, students are generally unaware of the perils facing the wetland and grassland habitats of the Prairie Pothole Region. The educational experience offered at Sullys Hill National Game Preserve contributes to the long-term effort to conserve wetland and grassland habitats within the Devils Lake WMD Complex.

In addition, today's life is electrified with computers, televisions, and video games that reduce children's sensory experience of nature. Nature is about smelling, hearing, tasting, and seeing (Louv 2006). The challenge is to link these modern modes of conservation education with outdoor education and hands-on learning (Hudson 2001). Children have to experience nature directly in order to learn and develop in healthy and appropriate ways (Rivkin 1995). "Time in nature is not leisure time; it's an essential investment in our children's health" (Louv 2006).

Sullys Hill National Game Preserve would provide the opportunity for students to experience and learn from nature through educational programs and first-hand experiences with their natural surroundings. The refuge provides opportunity for students to complement the traditional indoor classroom and truly experience science and conservation biology in actual wetland and grassland habitats.

Education, Interpretation, and Outreach Objective 2

Sullys Hill National Game Preserve will serve to educate students and refuge visitors of all abilities about the values of wildlife and habitat conservation. Seventy-five percent of refuge visitors and students that participate in programs at the refuge will be able to understand the conservation role of the Devils Lake WMD Complex and the Refuge System.

Strategies

- Annually recruit local students to participate in YCC. Participation will expose students to the management of public lands for wildlife and people. The program will be headquartered at Sullys Hill National Game Preserve but will allow participants to work on Waterfowl Production Areas (WPAs) and refuges across the Devils Lake WMD Complex.
- Annually recruit volunteers, in partnership with the Sullys Hill Wildlife Refuge Society, to assist with various refuge education activities.
- Annually recruit students interested in the natural resource conservation profession to be interns, through the university system, including Cankdeska Cikana Community College to assist with various refuge education activities.
- Serve as a critical environmental education outlet for the Devils Lake WMD Complex, developing 24 media releases per year for the general public on the importance of wetland and grassland conservation, dependent wildlife species (specifically waterfowl), and the critical role of the Service in this arena.
- Continue to conduct annual events in partnership with the Sullys Hill Wildlife Refuge Society and others. Such events include the Birding and Nature Festival, Winterfest, and participation in the Chautauqua Program.
- Use various techniques to evaluate whether students and visitors are able to better understand the conservation role of the Devils Lake WMD Complex and the Refuge System.
- Electricity and water will be provided to the remote classroom.

Rationale

Many students and refuge visitors have an awareness of the need for wildlife conservation; however, they lack a complete understanding of the role of the U.S Fish and Wildlife Service in wildlife conservation. Additionally they often do not recognize their personal role in the conservation of our nation's natural resources.

Sullys Hill National Game Preserve would provide an opportunity for the public to engage with wildlife and expand their appreciation for natural resource conservation and develop their own environmental ethics. The refuge programming will provide opportunities for students and visitors to gain knowledge of how their actions protect or harm habitats (particularly wetland and grassland habitats), associated wildlife, and why that should matter to them. Opportunities would be presented on avenues to participate with the Refuge System in the conservation of wildlife and habitats, even on their own properties.

Environmental Education, Interpretation, and Outreach Objective 3

Educate adults in the agricultural community on conservation opportunities associated with farming in the Prairie Pothole Region and farming technology that will benefit the environment and promote natural resource conservation.

Strategies

- Partner with NDSU Extension, NRCS, agricultural chemical companies and others to conduct one annual information exchange between conservation and agricultural producers. The exchange will focus on such topics as grassland/livestock/waterfowl interactions, invasive species management, and farming "Best Management Practices."
- Dedicate one portion of the habitat diorama display to be placed in the education and visitor center to interpret agricultural landscapes.
- Work with partners to develop information packets on "Best Management Practices" to be used for interactions with farming/ranching and wildlife/agricultural producers.
- Hold presentations for area landowners on refuge and WPA management and regulations.

Rationale

The Devils Lake WMD Complex has a mission of preserving and restoring the native wetlands and grasslands within the Devils Lake Basin. They accomplish this primarily by acquiring wetland and grassland easements from willing sellers. Although this program has been very successful in protecting thousands of acres of habitat, the easement program's conservation role is regularly overlooked and misunderstood. The refuge has the potential to not only provide information to the local communities and students about habitat conservation, but could also create a bridge to potential landowners who might otherwise be unaware these compensated programs exist. Developing this mutual awareness, knowledge, and appreciation for protecting these natural resources while understanding the challenges

of farmers and ranchers, will create a greater appreciation of each other's needs and should ultimately aid in future wetland and grassland protection and restoration efforts within the Devils Lake WMD Complex.

Visitor Services Goal

Provide captivating visitor services facilities and activities for visitors of all abilities, community groups, youth groups, and the members of Spirit Lake Nation to provide enjoyment that results in a greater understanding and support of the preservation of native habitats and landscapes of North Dakota's Prairie Pothole Region and the mission of the Refuge System. Appendices G and H contain draft compatibility determinations for the fishing and wildlife observation and wildlife photography uses proposed for Sullys Hill National Game Preserve.

Visitor Services Objective 1

Annually, 60,000 visitors, including 7,500 youth and adult students, will visit and explore Sullys Hill National Game Preserve. This experience will create a greater awareness and understanding of the national wildlife refuge system while fostering a personal environmental ethic and developing skills to further understand wildlife and engage with nature.

Strategies

- Staff will work with volunteers and other partners to develop a year-round educational program that will highlight the Refuge System's priority public uses of wildlife observation and photography techniques, hunting, fishing, interpretation, and environmental education. Staff will use a website and media to provide public advance notice of programming. Typical programming will include birding walks, plant identification tours, photography field trips, guided hay rack rides, elk bulging tours, and fishing and hunter education courses.
- Through partnerships, the Service will develop and maintain an interactive habitat diorama display to be located in the education and visitor center. The display will include static and dynamic components to engage and educate visitors of all ages and abilities. The diorama will cover grassland, wetland, agricultural, and forest landscapes.
- Staff the education and visitor center year-round providing consistent hours of operation (up to 48 hours per week). This will be accomplished through added staff and the expanded use of partners, volunteers, seasonal staff, and the YCC program.
- Provide environmental education materials in the education and visitor center bookstore. The bookstore will be administered by the Sullys Hill Wildlife Refuge Society through a cooperative agreement with the Service. The materials must meet the mission of the Service and be approved by the refuge manager.
- Develop a remote camera and video system that will allow students in the education and visitor center to observe wildlife on the refuge. This system will be linked to the website for the general public to view from remote locations.
- Maintain the trail system for year-round use for hikers, snowshoers, and cross-country skiers (see figure 8, public use map). A "tear sheet" map will be developed for navigation as well as an interpretation tool. The trail system will be properly signed correlating with the "tear sheet".
- Maintain the auto tour network for year-round use (see figure 8, public use map). A "tear sheet" map will be developed for navigation as well as a self-guided interpretive tool. The auto tour will be properly signed, correlating with the "tear sheet." The "tear sheet" will also direct visitors to the refuge's four observation platforms.
- To ensure visitor safety and assist in maintenance, complete a chip and seal on refuge roads.
- Maintain two newly constructed informational kiosks at the entrance and the education and visitor center to inform and orient visitors (see figure 8, public use map).
- Finish updating the refuge brochure and distribute it to visitors at key locations within the refuge.
- Maintain the five observation platforms along the auto tour and nature trail with proper interpretive panels (see figure 8, public use map). These platforms are the Devils Lake vista, wetland overlook, Sullys Hill, nature trail, and the prairie dog town overlooks.
- Replace the temporary outdoor amphitheater adjacent to the education and visitor center with one that is accessible and consists of a covered stage and permanent seating for 250 people with space to include additional temporary seating (see figure 8, public use map).

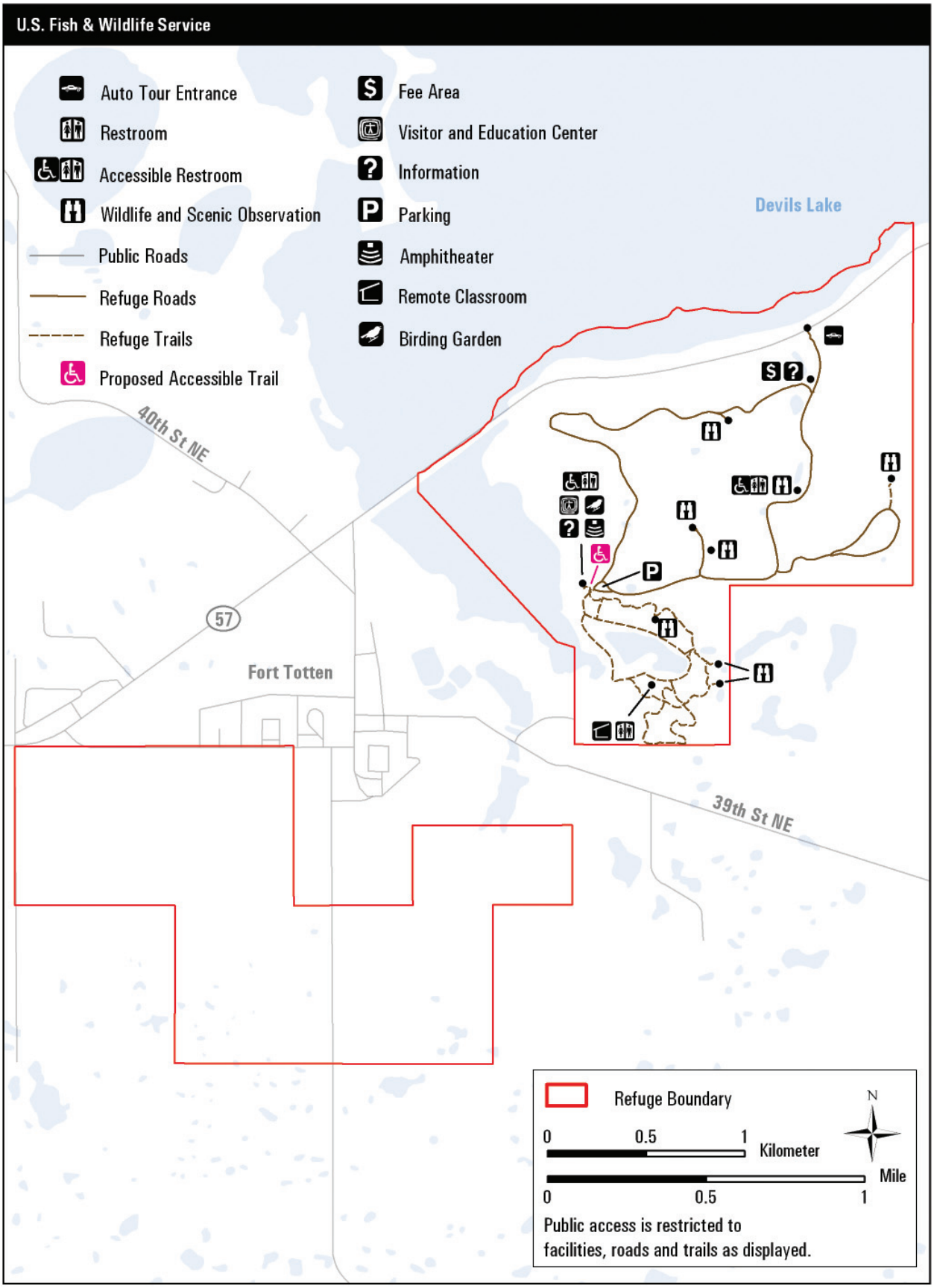

Figure 8. Sullys Hill National Game Preserve public use map.

- Replace an accessible trail and overlook that was lost to Devils Lake flooding. The trail and overlook will be located adjacent to the education and visitor center and outdoor amphitheater, providing a link to these facilities while providing an opportunity for visitors of all abilities to enjoy nature (see figure 8, public use map).
- Continue to monitor public use of the refuge and facilities. Weekly auto tour and trail system use data will be collected and recorded. Education and visitor center use will be recorded through a guest book and by education and visitor center staff and volunteers. Classroom use, including the number of visitors and topics presented, will be documented and monitored to ensure the refuge is achieving its vision, goals, and objectives.
- A patio and seating area for the outdoor birding garden would be constructed.
- Counters would be installed on single- and double-lane portions of the auto tour route for accurate use data.
- The daily recreation fee would be increased to $3.00 ($20.00 calendar year annual pass) and collected through an automated collection booth.
- A vehicle radio transmitter system would be developed for audio interpretation of the auto tour.
- The directional signage for trails and auto tour route would be updated and installed.

Rationale

Over the last century, the percentage of people living in the United States in urban areas rose from 39% to more than 73% (National Aeronautics and Space Administration 2000). This urbanization results in a general disconnect between humans and the natural world. Surprisingly, adults have more opportunities to interact directly with nature than children, yet children have more access to information about the environment through nature shows, computer games, and graphics (Hudson 2001).

Sullys Hill National Game Preserve will expand opportunities for visitors and students to experience wildlife and nature first-hand. The refuge will serve as a vehicle to foster an environmental ethic through the opportunities of wildlife observation, photography, interpretation, and environmental education.

Protection And Maintenance Goal

Refuge visitors, staff, and volunteers will have a safe, protected, and well-maintained environment in which to learn about, work with, understand, and appreciate the importance of protecting the unique natural and cultural resources of Sullys Hill National Game Preserve.

Protection and Maintenance Objective 1

100% of all refuge visitors, volunteers, and staff will report feeling safe when visiting or working on the refuge. These same visitors will fully comprehend the laws and regulations in place for their protection and the protection of the refuge's wildlife, lands, facilities, and cultural resources (throughout the 15-year CCP).

Strategies

- Recruit one GS-9 park ranger for law enforcement duties to provide regular routine patrols and provide for visitor and staff safety, and facilities and resource protection.
- Pursue a cooperative agreement with local law enforcement agencies to add resources that will help achieve a high-visibility law enforcement presence to deter vandalism and other inappropriate behavior on the refuge and protect refuge visitors, staff, volunteers, facilities, lands, and wildlife.
- Provide proper signage and an outreach program that will clearly warn visitors of the dangers of approaching wildlife.
- Initiate a background check for volunteers to ensure a safe environment for environmental education programs, facilities, and visitors.
- Develop a visitor safety section for the visitor services plan.
- Interpretive programs, materials, and signage will be developed to provide visitors with information on how to view wildlife safely without causing harm to the wildlife or themselves.
- Arson patrols will be conducted to prevent wildfires during peak fire seasons.
- Security, including camera surveillance, and fire alarm systems will be installed.

Rationale

There are few resources available to provide a safe environment for staff, volunteers, visitors, wildlife, facilities, and cultural resources. If management of Sullys Hill National Game Preserve includes plans to invite visitors;

increase the number of staff and volunteers; maintain and protect facilities; and protect wildlife, habitat, and cultural resources, then the Service is required to provide a minimum level of safety. Providing a minimum level of safety is the most fundamental responsibility of refuge managers (National Wildlife Refuge System Improvement Act 1997).

Protection and Maintenance Objective 2

All refuge equipment and facilities will be maintained at a level that will adequately support and will not hinder visitor, habitat management, and programs while ensuring the safety of all staff and visitors.

Strategies

- Recruit one full-time maintenance worker, WG-8, to maintain the refuge infrastructure, including the education and visitor center, roads, snow removal, plumbing, carpentry, electrical, masonry, painting, groundskeeping, enclosure fence, and general operations.
- Recruit one career-seasonal maintenance worker, WG-6, to help meet peak maintenance needs during the high visitor services field season (April–November). Duties will include maintaining roads, trails, kiosks, amphitheater, and grounds, and supervise YCC and other temporary staff to meet the maintenance demand of the refuge's peak season.
- Routine boundary fence checks will be conducted and feral animals that harm native wildlife will be controlled.

Rationale

There is no dedicated maintenance staff for Sullys Hill National Game Preserve. The refuge does receive some assistance from the two Devils Lake WMD Complex maintenance staff. The refuge has over $18 million in real property assets, not including personal property, that needs regular daily maintenance. Some of the facilities that need routine and consistent maintenance include the following:

- A 6-mile, 7-foot-high big-game exclusion fence
- Sullys Hill overlook interpretive platform
- Devils Lake interpretive overlook
- wetland overlook
- prairie dog overlook
- two residences
- 5-mile paved auto tour route
- 1.2 mile interpretive trail
- 3,120 square foot fire maintenance shop
- 32-foot by 28-foot environmental classroom
- 380-foot accessible nature trail
- amphitheater
- 1,600 square foot fire storage building
- kiosks, entrance signs, interpretive signs
- 6,094 square foot education and visitor center
- 6,900 square foot shop/cold storage building

Protection and Maintenance Objective 3

Within two years of initiation of this plan, generate additional entrance fees and increase payment compliance to 90% to ensure resources are available for maintenance and safety of visitor facilities.

Strategies

- Use random recreation fee compliance patrols conducted by on-site law enforcement officer (GS-9 park ranger).
- Install an automatic fee collection booth eliminating the unreliable volunteer fee program.
- Increase entrance fee initially to $3.00 per visit ($20.00 annually) and then increase as needed over the next 15 years.

Rationale

Entrance fees have been collected through an honor system with only an estimated 40% of visitors actually paying the $2.00 fee. Given that 60,000 visitors come to the refuge each year, that is a significant loss of revenue. In addition, the fee has not increased for years, while visitor services have continued to expand, including the construction of the new education and visitor center and classrooms. If fee compliance were improved along with a nominal increase in the entrance fee, additional revenue could be generated to provide the resources necessary to maintain visitor facilities and fund additional law enforcement support.

Protection and Maintenance Objective 4

Adverse effects to significant cultural resources are avoided, or when necessary, are mitigated in compliance with Section 106 of the National Historic Preservation Act 100% of the time.

Strategies

- Cultural resources that would be potentially affected by an undertaking are identified and, if significant, preserved when possible.
- Cultural resource evaluations will be done to fulfill compliance with historic preservation laws.
- Consult the regional archaeologist to ensure proper implementation of Section 106 into all applicable refuge projects.
- Cultural resource surveys will first be completed in high probability areas.
- Complete a comprehensive cultural resource survey of the refuge in partnership with other agencies and organizations.
- Historical documents and information will be organized and protected.
- Maintain all buildings, structures, objects, and sites designated as a "historic properties" as defined in Section 106 of NHPA. All significant cultural resources will be protected from refuge activities and vandalism.

Rationale

Federal laws and policies mandate the identification and protection of cultural resources. Ideally, a comprehensive inventory of the refuge's cultural resources would be useful for ensuring their protection. However, these inventories are costly and time-consuming and require special abilities, such as those of an archaeologist to complete. Although the refuge does not have such an inventory, it is still necessary to protect these resources. To meet this requirement, a cultural resources investigation must be completed on any site proposed for excavation, prior to any action that may disturb the site.

6.2 PERSONNEL AND FUNDING

One full-time person is assigned to Sullys Hill National Game Preserve. This person primarily has a background in outdoor education. The overall budget for the refuge is quite modest ($116,000) and primarily pays the salary of this one staff person. Most of the current work is carried out by a volunteer workforce.

Table 3 lists this position along with 3.5 new full-time equivalent positions (specifically assigned to Sullys Hill National Game Preserve) that are needed for full implementation of the CCP.

Table 3. Current and proposed staff for Sullys Hill National Game Preserve.

	Current Staff	*Proposed Position*
Management/ Visitor Services Staff	Park Ranger, GS-11	Change the title of this current position to visitor services manager
Environmental Education Specialist	None	GS-9 environmental education specialist
Biological Staff	None	GS-9 wildlife biologist
Administrative Staff	None	No change
Maintenance Staff	None	WG-6 full time maintenance worker
Law Enforcement Staff	None	GS-9 park ranger (shared position with Devils Lake WMD Complex)

6.3 MONITORING AND EVALUATION

Adaptive management is a flexible approach to long-term management of biotic resources. It allows for management to be shaped and directed over time by the results of ongoing monitoring activities and other discovered information. More specifically, adaptive management is a process by which projects are implemented within a framework of scientifically-driven experiments to test the predictions and assumptions outlined within a plan. On-the-ground observations of responses to management by habitats and wildlife are also factored in. Analysis of results helps managers determine whether current management should continue "as-is" or whether it should be modified to achieve desired conditions. Changes and adjustments to management and operations are considered using the best information currently available.

To apply adaptive management, specific survey, inventory, and monitoring protocols will be adopted for Sullys Hill National Game Preserve. The habitat management strategies will be systematically evaluated to determine management effects on wildlife populations. This information will be used to refine approaches

and determine how effectively the objectives are being accomplished. If monitoring and evaluation indicate undesirable effects for target and nontarget species or communities, the management projects would be altered accordingly. Subsequently, the CCP would be revised.

Step-down Management Plans

Specific monitoring and evaluation activities will be described in step-down management plans. This CCP is intended as a broad umbrella plan that provides general concepts and specific wildlife, habitat, endangered species, public use, and partnership objectives over the next 15 years.

The purpose of a step-down management plan is to provide greater detail to managers and employees who will implement the strategies described in the CCP. Step-down management plans provide greater detail for implementing specific actions authorized by the CCP. Table 4 presents those plans needed for Sullys Hill National Game Preserve, their current status, and the next revision date.

Plan Amendment And Revision

This CCP will be reviewed annually to determine the need for revision. A revision will occur if and when significant information becomes available, such as a change in ecological conditions. The final CCP will be augmented by detailed step-down management plans to address the completion of specific strategies in support of the CCP goals and objectives. Revisions to the CCP and the step-down management plans will be subject to public review and NEPA compliance. At a minimum, this plan will be evaluated every 5 years and revised after 15 years.

Table 4. Step-down management plans for Sullys Hill National Game Preserve

Plan/Proposal	*Completed Plan, Year Approved*	*New or Revised Plan, Completion Year*
Disease Management Plan	2006	2012
Chronic Wasting Disease Plan	2004	2012
Black-tailed Prairie Dog Management Plan	—	2009
Big Game Management Plan	1984	2011
Habitat Management Plan		2011
Integrated Pest Management Plan	2005	2011
Prescribed Burning (Annual)	2007	2011
Forest Plan	—	2011
Grassland Plan	—	2011
Migratory Bird Plan	—	2011
Wildlife Inventory and Monitoring Plan	—	2010
Visitor Services Plan	1993	2010
Sign Plan	—	—
Refuge Safety Plan	—	2009
Law Enforcement Plan	—	—
Occupant Emergency Plan	—	—
Fire Management Plan	2002	2009
Spill Prevention Control and Countermeasures Plan	2002	2012

Adaptive Management

Adaptive management is a rigorous application of management, research, and monitoring to

- gain information and experience necessary to assess and modify management activities;
- use feedback from research, monitoring, and evaluation of management actions to support or modify objectives and strategies at all planning levels; and
- determine which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in management plan (see figure 9, adaptive management process).

Analysis of results helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

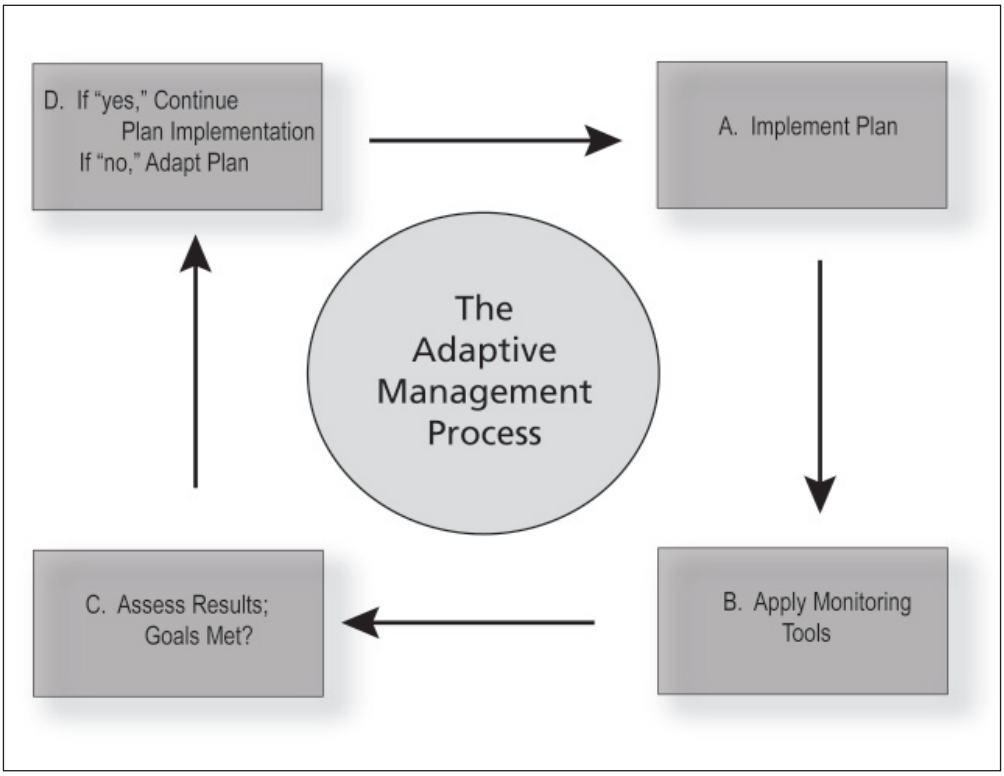

Figure 9. Adaptive management process.